Strategic Conservation Plan

for the

North Carolina Sandhills Conservation Partnership

Final Draft

June 2013

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EXECUTIVE SUMMARY

Introduction

The North Carolina Sandhills Conservation Partnership (NCSCP), formed in 2000, was established with the specific intent to facilitate collaboration among Federal, State, and non-profit conservation groups for the purpose of conserving the diminishing longleaf pine ecosystem and recovering the endangered red-cockaded woodpecker (RCW) in the NC Sandhills. In 2010, the NCSCP's Steering Committee approved the creation of a new Strategic Conservation plan based on a formal 10-year review of the NCSCP. The plan will serve as a comprehensive guide for Partnership activities to further its mission and improve conservation in the NC Sandhills. The Partnership represents 10 core partners and 5 regional partners. At least one representative from each core partner organization sits on the Steering Committee. To achieve its mission five Partnership working groups focus on different roles. These working groups include the Red Cockaded Woodpecker Working Group, the Reserve Design Working Group, the Land Protection Working Group, the Natural Resource Management Working Group, and the Communications Working Group.

NC Sandhills Landscape Description

The Conservation Area of the NCSCP encompasses the Sandhills physiographic region in North Carolina and its longleaf pine forests and embedded natural communities that cover just over 1 million acres and part of 8 counties. The region is home to 40% of the species in the state with more than 150,000 acres of intact natural longleaf pine community estimated to remain in the region. This biodiversity results from a combination of topographical relief, higher elevation than other coastal plain sites, coarse textured soil layers alternating with fine-textured clays, and a naturally high frequency fire-return interval. The ability of longleaf pine communities to persist and support the numerous rare species found in the NC Sandhills will depend on effective conservation efforts amidst changing land uses and further habitat fragmentation.

Planning Process

The Open Standards for the Practice of Conservation and its companion Miradi Adaptive Management Software were used in the development of the Strategic Conservation Plan. Existing Partnership plans and documents generated by members of the Partnership and working groups were used to facilitate and help guide development of the Strategic Conservation Plan. A Core Team was approved by the Steering Committee and assembled in the fall of 2011 to lead this process. A Strategic Conservation Plan Advisory Committee met twice with the Core Team in the spring of 2012 to provide expert opinion and review products developed by the Core Team. The Core Team created conceptual models of our biological priorities that identify the scope and vision of the partnership, its conservation targets, and threats to those conservation targets, a target viability assessment and goals for the targets, and strategies to achieve the goals.

Conservation Targets and Goals

Conservation targets are elements of biodiversity at a project site, which can be species, habitat/ecological systems, or ecological processes on which a project has chosen to focus. The four

conservation targets chosen to represent the NC Sandhills were: the Longleaf Pine Mosaic, Upland Depressional Wetlands, Streamhead Pocosins/Seeps, and Blackwater Streams. The conservation targets and associated nested targets were selected to collectively represent the biodiversity of concern in the NC Sandhills. For each target, goals were drafted that represent the desired future condition.

Conservation Target Viability Assessment

The purpose of the Conservation Target Viability Assessment is to understand the critical functions of the selected conservation targets, how the targets are affected by human actions, and develop an understanding of the overall status for each target. This Plan works from the same TNC Conservation Action Planning principles from which the 2004 Site Conservation Plan was created and presents an updated viability assessment with revised key ecological attributes and indicators. This updated assessment identifies the steps necessary to effectively manage and restore the natural processes on which each target depends. The Viability Assessment involves the identification of key ecological attributes and indicators to document the health of each conservation target. The Viability Assessment will serve as a point of reference for future assessments in order to measure the progress that has been made through the implementation of strategies.

Threats to Conservation Targets

A threats analysis conducted by the Core team investigated the direct threats and stresses to the biological integrity of the conservation targets. Eleven direct threats were identified and the impact of each was ranked according to its scope, severity, and irreversibility. The direct threats identified are: incompatible development, incompatible forestry practices, incompatible agricultural practices, incompatible pine straw production, fire suppression, transportation planning and road construction, conventional golf course maintenance and management, small dams on headwater tributaries, surface mining, unsustainable surface water withdrawals, and invasive species. The stresses identified are: altered composition/structure, altered hydrologic regime, altered natural fire regime, habitat loss, fragmentation, or degradation, nutrient loading, reduced primary productivity, sedimentation, and contamination.

Strategies and Objectives

A set of strategies was identified to address the direct threats to the conservation targets at key intervention points in the conceptual models. Strategies were reviewed and vetted by the Advisory Committee, and objectives were then created to assess desired outcomes and evaluate the success of selected strategies towards achieving the goals set for the conservation targets. The Partnership does not have the capacity or expertise at present to implement all of the identified strategies, but a set of strategies was chosen that is seen as realistic and likely to have positive and measurable impacts on Sandhills biodiversity. The Partnership will continue to implement strategies using the resources and expertise available, while seeking to address its capacity gaps to increase effectiveness.

Implementing the Strategic Conservation Plan

Each identified strategy has been designated as falling under the purview of one the five working groups. Designated working groups will decide how a strategy and associated activities are executed

and will be responsible for documenting progress. Working group leaders and the Partnership Coordinator are responsible for identifying and prioritizing activities in order to implement strategies and report to the Steering Committee. Working groups will provide annual status reports of their prioritized strategies and the status of strategies being implemented to the Partnership Coordinator. Where conflicts arise or coordination among working groups is necessary, working group chairs and the Partnership Coordinator will be responsible for overseeing necessary communications and actions in order to ensure that the work of the Partnership moves forward. A Finance Subcommittee will be established by the Steering Committee with the mission of overcoming financial obstacles of the Partnership and building capacity for monitoring and applied research. The Finance Subcommittee will meet as necessary and report to the Steering Committee. In order to evaluate Partnership success and progress, an Annual Report will be provided to the Steering Committee. Every 2 years, working groups will conduct a review of strategy implementation and monitoring efforts to assess the effectiveness towards meeting the identified goals. This review will focus on the status of indicators and metrics, and identify additional research needs. A standardized reporting template for this bi-annual review will be created by the Partnership Coordinator for working groups to submit to the Steering Committee. In 5 years, the Strategic Conservation plan will be reviewed and updated by a subcommittee who will consider the successes and failures of the Plan, adapt existing methodologies or propose new ones to strengthen the Partnership, and address new threats and changing conditions of conservation targets. A cooperative Monitoring Plan will be created to guide the Partnership's monitoring program and delineate monitoring responsibilities among the various partners. The *State of the Sandhills* report will be an annual outreach document produced by the Communications Working Group for the public that outlines the accomplishments and issues faced by the Partnership and details how the NC Sandhills ecosystem is faring.

I. INTRODUCTION

The North Carolina Sandhills (NC Sandhills) is approximately a million acres in extent, covering all or parts of 8 counties (Figure 1). It is best known for longleaf pine, an ecosystem with incredible species diversity. The longleaf pine ecosystem in the Sandhills is anchored by two large protected core blocks of longleaf pine forest; the 160,000 acre US Army installation at Fort Bragg, and the 65,000 acre Sandhills Game Lands. The NC Sandhills also contain the second largest concentration of the endangered red-cockaded woodpecker (*Picoides borealis*) in existence. However, land use changes and fire exclusion across much of the native longleaf pine ecosystem in the NC Sandhills has resulted in degradation and loss of habitat. Competing land uses including horse farms, residential and commercial development, industrial forestry, and golf course construction have created a fragmented mosaic of land use patterns in the Sandhills. Since the late 1970's public lands including Fort Bragg/Camp Mackall (US Army), Weymouth Woods (NC Division of State Parks), McCain Forest (NC Dept. of Agriculture), and the Sandhills Game Lands (NC Wildlife Resources Commission), have become the last strongholds of large extents of longleaf pine habitat in the NC Sandhills. This fragmentation, loss, and lack of management of longleaf pine habitat caused a significant reduction in the number of red-cockaded woodpecker groups. In order to sustain the longleaf pine ecosystem and recover the NC Sandhills populations of red-cockaded woodpeckers (RCW), a collaborative process to integrate private and public land management concerns and objectives was needed. The North Carolina Sandhills Conservation Partnership (Partnership) was established to meet this need.

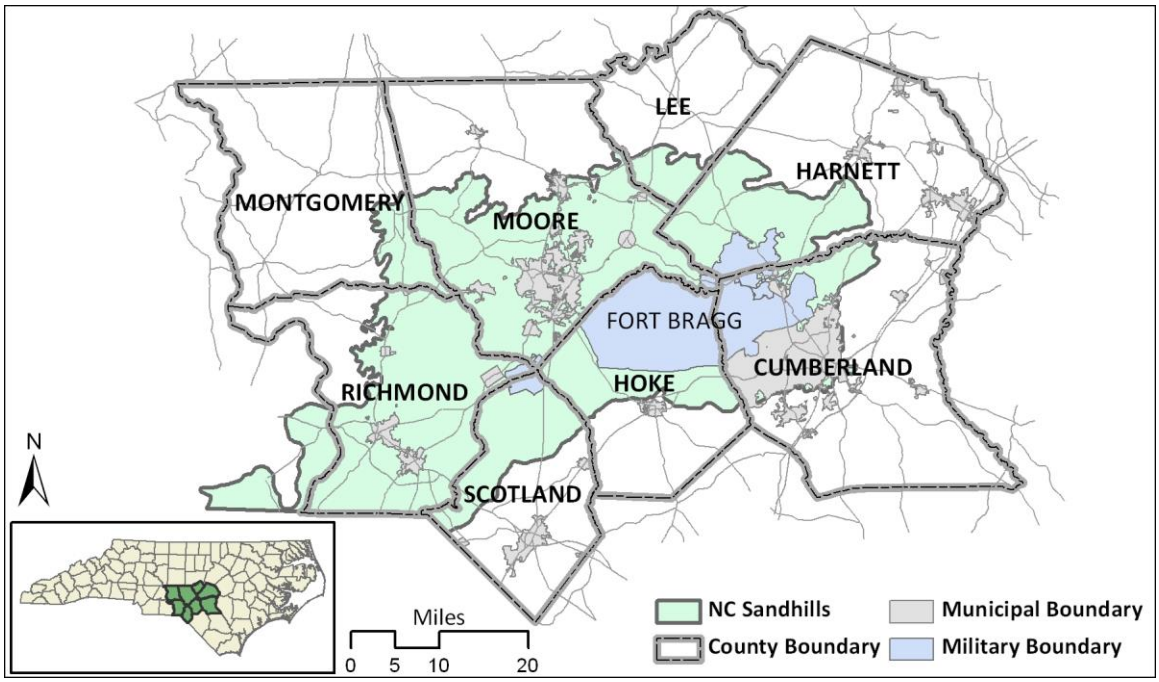

Figure 1: Map of NC Sandhills

Plan Purpose

In concert with the 10-year anniversary of the partnership in 2010, a formal review of partnership accomplishments was conducted[1]. Based in part on that review, the Steering Committee approved the creation of a new Strategic Conservation Plan (Plan). Building from the 2004 *Site Conservation Plan for the NC Sandhills*[2], this Plan seeks to develop a comprehensive guide for Partnership activities. Unlike the Site Conservation Plan, this Plan addresses many of the concerns identified in the 10-year review by incorporating work plans, monitoring, and metrics of success to increase the effectiveness of Partnership strategies and actions. By the adoption and implementation of the Plan, the Partnership strives to further its mission and improve conservation in the NC Sandhills.

The North Carolina Sandhills Conservation Partnership

The Partnership was formed in 2000 with the specific intent to facilitate collaboration among various Federal, State, and non-profit conservation groups for the purpose of conserving the diminishing longleaf pine ecosystem and recovering the endangered RCW in the NC Sandhills. The mission of the Partnership is to *"coordinate the development and implementation of conservation strategies for the red-cockaded woodpecker, other native biota, longleaf pine and other ecosystems in the Sandhills of North Carolina compatible with the land use objective of the partners*[3]." Partnership organization and collaborative framework are detailed by the *Charter for the North Carolina Sandhills Conservation Partnership*[3] (Charter) and *Memorandum of Understanding*[4] (MOU).

The Charter, first signed in 2000, serves as the Partnership's operational guiding document. It defines the Partnership's mission and describes the structure, membership, operations, rules of order, authority, and responsibilities of the Steering Committee. The Charter also describes the roles and responsibilities of the Steering Committee Chair and Partnership Coordinator. Changes and amendments to the charter can be made by consensus decisions of the Steering Committee. The MOU, last signed by the partners in 2010, formalizes "the collaborative environment necessary to sustain the seminal mission of the NCSCP". Recognizing the complementary nature of the objectives of the individual organizations, the MOU seeks to improve collaboration, planning, monitoring, communications, resource sharing, and stewardship within the Partnership to maximize the effectiveness of the conservation efforts in the Sandhills Conservation Area. The MOU is a voluntary agreement that can be amended at any time with the written consent of the signatories.

The Partnership represents a diverse set of stakeholders including core partners that are signatories on the Charter and MOU as well as regional non-signatory partner organizations and individuals. Core partner organizations are: NC Department of Environment and Natural Resources (DENR), NC Forest Service (FS), NC Division of Parks and Recreation (NC Parks), NC Wildlife Resources Commission (WRC), Sandhills Area Land Trust (SALT), Sandhills Ecological Institute (SEI), The Nature Conservancy (TNC), US

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[1] DiBacco, S. 2010 *Ten Years of Collaborative Conservation: A review of the North Carolina Sandhills Conservation Partnership*. Sandhills, NC. Detailed report.

[2] *Nelson, L.* 2004*. Site Conservation Plan for the NC Sandhills*. North Carolina Sandhills Conservation Partnership. Sandhills, NC.

[3] North Carolina Sandhills Conservation Partnership*.* 2010*. Charter for the North Carolina Sandhills Conservation Partnership.* Sandhills, NC.

[4] North Carolina Sandhills Conservation Partnership*. 2010. Memorandum of Understanding.* Sandhills, NC.

Army at Fort Bragg (Ft. Bragg), US Army Environmental Command (AEC), and US Fish and Wildlife Service (FWS). Descriptions of Partner missions and expertise related to the Partnership can be found in Appendix A. At least one representative from each core partner organization sits on the Steering Committee, the supervising body of the Partnership. Regional partners are: Sustainable Sandhills, Fort Bragg Regional Alliance, Fort Bragg/Pope Air Force Base Regional Land Use Advisory Committee (RLUAC), NC Department of Agriculture and Consumer Services, as well as individual forestry consultants and private landowners. Both core and regional partner representatives serve on one or more of five Partnership working groups established for the following purposes:

- The **Red Cockaded Woodpecker Working Group** identifies key areas of the NC Sandhills landscape that need protection in order to achieve and sustain the recovery status of the Sandhills East and Sandhills West RCW populations[5].
- **The Reserve Design Working Group** works to maintain an updated Reserve Design, which identifies areas of the greatest overall biological value and diversity in the NC Sandhills (see map, Appendix B).
- **The Land Protection Working Group** identifies strategies and funding sources for land protection, and works with the Reserve Design Working Group to identify strategic properties that will increase protection and restoration opportunities for key ecological resources through fee simple acquisition of title, conservation easements, and other land protection tools.
- The **Natural Resource Management Working Group** identifies issues regarding longleaf ecosystem management on public and private lands and develops recommendations to resolve the issues.
- The **Communications Working Group** maintains open lines of communication between partners and facilitates community relations and educational opportunities.

Background

Partnership Accomplishments

RCW Population Recovery

- The North Carolina Department of Agriculture, NC Parks, WRC, and TNC agreed in 2000[3] to manage their lands to promote recovery of the Sandhills East and West (RCW) populations. Prior to this agreement the Army at Fort Bragg, as the only federal entity owning land in the Sandhills, had the sole responsibility to manage for recovery of RCW.
- In 2006, both NC Sandhills populations of red-cockaded woodpeckers exceeded their respective goals.
- Recovery of the Sandhills East Primary Recovery Population, which includes Fort Bragg, was achieved six years earlier than predicted, due in part to the contribution of 23 breeding groups from the acquisition of new conservation lands and management agreements entered with state and NGO partners.

[5] U.S. Fish and Wildlife Service. 2003. *Recovery plan for the red-cockaded woodpecker*. (Picoides Borealis): second revision. U.S. Fish and Wildlife Service, Atlanta, GA. 296 pp.

Land Conservation

- Since 2000, the partners have expended over $58 million dollars to purchase fee simple ownership or conservation easements for over 17,000 acres of new lands.
- More than 16 miles of the Fort Bragg boundary buffered from encroachment by incompatible land use.
- Protected and established the new 4,500 acre Carver's Creek State park.
- Over 5,500 new acres added to the Sandhills Game Lands.
- Over 3,500 acres of longleaf pine forest have been restored.

Collaborative Successes

- In 2001, four of the partners, USFWS, AEC, TNC, and the Sandhills Area Land Trust co-located in a new *Conservation Center of the Sandhills*, a "store front" office accessible to the public.
- In 2005, the Partnership received the Secretary of Interior's 4 *C's Award for its collaborative appro*ach to natural resource protection and management.

Partnership 10 Year Review

In 2010, the Partnership celebrated its 10th year. This benchmark presented an opportunity to 'check-in' with partners to reflect on the Partnership's successes and failures. An independent review of the Partnership was conducted which sought to engage partners, foster dialogue, and promote action to ensure the efficiency, effectiveness, and sustainability of the Partnership for years to come. Surveys and interviews were conducted from July – August 2010. A report and presentation were submitted to the Steering Committee on September 13, 2010.

Results from the *10-Year Review*[6] identified the numerous benefits received through participation in the Partnership. These included the ability to leverage funding for acquisition and resource management, the establishment of stronger relationships that consistently help prevent major issues before they arise, and access to data and other information that increase knowledge and ease work flows. Partners also highlighted contributions the Partnership has made to the greater conservation community, including demonstrating the effectiveness of a collaborative approach to conservation.

Partner responses captured by the survey also identified several common themes for the Partnership to consider going forward. These included the need to reassess the Steering Committee and working groups' roles, responsibilities, and objectives; improve internal and external communication; explore mechanisms for documenting progress and achievements; improve public outreach and influence public perceptions; and confirm continued commitment to acquisition and management while considering other conservation strategies and challenges.

Partner responses suggest there is not a common understanding about how the Partnership documents progress toward accomplishing its mission. No formal process within the Partnership has required such

[6] DiBacco, 2010.

assessments to be regularly conducted and reported. This Plan was conceived as a way to increase the effectiveness of the Partnership towards achieving its' mission.

Regional Conservation Efforts

The Partnership supports the efforts of *America's Longleaf* Conservation Initiative. The Initiative's Range-wide Conservation Plan for Longleaf Pine 15-year goal is an increase in longleaf from 3.4 to 8.0 million acres, with half of this acreage targeted in the 16 range-wide "Significant Landscapes" in ways to support a majority of ecological and species' needs[7]. The NC Sandhills is identified as one of the Initiative's 16 Significant Landscapes.

The North Carolina Longleaf Coalition was created in 2010 as a state implementation team for America's Longleaf effort. The Partnership works with the North Carolina Longleaf Coalition which aims to provide the state/local level leadership called for in the regional plan. The North Carolina Longleaf Coalition coordinates closely with on-the-ground restoration efforts of the Partnership, the Onslow Bight Conservation Forum and the Cape Fear Arch.

[7] Regional Working Group. 2009. *Range-Wide Conservation Plan for Longleaf Pine*. America's Longleaf.

II. NC SANDHILLS LANDSCAPE DESCRIPTION

Introduction

This section describes the general geographic, climactic, geomorphologic, ecological, and human characteristics of the NC Sandhills Conservation Area. The scope, referred to in the Plan as the Conservation Area, is the area of the NC Sandhills physiographic region that encompasses the longleaf pine ecosystem and embedded natural communities. At just over 1 million acres, the Sandhills conservation area includes northern Hoke, eastern Richmond, northern Scotland, western Cumberland, Harnett, southern Moore, and small areas of eastern Anson and southern Lee counties of North Carolina.

Climate

Despite a humid subtropical climate and relatively high levels of precipitation, the fast-draining Sandhills soils have led to the dominance of xeric ecological communities throughout much of the Conservation Area. On average, the NC Sandhills receives from 46-49 inches of annual precipitation evenly distributed throughout the year, with summer high temperatures averaging from ~83-92^{o}F and winter high temperatures averaging ~52-64^{o}F[8]. Natural disturbance is an important element of the Sandhills ecosystem. Rapid drainage of precipitation supports an active fire regime. Wildfires are ignited an average 45 days each year by thunderstorms and human activities. Furthermore, tropical storms and hurricanes have important roles in the system through blow-down events that create gaps in pine and hardwood stands. It is generally recognized that these historic, Holocene climate conditions have begun shifting in recent years towards a hotter and more drought prone scenario that may favor some conservation targets but will certainly exacerbate management challenges and likely present new ones.

Fire Ecology

The critical role of fire in creating and maintaining the Sandhills' longleaf pine ecosystem has not diminished despite vast changes in fire frequency due to suppression and habitat conversion[9] over the past 200 years. Two of the most dominant species, longleaf pine (*Pinus palustris)* and wiregrass (*Aristida stricta)*, are specifically adapted to and thrive in high-frequency, low-intensity fire regimes. Some plants are specifically adapted to survive fire events; others tend to colonize newly burned patches. Many of the plant species in the Sandhills ecosystem have low reproductive rates or require fire occurrence to release seed or stimulate seed production. Furthermore, the habitat structure and species composition of Sandhills natural communities is maintained by fire, with fire suppression leading to hardwood dominance and decreased levels of species richness. The ability for this natural fire regime to exist on the historic scale is no longer possible due to the complexity of human development in the Area. Now,

[8] Figures averaged from historic climate summaries from the Southeast Regional Climate Center, found at http://www.dnr.state.sc.us/climate/sercc/climateinfo/historical/historical_nc.html.

[9] Thus, reducing fire's ability to spread across roads and increasing the tendency for human suppression near homes and agricultural sites.

fire must be prescribed, ignited, and managed according to standards that protect human communities while perpetuating natural communities.

Regional Ecology

The NC Sandhills physiographic region is home to 40% of the species in the state with more than 150,000 acres of intact natural longleaf pine community estimated to remain in the Area. This biodiversity results from a combination of topographical relief, higher elevation than other coastal plain sites, coarse textured soil layers alternating with fine-textured clays, and a naturally high frequency fire-return interval. Each community type identified in the Plan differs in hydrology, soils, species composition, fire regime, and biological associations. The ability of these communities to persist and support the numerous rare species found in the NC Sandhills will depend on effective conservation efforts amidst changing land uses and further habitat fragmentation.

Rare and Endangered Species of the Sandhills[10]

- Birds – red-cockaded woodpecker (*Picoides borealis*) (RCW), Bachman's Sparrow (*Aimophila aestivalis*)
- Mammals – fox squirrel (*Sciurus niger*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*)
- Herpetofauna – Carolina gopher frog (*Rana capito capito*), eastern tiger salamander (*Ambystoma tigrinum tigrinum*), Northern pine snake (*Pituophis melanoleucus melanoleucus),* Southern hognose snake *(Heterodon simus)*
- Fish – "Broadtail" madtom (*Noturus* sp. 1), cape fear shiner (*Notropis mekistocholas*), Sandhills chub (*Semotilus lumbee*), shortnose sturgeon (*Acipenser brevirostrum)*
- Mussels – atlantic pigtoe (*Fusconaia masoni*), brook floater (*Alasmidonta varicose*), cape fear spike (*Elliptio marsupiobesa*), Roanoke slabshell (*Elliptio roanokensis),* savannah lilliput (*Toxolasma pullus*), squawfoot (*Strophitus undulates),* triangle floater (*Alasmidonta undulata*), yellow lampmussel (*Lampsilis cariosa*)
- Lepidopterae – St. Francis satyr (*Neonympha mitchellii francisci*)
- Plants – bog spicebush (*Lindera subcoriacea),* Carolina grass-of-Parnassus (*Parnassia caroliniana*), chaffseed (*Schwalbea americana*), Georgia indigobush (*Amorpha georgiana* var. *Georgiana*), Michaux's sumac (*Rhus michauxii*), roughleaved loostrife (*Lysimachia asperulifolia*), Sandhills bog lily (*Lilium pyrophilum*), Sandhills pixie-moss (Pyxidanthera barbulata var. brevifolia), spiked medusa (*Pteroglossaspis eristata*)

Human Context

Beginning in the early 19th century, the forests of the Sandhills were heavily exploited by the naval stores and timber industries. This practice, along with increasing settlement and hog/cattle ranging, led

[10] Russo, M. 2000. *Threatened and Endangered Species in Forests of North Carolina: A Guide to Assist with Forestry Activities.* International Paper Company. Raleigh, NC, and *Threatened and Endangered Species of North Carolina*, http://nc-es.fws.gov/es/countyfr.html - 8/4/04. This list includes a sample of rare or threatened species, but is not a comprehensive list.

to severe habitat degradation in the region by the early 20th century. Despite the loss of most of the old growth longleaf during this time period, many inhabitants of the Sandhills relied on the forests as a source for food, raw materials, and income well into the 20th century. These regenerating forests also provided ecological services such as clean air, clean water, and soil retention to the local communities. However, as the human population continued to grow and land use patterns became more sprawling in nature, the services provided by these forests were diminished. Fire suppression, habitat fragmentation, and conversion of longleaf to other Southern pines and cropland also degraded native ecosystems and increased the intervals between and the intensity of fires.

The best remaining examples of fire-maintained longleaf pine forest are found on Fort Bragg, a stronghold for many of the rare species in the region. However, recent development and ever-increasing human populations continue to threaten the ecosystems and habitat corridors found in the NC Sandhills. Encroachment of development along the boundary of Fort Bragg is impacting the Army's ability to train and manage habitat on the installation.

III. PLANNING PROCESS

Introduction to *Open Standards for the Practice of Conservation*

The *Open Standards for the Practice of Conservation*[11] (Open Standards) is a product of the Conservation Measures Partnership (CMP), a joint venture of conservation NGOs that seek ways to better design, manage, and measure the impacts of their conservation actions. The Open Standards represent an idealized adaptive management process and provide a conceptual framework for good project design, implementation, monitoring, and evaluation. The CMP published version (1.0) of the Open Standards in 2004. Since then, several initiatives have emerged to help the Open Standards become the accepted practice within the conservation community. The Open Standards have also served as the framework for the development of the Miradi Adaptive Management Software Program.

The Open Standards, companion "Miradi" software version (3.3.1), past and current Partnership plans, and documents generated by members of the Partnership and working groups were used to facilitate and help guide development of the Strategic Conservation Plan. A Core Team, approved by the Steering Committee, assembled in the fall of 2011 to lead this process. A Strategic Conservation Plan Advisory Committee met twice with the Core Team in the spring of 2012 to provide expert opinion and review products developed by the Core Team through the Open Standards process.

Open Standards Approach

The main components of the Open Standards are broken into five steps that comprise the project management cycle (see figure 2, below). The basic structure of these generic steps is widely used in conservation and other fields that implement projects to achieve clearly defined goals. The steps include:

1. **Conceptualize** what will be achieved in the context of project location
2. **Plan** both **Actions** and **Monitoring**
3. **Implement** both **Actions** and **Monitoring**
4. **Analyze** data to evaluate the effectiveness of actions. **Use** results to **Adapt** project to maximize impact
5. **Capture and Share** results with key external and internal audiences to promote **Learning**

[11] The Conservation Measures Partnership. 2008. Open Standards for the Practice of Conservation, Version 2.0.

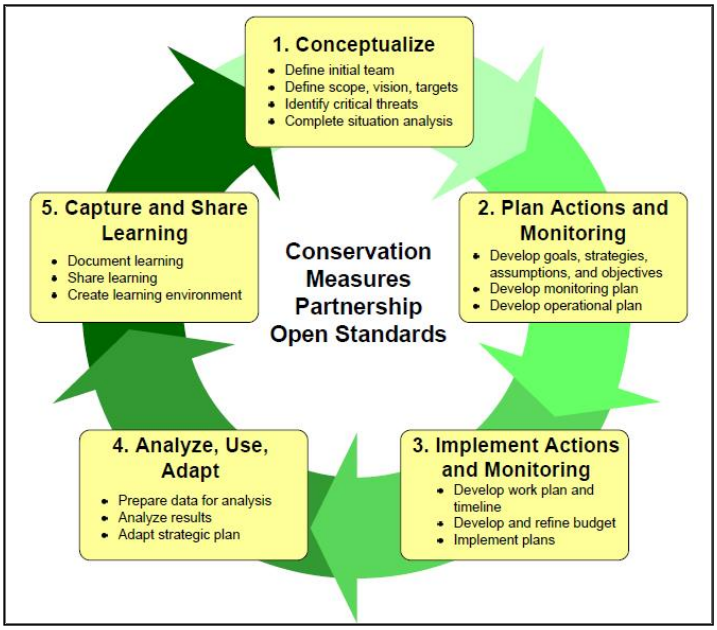


Figure 2: CPM Open Standards Project Management Cycle Version 2.0

Planning Process

The planning process for the Plan focuses on steps 1 and 2. The Core Team applied the Open Standards framework within the Miradi Software to create conceptual models of our biological priorities that identify/validate/refine:

a. Scope and Vision of the Partnership
b. Conservation Targets and Target Goals
c. Target Viability Assessment (highlight the current status of each target and facilitate monitoring of the target health and status over time) through identification of Key Ecological Attributes and Indicators
d. Threats to Conservation Targets including Direct Threats and Stresses
e. Strategies and associated specific Activities to abate threats and Objectives

Miradi software is based on developing a situation analysis in the form of a Conceptual Model that visually represents the inter-connection between conservation targets, direct threats, contributing factors, and strategies to abate the threats. The Partnership operates on a large landscape scale in the Sandhills and the complexity of threats and targets does not lend itself to one conceptual model. After several iterations, the Core Team decided to develop separate conceptual models for each Direct Threat identified. This decision made the planning process more effective and can be presented in a more easily digestible format for reading the Plan.

IV. CONSERVATION TARGETS AND GOALS

Introduction

Conservation targets (targets) are elements of biodiversity at a project site, which can be species, habitat/ecological systems, or ecological processes on which a project has chosen to focus. All targets at a site should collectively represent the biodiversity of concern at the site. In this case, targets for the NC Sandhills were selected to focus the planning efforts and guide conservation strategies towards biodiversity most in need of conservation. Defining goals for each target is also an important part of the Open Standards planning process. A goal is a formal statement detailing a desired impact of a project. Goals define a desired end state for targets and help to shape strategies, develop objectives, and structure monitoring efforts. This section describes the planning process used to select targets, the ecological components that make up each of the selected targets, and the goals for each selected target.

Target Selection Process

Targets were selected by the Core Team in the fall of 2011 and were based on the targets previously identified in the 2004 Site Conservation Plan. The Open Standards recommends selecting a limited number of ecosystem and species targets to collectively represent the full suite of biodiversity in the project area. The Core Team investigated a handful of different methods for selecting conservation targets and determined that data availability on most species was a limiting factor. Also, the landscape scale planning and operations of the Partnership lends itself to broader ecosystem and community level targets to represent NC Sandhills biodiversity. Therefore, the only deviation from the 2004 Site Conservation Plan is that the Red-Cockaded Woodpecker, which was previously considered its own conservation target, is now part of the Longleaf Pine Mosaic as a nested target. Nested targets are species, ecological communities, or ecological system targets whose conservation needs are subsumed in one or more focal conservation targets. Nested targets represent important natural communities or species that perform critical roles in the ecology of the selected target but for planning purposes, do not currently warrant individual listing as a conservation target. These nested targets are listed to summarize and illustrate important aspects of biodiversity included in our selected targets.

The four conservation targets chosen to represent the NC Sandhills were: the Longleaf Pine Mosaic, Upland Depressional Wetlands, Streamhead Pocosins/Seeps, and Blackwater Streams. The selected conservation targets and associated nested targets are listed in Table 1.

Goal Selection Process

The Core Team developed goals for each conservation target in January 2012 using Open Standards guidelines. Goals are based on the following criteria: linked to targets, impact oriented, measurable, time limited, and specific. The Core Team went through multiple iterations of draft goals and also received feedback from the Strategic Conservation Plan Advisory Committee. Each conservation target has at least one associated goal, while a few targets have multiple goals. Goals are described below their associated conservation target descriptions in the following pages. For each goal, descriptions of information gaps that limit the ability to assess its accomplishment are provided. These information

gaps along with additional areas of study needed for effective plan implementation are addressed and prioritized under Research Needs (section IX). The Conservation Target Viability Analysis (section V) and Research Needs (section IX) provide descriptions of future areas of study for the Partnership to explore for implementation of the Plan.

Target Summaries and Goals

Table 1 lists the selected conservation targets, related target selection justifications, and nested community targets. A full description of nested species and community targets is found in Appendix C. The Reserve Design Working Group maintains the full list of species and community targets for the Sandhills.

Table 1: Conservation Target Summary

Conservation Target	Target Selection Justification	Nested Community Targets
Longleaf Pine Mosaic	Longleaf community types encompass the primary source of biodiversity in the Sandhills and have experienced great losses in original habitat extent and integrity	Xeric Sandhill Scrub, Sand Barren, Pine/Scrub Oak Sandhill, Mesic Transition, Mesic Pine Flatwoods, River Terraces, Wet Pine Flatwoods, Pine Savanna
Streamhead Pocosins/Seeps	Habitat for rare plants ,animals, and lepidoptera (see p.38) sensitive to diverse sets of environmental factors	Canebrakes, Sandhills seeps, Streamhead Atlantic white cedar, Streamhead pocosins
Blackwater Streams	Habitat for rare and threatened aquatic species (see p.39). Include aquatic systems that are threatened by increasing development	Beaver ponds, successional sedge meadows, and floodplain forests
Upland Depressional Wetlands	Habitat for rare plants and animals including herpetofauna (see p.38), sensitive to diverse sets of environmental factors	Small depressional ponds, vernal pools, small depressional pocosins and swamps

LONGLEAF PINE MOSAIC[12]

Description

The longleaf pine mosaic is the dominant ecological system of the Sandhills and includes a matrix of community types that form a complex web of relationships. Historically, longleaf pine covered more than 90 million acres of land from Virginia to Texas. A range-wide reduction of longleaf pine to 3.4 million acres has highly fragmented longleaf habitat and impacted important natural elements of the system, especially through the suppression of the natural fire regime. Yet, when compared to other longleaf pine areas, the NC Sandhills still has large acreages of intact longleaf community types and retains great biological diversity. Sandhills longleaf pine communities have been rated as retaining some of "the highest species richness values reported anywhere in the world."[13] The Red-Cockaded Woodpecker, a federally endangered species and nested target, is dependent on large tracts of fire-maintained mature longleaf pine habitat. The eight community types that form the ecological system and represent the longleaf pine mosaic in the Sandhills are Xeric Sandhill Scrub, Sand Barren, Pine/Scrub Oak Sandhill, Mesic Transition, Mesic Pine Flatwoods, River Terraces, Wet Pine Flatwoods, and Pine Savanna described below. These community types are listed as nested targets, since the preservation of the longleaf pine mosaic requires the protection and management of each community type. The full list of species and community nested targets is found in Appendix C. A few characteristics shared by all Sandhills longleaf pine communities are: a canopy dominated by longleaf pine (*Pinus palustris*), a scrub hardwood layer of varying characteristics, ground cover dominated by wiregrass (*Aristida stricta*) and/or macrolichens (*Cladonia spp.*), and dependence on a frequent fire regime.

[12] Content adapted from Schafale, M. 1994. *Inventory of Longleaf Pine Natural Communities*. DENR, North Carolina Natural Heritage Program and B. Sorrie, personal communication, 8/15/04.

[13] Schafale, p.4. These species richness values refer to the number of species in patches ranging in size from $1m^2$-$1000m^2$.

GOALS OF LONGLEAF PINE MOSAIC (LLP):

1. By 2025, natural longleaf pine communities* containing healthy assemblages** of longleaf pine associated species are restored within core areas***, buffers, and connectors**** as defined by the Reserve Design.

*Natural longleaf pine communities have the appropriate ground cover and native pine distribution for each specific community type, e.g. upland LLP has wire-grass dominated herbaceous ground cover, minimal or patchy hardwood mid-story, and an uneven-aged LLP component.

** A healthy assemblage is a defined suite of longleaf pine generalists and specialists from NHP's Landscape Habitat Indicator Guilds

*** Core areas are defined as fire maintained habitats on permanently protected lands including Ft. Bragg, Camp Mackall, Blocks A, B, C and D of the Sandhills Game Lands, and contiguous conservation lands.

****Buffers and connectors are generally forested habitat with minimal development suitable to buffer/link core areas for animal movement and maintenance of critical ecological processes

WHAT WE NEED TO KNOW

- Indicator species to be identified for LLP Monitoring (see Appendix C)
- Methodologies for monitoring extent and condition of longleaf pine communities
- Longleaf Pine condition and prescribed fire information for private lands
- Identify anticipated impacts of climate change on the LLP in the NC Sandhills

2. By 2025, the Sandhills East and West RCW populations have achieved demographic connectivity with a minimum 500 breeding pairs.

WHAT WE NEED TO KNOW

- Follow-up demographic connectivity study of RCWs in Sandhills at a future date

STREAMHEAD POCOSINS/SEEPS[14] (SPS)

Target Description

The conservation target of Streamhead Pocosins and Seeps is an aggregate of four distinct natural community types with diverse characteristics and species composition. The four community types are Canebrakes, Sandhill Seeps, Streamhead Atlantic White Cedar, and Streamhead Pocosins. These community types are listed as nested targets and share certain traits that are susceptible to similar threats and benefit from the same mitigation strategies, thereby lending to their consolidation into one target. These traits are: an occurrence on wet soils dependent on seepage, site location near streamheads or slopes, ranges in fire frequency, and a dependence and susceptibility to hydrologic disturbance and habitat destruction. The full list of species and community nested targets is found in Appendix C.

GOALS OF STREAMHEAD POCOSINS/SEEPS:

1. By 2020, all known pocosins and seeps on protected lands support appropriate biological communities including vegetative structure and presence of a minimum number of indicator plant and animal species.
2. By 2020, 75% of seeps and 25% of streamhead pocosins within connectors and buffers on private lands support appropriate biological communities including vegetative structure and presence of a minimum number of indicator plant and animal species.

WHAT WE NEED TO KNOW

- Location and condition of all SPS within Reserve Design
- Indicator species to be identified for SPS monitoring (see Appendix C)
- Determine desired vegetative structure for SPS communities (Reference habitat from NHP?)
- Define connectivity metrics for SPS conservation targets (see Appendix C)

[14] Adapted from Schafale, M. and Weakley, A. 1990. *Classification of the Natural Communities of North Carolina: Third Approximation.* DEHNR, North Carolina Natural Heritage Program. Raleigh, NC. Also,
Hall, S. and Schafale, M. 1999. *Conservation Assessment of the Southeast Coastal Plain of North Carolina, Using Site-Oriented and Landscape-Oriented Analysis.* DEHNR, North Carolina Natural Heritage Program. Raleigh, NC.

BLACKWATER STREAMS[15](BWS)

Description

The conservation target of blackwater streams is an aggregate of three distinct natural community types with diverse characteristics and species composition. The three community types are Beaver Ponds, Successional Sedge Meadows, and Floodplain Forests. These community types are listed as nested targets. The full list of species and community nested targets is found in Appendix C. Each community type is directly associated with or dependent on the natural and hydrologic systems of blackwater streams. Thus, each is susceptible to similar threats and responsive to similar mitigation strategies, thereby lending to their consolidation into one target. General characteristics of blackwater streams are sandy bottoms, slow to moderate flow rates, clear acidic water stained by tannins, and low turbidity. Sandhills blackwater streams also experience less variable flow rates than other blackwater streams due to the seepage rates of soils in the area, which result in relatively steady stream inputs.

GOALS OF BLACKWATER STREAMS:

1. By 2020, the hydrologic regime of priority blackwater streams supports associated forest communities that meet the habitat requirements for healthy assemblages* of common and nested target species.
   *A healthy assemblage is defined as a suite of generalists and specialists from NHP's Landscape Habitat Indicator Guilds

WHAT WE NEED TO KNOW

- Strategic Environmental Research and Development Program(SERDP) Report on Blackwater Streams (Deliverables starting 2012)
- Identify priority blackwater streams
- Spatial occurrence data on community targets (investigate Fort Bragg and DENR datasets)
- Define/describe aquatic and forest community habitat requirements
- Locations of dams and levees, as well as release rates from dams

2. By 2020, the water quality in all priority blackwater streams meets or exceeds the minimum criteria for a good rating as defined in the stream bioclassification metrics (criteria forthcoming from SERDP funded project)

WHAT WE NEED TO KNOW

- DENR monitoring sites and type of data collected for water quality metrics
- Appropriate water quality metrics (SERDP Report pending)
- Point source locations such as NPDES permitted locations

[15] Adapted from Schafale and Weakley, 1990. Also,
Adapted from Hall and Schafale, 1999.

UPLAND DEPRESSIONAL WETLANDS[16](UDW)

Description

The conservation target of upland depressional wetlands is an aggregate of three distinct natural community types (vernal pools, small depressional ponds, and small depressional pocosins) with certain distinguishing characteristics and species compositions. These community types are listed as nested targets. However, each type shares landscape features and they are often located in proximity to each other and are highly associated with one another. Thus, these communities are susceptible to similar threats and can benefit from the same protection and threat abatement strategies, thereby supporting their consolidation into one target. Generally upland depressional wetlands are seasonally or perpetually inundated areas characterized by a shrubby border and high herbaceous diversity maintained by seasonal fire. An active fire regime is assumed to be important for nutrient cycling and woody vegetation control. These areas are relatively unstudied with much yet to be learned about their ecological importance and roles. The full list of species and community nested targets is found in Appendix C.

GOALS FOR UPLAND DEPRESSIONAL WETLANDS:

1. By 2025, vegetative structure and connectivity with associated habitats are restored for all known intact or restorable UDWs on protected lands and 50% of UDWs on private lands within reserve design.

WHAT WE NEED TO KNOW

- Location, spatial relationship (regarding herpetofauna), and condition of all UDWs
- Define connectivity metrics for target species
- Define vegetative structure goals and metrics

[16] Adapted from Schafale and Weakley, 1990. Also,
Adapted from Hall and Schafale, 1999.

V. CONSERVATION TARGET VIABILITY ASSESSMENT

Introduction

A key pillar of the 2004 Site Conservation Plan was its *Biodiversity Health Assessment.* The purpose of the assessment was to understand the critical functions of the selected conservation targets, how the targets are affected by human actions, and develop an understanding of the overall status for each target. The 2004 Site Conservation Plan was created using TNC's Conservation Action Planning (CAP) process. This 2012 Plan works from the same CAP principles and presents an updated Conservation Target Viability Assessment with revised key ecological attributes and indicators. This new assessment, like its predecessor, helps identify the steps to be taken to manage and restore the natural processes on which each target depends. The current Viability Assessment will serve as a point of reference for future assessments in order to measure the amount of progress that has been made through implementing the strategies outlined in Section VIII of this plan.

Viability Assessment Process

The Viability Assessment involves the identification of key ecological attributes (KEAs) for each conservation target. These KEAs are aspects of a target's biology or ecology that if present, define a healthy target and if missing or altered, would lead to the outright loss or extreme degradation of that target over time. Identification of KEAs is based on three attribute categories that can collectively determine the health of a conservation target:

- Size – a measure of the area of the conservation target's occurrence (for an ecosystem target) or abundance of the target's occurrence (for a species or population target)
- Condition – is a measure of the biological composition, structure and biotic interactions that characterize the space in which the target occurs
- Landscape Context – is an assessment of the target's environment including: a) ecological processes and regimes that maintain the target occurrence such as flooding, fire regimes and other kinds of natural disturbance; and b) connectivity that allows species targets to access habitats and resources or allows them to respond to environmental change through dispersal or migration.

The Viability Assessment also involves the identification of indicators, defined as a unit of information measured over time that documents changes in the condition of attributes. Indicators are selected to assess the status of each KEA. For each indicator a rating scale is developed to assess the current status and also the desired future status of a KEA. Assumptions are recorded relative to indicators such as any relevant issues or comments. Sets of KEAs and Indicators are then developed for each target.

The identification of KEAs and indicators is an iterative process that uses the best available knowledge to evaluate the condition of the targets and what condition we want them to be in. The Core Team conducted an initial iteration of the Viability Assessment which was presented to the Strategic Conservation Plan Advisory Committee for expert review in March 2012. The committee's feedback on this first draft fueled a second iteration by the Core Team which was conducted in April, and was

reviewed by the Strategic Conservation Plan Advisory Committee in May. The analysis developed in these sessions is a work in progress with information gaps we expect to fill while developing the Monitoring Plan described in section VIII. The Monitoring Plan will build on the Conservation Target Viability Assessment and identify monitoring priorities, available resources, and research needs. The plan will continue to be refined as these systems are better understood and our monitoring efforts evolve.

Format

For each target, sets of KEAS, indicators, and indicator ratings are arranged in the tables. The attribute categories (Size, Condition, Landscape Context) are provided along with target rating scale, ratings, and assumptions. The Viability Assessment tables are provided in Appendix D.

VI. THREATS TO CONSERVATION TARGETS

Introduction

In the Open Standards model, direct threats are the actions taken by humans that degrade a conservation target. The Threats Analysis investigates the direct threats that are impairing the biological integrity of the conservation targets. The Threats Analysis is organized in 2 sections: direct threat ratings and stress identification. The direct threat rating section identifies, defines, and rates the direct threats to conservation targets and makes the assessment of threats more explicit and objective. The second section identifies the stresses associated with the direct threats affecting the conservation targets and explains the roles of each stress in the current impairment of biodiversity health. Open Standards defines stresses as attributes of a conservation target's ecology that are impaired directly or indirectly by human activities. Identifying stresses assists the overall threats analysis by describing the biophysical impact of the threat on the conservation target. Ultimately, the threats and stresses analyzed in this section are addressed by the conservation strategies that will be carried out by the Partnership**.**

Threats Analysis

Utilizing the 2004 Site Conservation Plan as a starting point to identify direct threats, the Threats Analysis was conducted by the Core Team in January 2012. Eleven direct threats were identified through group discussion and entered into Miradi, with the impact of each threat ranked according to three criteria:

- Scope (Sc.): proportion of the target affected by an actual threat or likely to be affected by a potential threat
- Severity (Sev.): level of damage it would cause to the target
- Irreversibility (Irr.): extent to which the effects of the threat can be undone and the target restored

Miradi uses a 4-point scale (Very High, High, Medium, and Low) to rank each criterion. Once each criterion is rated, Miradi uses a rule-based procedure to aggregate threat ratings into summary threat ratings, and subsequent summary target ratings when all threats are rated. As an example, fire suppression directly threatens the health of the longleaf pine mosaic and is rated high in scope and severity, but low in irreversibility. In Figure 7.1 below, a rating of very high is depicted in red, a rating of high is depicted in yellow, a rating of medium is depicted in dark green, and a rating of low is depicted in light green. The full set of direct threats and ratings were reviewed by the Strategic Conservation Plan Advisory Committee in March 2012. From the critique generated by this review, a summary of the direct threats and ratings is found on the following page.

Direct Threat Descriptions

Incompatible development: "Incompatible" development negatively impacts natural communities, populations of associated species, and ecological processes such as fire. Incompatible development occurs within core areas and buffers of the Reserve Design and diminishes the ecological function of the core area or buffer. Examples include various types of conventional development including but not limited to commercial properties and shopping centers, housing developments, horse farm development, golf courses, utilities, wastewater treatment, etc.

Incompatible forestry practices: Includes unsustainable timber harvesting practices, site preparation practices such as bedding, conversion of native forests to plantations of off-site pines that lack the natural character of intact Sandhills ecosystems, and short rotation forestry for biofuels.

Incompatible agricultural production practices: Includes habitat loss and conversion, encroachment into riparian areas, overuse and misuse of fertilizers and pesticides, planting of potentially invasive species such as "sterile" Chinese silvergrass (*Miscanthus sinensis)* for biofuel production, and incompatible industrial poultry production practices.

Incompatible pine straw production: Pine straw harvesting in longleaf stands leads to deteriorated groundcover conditions, erosion, biodiversity loss, and a reduction in fuels needed to carry fire. This includes the inappropriate application of fertilizers, use of herbicides to control the hardwood mid-story, and short pine straw raking cycles.

Fire Suppression: Fire suppression includes suppression of wildfires, as well as insufficient amount or improper timing of prescribed burns in fire-dependent habitats, and policies (state, local, agency, etc.) and landowner concerns with smoke and fire risk that can limit the ability to implement prescribed fire on adjacent lands.

Transportation Planning and Road construction: Transportation planning and road construction, including construction of culverts and stream crossings, destroys, and fragments habitat. Road construction can also impact the hydrology and connectivity of aquatic targets. Roads also facilitate the spread of other threats such as non native and invasive species.

Conventional Golf course maintenance and management: Conventional golf course maintenance and management include the application of chemical fertilizers and pesticides (which can lead to nutrient and toxin runoff), planting of invasive species, snag and woody debris removal, and high demand for water resources.

Small dams on headwater tributaries: Small dams typically occur on private property and degrade hydrologic connectivity and flow regimes.

Surface mining: Surface mining includes sand, gravel, granite, and other mining operations, which can severely degrade water quality and stream hydrology, as well as destroy or degrade habitat in areas that are mined or receive mining waste.

Unsustainable Surface Water withdrawals: Unsustainable withdrawals lead to a disruption of hydrology and habitat degradation in streams especially during prolonged drought periods when water demand is high and aquatic habitats are stressed.

Invasive species: Non-native and invasive plant and animal species can severely impact biodiversity and ecological processes. Introduction of fire tolerant invasive plant species such as Cogongrass (*Imperata cylindrica*) pose a significant threat to longleaf pine systems by increasing the intensity of fire stress on mature longleaf.

Direct Threats/ Targets	Longleaf Pine Mosaic		Upland Depressional Wetlands		Streamhead Pocosins/Seeps		Blackwater Streams		Summary Threat Rating
Fire Suppression	Sc.	High	Sc.	High	Sc.	High	Sc.	Low	High
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Invasive Species	Sc.	Medium	Sc.	Medium	Sc.	Medium	Sc.	Medium	Medium
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Surface Mining	Sc.	Medium	Sc.	Medium	Sc.	Medium	Sc.	Medium	Medium
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Incompatible Development	Sc.	Medium	Sc.	Medium	Sc.	High	Sc.	Low	Medium
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Incompatible forestry practices	Sc.	Medium	Sc.	Low	Sc.	Low	Sc.	Medium	Medium
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Transportation Planning and Construction	Sc.	Medium	Sc.	Medium	Sc.	Medium	Sc.	Low	Medium
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Unsustainable Surface Water Withdrawals	Sc.		Sc.		Sc.		Sc.	Medium	Low
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Incompatible Agricultural Production Practices	Sc.		Sc.	Low	Sc.	Low	Sc.	Medium	Low
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Incompatible Pine Straw Production	Sc.	Medium	Sc.		Sc.		Sc.	Low	Low
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Conventional Golf course Maintenance and Management	Sc.		Sc.		Sc.	Low	Sc.	Low	Low
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Small dams on headwater tributaries	Sc.		Sc.		Sc.		Sc.	Medium	Low
	Sev.		Sev.		Sev.		Sev.		
	Irr.		Irr.		Irr.		Irr.		
Summary Target Ratings	High		Medium		High		Medium		High

Figure 7.1: Miradi Threat Analysis

Stresses

The stresses identified in the Plan are adapted from the 2004 Site Conservation Plan and CAP and updated to match the conservation targets. These stresses show how the contributing factors and direct threats lead to the destruction, degradation, or impairment of the conservation targets. Below are the definitions of each of the stresses, as well as brief descriptions of how they affect the conservation targets. Figure 7.2 provides context for the association of the stresses, direct threats, and conservation targets.

Stresses Definitions[17]

Altered composition/structure: This stress refers to fundamental changes in the ecological processes and key habitats of species in a given target. For the longleaf pine mosaic, this stress refers to density of stands, age distribution of longleaf pine within stands, RCW foraging and nesting habitat availability, quality and diversity of groundcover, and the amount of scrub oak mid-story. For blackwater streams, this stress refers to a combination of water quality, species diversity, and population size amongst rare and endangered species. For SPS's and UDW's, this means the structure of the vegetation, particularly the shrubby mid-story, and how this influences the biodiversity found in these habitats through light availability.

Altered hydrologic regime: This stress refers to changes in the patterns and/or quantity of water flow as compared to the natural run of a given blackwater stream.

Altered natural fire regime: This stress refers to changes to the frequency, intensity, and/or ability of fire to carry across a landscape relative to the natural, historic fire regime. Though the effects are many, alterations to a natural fire regime generally influence all targets similarly by reducing the abilities of indigenous species, which are adapted to a natural fire regime, to grow and reproduce due to the influx of fire-intolerant species and unchecked growth of mid-story plants, such as scrub oaks.

Habitat loss, fragmentation, or degradation: Habitat loss, fragmentation, or degradation refers to the destruction of, or changes to habitats that prevent a target from surviving in its natural location or state. Habitat loss and degradation affects all targets similarly by altering the conditions necessary for a given target to persist in a location. Habitat fragmentation refers to the isolation of habitat patches through the loss or degradation of connecting habitat. For species in all habitats, habitat fragmentation leads to loss of genetic viability. For the longleaf pine mosaic, habitat fragmentation reduces the ability for fire to spread in a natural mosaic, increases scrub oak populations, benefits invasive species, reduces the ability of component species to exchange genetic material, and increases the susceptibility for patches to experience local extinctions.

[17] Definitions from 2004 Site Conservation Plan

Nutrient loading: This stress refers to the export of excess nutrients, such as nitrogen and phosphorus, which negatively impact native flora and fauna of blackwater streams. Nutrient loading can lead to algal blooms, changes in invertebrate populations, raising water temperatures, and subsequent fish kills.

Reduced primary productivity:
This stress refers to the reduced photosynthetic ability of primary producers at the base of the food chain in the aquatic system due to shading associated with fire suppression.

Sedimentation: This stress refers to increased particulate levels (i.e., mud, sand or organic matter) in water bodies. Sedimentation affects all targets both by reducing light transmission and increasing the temperature of a water body and thus altering the natural conditions for native species of a given aquatic target.

Contamination: This stress refers to the presence of polluting chemicals, contaminants, and toxins in a blackwater stream. These pollutants can directly lead to fish kills or “dead zones”, as well as indirectly lead to lowered reproductive rates and bioaccumulation of toxins in species higher in a given food chain.

Direct Threat	Stresses	Target Affected
Incompatible development	Habitat loss, fragmentation, and degradation Altered natural fire regime Sedimentation Contamination	All BWS
Incompatible forestry practices	Habitat loss, fragmentation, and degradation Altered natural fire regime Sedimentation	LLP BWS
Incompatible agricultural production practices	Habitat loss, fragmentation, and degradation Sedimentation Nutrient Loading Contamination	LLP BWS & SPS
Incompatible pine straw production	Habitat loss, fragmentation, and degradation Altered composition/structure Altered natural fire regime	LLP
Fire suppression	Altered natural fire regime Altered composition/structure Reduced primary productivity	All BWS
Conventional golf course maintenance and management	Nutrient loading Sedimentation Contamination	BWS & SPS
Small dams on headwater tributaries	Altered hydrologic regime Habitat loss, fragmentation, and degradation	BWS & SPS
Surface mining	Habitat loss, fragmentation, and degradation Sedimentation Contamination	LLP BWS
Unsustainable surface water withdrawals	Altered hydrologic regime Habitat loss, fragmentation, and degradation	BWS
Invasive species	Habitat loss, fragmentation, and degradation Altered natural fire regime	All

Figure 7.2 Direct threats, stresses, and targets affected

VII. STRATEGIES AND OBJECTIVES

Introduction

Through the Open Standards process, the Core Team developed a set of strategies and activities intended to address the direct threats identified as affecting conservation targets. Strategies currently being used by various working groups and those found in the 2004 Site Conservation Plan were used to inform the development and selection process for this Plan. Strategies were selected at key intervention points in the conceptual models (see Appendix E) to logically depict how they would address the direct threats (see section VI). Strategies were reviewed and vetted by the Strategic Conservation Plan Advisory Committee, and objectives were then created to assess desired outcomes and evaluate the success of selected strategies towards reaching the goals of our conservation targets. The Partnership might not necessarily have the capacity or expertise to implement all of the identified strategies at present, but strategies were identified that are seen as realistic and likely to have a positive and measurable impact on Sandhills biodiversity. The Partnership will continue to implement strategies using the resources and expertise available (see section VIII), and will also seek to address its capacity gaps to increase effectiveness.

Strategy Selection Process

Open Standards defines a strategy as a group of actions with a common focus that work together to reduce threats, capitalize on opportunities, and/or restore natural systems, and include one or more activities designed to achieve specific objectives and goals. The process of developing strategies involves the identification and arrangement of contributing factors into conceptual models in *Miradi* (see Appendix E) and determining the key intervention points at which the Partnership can implement corrective measures. At these intervention points the Core Team brainstormed potential strategies to affect the threats. The Core Team utilized and modified prior Partnership strategies as well as created new ones. Activities designed to implement each strategy were developed. The strategies and activities for the Plan were generated in Core Team meetings held from February through April 2012. Draft strategies were identified through group discussion and entered into *Miradi* Conceptual Models. The draft strategies were then sent out to the Strategic Conservation Plan Advisory Committee for review and refinement. Later, the strategies were evaluated and rated in Miradi based on the overall benefit to the selected conservation targets and feasibility. The full list of strategies and associated activities can be found in Appendix F.

Objective Selection Process

An objective, defined by Open Standards, is a formal statement detailing a desired outcome of a project. Objectives define what the Partnership aims to achieve in the near term and can help to focus monitoring efforts. Objectives aim to collectively achieve goals for conservation targets and to ultimately achieve the Partnership's mission and vision. In many planning processes, objectives would be selected early on and strategies developed around them. In Open Standards however, all threats and contributing factors were identified first in a conceptual model that allowed the Core Team to identify key intervention points where appropriate strategies were developed to abate threats. At this point, the Core Team "flipped" the conceptual models into results chains in Miradi to visualize the

anticipated “results”, or outcomes, of identified strategies. Objectives were selected based on anticipated outcomes. The Advisory Committee refined the Core Team’s work on strategies, activities, and objectives to help focus monitoring efforts of the Partnership.

Strategies and Objectives Tables

The Open Standards planning process detailed in Section 3 is a set of recommended steps. Planning processes and outputs do not necessarily follow a linear path. The development of strategies and objectives is no different. Although strategies were developed as a precursor to objectives, vetting and drafting of strategies and objectives occurred in tandem. In order to fully understand the association between identified strategies and objectives, the conceptual model and results chain outputs from *Miradi* can be reviewed in Appendix E. This will allow the reader to understand the breadth of the threats in the Sandhills and visualize the strategic intervention points and anticipated outcomes that are assessed according to the defined objectives and intended to result in threat abatement. The tables found in Appendix F were developed to show the association of strategies and objectives that were selected for the Plan and the responsible working group. The following section, Implementing the Plan, details how the strategies will be implemented within the Partnership including the responsibilities of each working group.

VIII. IMPLEMENTING THE STRATEGIC CONSERVATION PLAN

Introduction

Collaboration and coordination are the keys to achieving the vision of the Strategic Conservation Plan. The Plan represents a tangible shared vision of coordinating actions and strengthening the political will vital to make this vision a reality. Through the Open Standards process, strategies discussed in the previous section were developed to address the identified direct threats affecting the conservation targets. Past planning documents for the Partnership have stopped short of delegating responsibility for implementing strategies. This section sets the framework for how strategies are implemented and how success will be measured for the Partnership and for conservation targets.

Strategy Implementation

Each strategy identified in Section VIII has been designated as falling under the purview of one the five working groups. Although all strategies do not necessarily fit precisely within the scope and expertise of a single working group, the designated working groups will decide how a strategy and associated activities are executed and will be responsible for documenting progress. Each working group, with support from the Partnership Coordinator, is responsible for identifying and prioritizing activities in order to implement strategies and report to the Steering Committee. Working groups will provide annual status reports of their prioritized strategies and the status of strategies being implemented to the Partnership Coordinator. Where conflicts arise or coordination among working groups is necessary, working group chairs and the Partnership Coordinator will be responsible for overseeing necessary communications and actions in order to ensure that the work of the Partnership moves forward.

Finance Subcommittee

A Finance Subcommittee comprised of the chair of each working group and three Steering Committee members will be established by the Steering Committee. The subcommittee will be staffed by the Partnership Coordinator and chaired by a member of the Steering Committee. The Finance Subcommittee will have 2 charges:

1. Overcome financial obstacles of working groups- Working groups are responsible for overseeing the implementation of strategies including identification of funding sources. However, where significant obstacles exist, working group chairs can present such issues to the Finance Subcommittee. The Finance Subcommittee will then provide advice, assistance, and/or guidance on how to secure funding (or resolve funding issues).
2. Build capacity for monitoring and applied research- The subcommittee will seek to identify funding sources to enhance new and continuing biological monitoring efforts identified in the Plan and carried out by the working groups.

The Finance Subcommittee will meet as necessary and report to the Steering Committee.

Measuring Success Introduction

This Plan is designed to be an adaptive, iterative document that continually addresses the dynamic ecological processes and status of NC Sandhills biodiversity. It is necessary to measure the progress and success of strategies and activities undertaken by the Partnership. This requires a two part approach of monitoring Partnership success as well as monitoring biological success.

Partnership Monitoring

In order to evaluate Partnership success and progress, working group and subcommittee chairs will provide information to the Coordinator who will then compile progress metrics into an Annual Report that will be provided to the Steering Committee. The Annual Report shall include a synthesis of quarterly reporting in an easily digestible format as well as updates on the progress of strategies and activities being worked on. The report will also include challenges of the past year and expected outputs for the following year. Information for the report shall be provided to the Coordinator by the end of June each calendar year in order for the Coordinator to package and present findings at the fall Steering Committee meeting.

Every 2 years, working groups shall conduct a review of strategies and activities to assess whether the strategies are meeting identified goals, affecting positive change, and abating threats to the conservation targets. At this time, they will also evaluate monitoring efforts, indicators and metrics, and research needs. A standardized reporting template for this bi-annual review will be created by the Partnership Coordinator for working groups to submit to the Steering Committee.

In 5 years, the Strategic Conservation Plan will be reviewed and updated by a subcommittee to be established by the Steering Committee in the 4th year after Plan approval. The update will consider the successes and failures of the Plan, adapt existing or propose new methodologies to strengthen the Partnership, and address new threats and the changing condition of conservation targets. While this current plan was developed through the Open Standards process, the most current generation of conservation planning tools should be utilized.

Biological Monitoring

In order to evaluate the status of NC Sandhills biodiversity, it is necessary to measure the response of natural communities and conservation targets to the management and conservation strategies the Partnership implements. Through the Open Standards framework, KEAs and indicators have been selected to evaluate the condition of the biological health of our conservation targets. Indicators are measurable factors of conservation targets that can be quantitatively and qualitatively monitored to test the success of implemented strategies. Monitoring efforts will inform adaptive management strategies to help the Partnership achieve the goals set for our conservation targets.

A cooperative Monitoring Plan shall be created to guide the Partnership's monitoring program and delineate monitoring responsibilities among the various partners. The monitoring plan will be developed by the Partnership Coordinator and a Monitoring Plan subcommittee to be approved by working group chairs and the Steering Committee. The Monitoring Plan will ensure work is divided effectively among Partner organizations and field personnel, incorporating existing and newly-designed

monitoring programs with improved communication and centralized data management. The Partnership Coordinator will be responsible for the storage and organization of the monitoring data, and ensuring access to all partners. This approach will enable partners to share information more easily, process and analyze data more quickly, and improve our cumulative understanding of the status of targets and the impacts of strategies. The roles of Partner organizations and field personnel responsible for specific monitoring efforts will be reviewed on a bi-annual basis. A full review of monitoring and strategy success will be performed on a five-year basis.

Annual *State of the Sandhills* Report

The *State of the Sandhills* report will be an annual outreach document for the public outlining accomplishments and issues facing the Partnership and detailing how the NC Sandhills ecosystem is faring. The report is designed to increase the visibility and transparency and to gain public support for the Partnership's mission. The Communications Working Group will take the lead role in developing the document with support from the Partnership Coordinator and Steering Committee. Information to be presented in the *State of the Sandhills* report will include Partnership challenges, Partner success stories, and conservation and management successes and challenges over the previous year. The inaugural report for 2013 should include a history of the Partnership and its accomplishments to date. A draft report is to be presented for approval at the last Steering Committee Meeting of each calendar year and a final draft made public through free forms of media in January.

IX. RESEARCH NEEDS

Introduction

Since its inception in 2000, the Partnership's mission of protecting Sandhills biodiversity has been greatly aided by inventory, research, and analysis of biological information. The development of a Reserve Design for the NC Sandhills (see map, Appendix B) has played a key role in the Partnership's mission. The Reserve Design Working Group continues to improve and update the Reserve Design with the most current data available. Although the Reserve Design uses the most current data, there remains a dearth of spatially and biologically explicit information for conservation targets at the community and species level. The Monitoring Plan will identify monitoring priorities, available resources, and research needs.

Monitoring Plan

The Conservation Target Viability Assessment (Section VI) identifies sets of KEAS and indicators for the conservation targets, many of which require additional study in order to create informative monitoring efforts. The Conservation Target Viability Assessment is also a work in progress and requires refinement and prioritization. The forthcoming Monitoring Plan for the Partnership will address these shortcomings as well as identify information gaps and assign responsibilities among Partners. A critical piece to the Monitoring Plan will be an assessment of research needs and Partnership capacity for proposed monitoring efforts. The partnership will work to secure and leverage resources available for biological monitoring through academic institutions such as NC State, Duke, and UNC and also Partner organizations.

Once the Monitoring Plan is developed, partners and working groups will have a formal opportunity to provide comment and accept assigned responsibilities. The Monitoring Plan will prioritize monitoring and research activities to achieve the greatest impact with available resources. Through evaluating the status of conservation targets and effectiveness of management efforts, the Monitoring Plan will help to inform the Reserve Design and help the Partnership better achieve its goals and focus conservation efforts in the NC Sandhills.

XI. GLOSSARY

Adaptive Management – The incorporation of a formal learning process into conservation action. Specifically, it is the integration of project design, management, and monitoring, to provide a framework to systematically test assumptions, promote learning, and supply timely information for management decisions.

Assumption – A project's core assumptions are the logical sequences linking project strategies to one or more targets as reflected in a results chain diagram. Other assumptions are related to factors that can positively or negatively affect project performance **–** see also risk factor.

Conceptual Model – A diagram that represents relationships between key factors that are believed to impact or lead to one or more conservation targets. A good model should link the conservation targets to threats, opportunities, stakeholders, and intervention points (factors – threats, opportunities, or targets) – in a conceptual model where a team can develop strategies that will influence those factors. It should also indicate which factors are most important to monitor.

Conservation Land- Property that is either owned in fee by a Partnership member organization or private land that is protected through a conservation easement.

Conservation Target – An element of biodiversity at a project site, which can be a species, habitat/ecological system, or ecological process that a project has chosen to focus on. All targets at a site should collectively represent the biodiversity of concern at the site.

Contributing Factor (Indirect threats and Opportunities) - A human-induced action or event that underlies or leads to one or more direct threats.

Direct Threat – A human action that immediately degrades one or more conservation targets. For example, "logging" or "fishing." Typically tied to one or more stakeholders. Sometimes referred to as "source of stress." Compare with indirect threat.

Goal – A formal statement detailing a desired impact of a project, such as the desired future status of a target. A good goal meets the criteria of being linked to targets, impact oriented, measurable, time limited, and specific.

Indicator – A measurable entity related to a specific information need such as the status of a target/factor, change in a threat, or progress toward an objective. A good indicator meets the criteria of being: measurable, precise, consistent, and sensitive.

Indirect Threat – A factor identified in an analysis of the project situation that is a driver of direct threats. Often an entry point for conservation actions. For example, "logging policies" or "demand for fish." Sometimes called a root cause or underlying cause. Compare with direct threat.

Key Ecological Attribute-Aspect of target's ecology that if present, defines a healthy target and if missing or altered, would lead to loss or extreme degradation of that target over time.

Key Intervention Point – A factor in your conceptual model where you could develop a strategy to ultimately improve the conservation status of one or more targets.

Monitoring – The periodic collection and evaluation of data relative to stated project goals and objectives. (Many people often also refer to this process as monitoring and evaluation (abbreviated M&E)).

Method – A specific technique used to collect data to measure an indicator. A good method should meet the criteria of *accurate, reliable, cost-effective, feasible,* and appropriate.

Nested Target - Species, ecological communities, or ecological system targets whose conservation needs are subsumed in one or more focal conservation targets. Often includes ecoregional targets that a team wants to note and/or track.

Objective – A formal statement detailing a desired outcome of a project such as reducing a critical threat. A good objective meets the criteria of being: results oriented, measurable, time limited, specific, and practical. If the project is well conceptualized and designed, realization of a project's objectives should lead to the fulfillment of the project's goals and ultimately its vision. Compare to vision and goal.

Opportunity – A factor identified in an analysis of the project situation that potentially has a positive effect on one or more targets, either directly or indirectly. Often an entry point for conservation actions. For example, "demand for sustainably harvested timber." In some senses, the opposite of a threat.

Result – The desired future state of a target or factor. Results include impacts which are linked to targets and outcomes which are linked to threats and opportunities.

Results Chain – A graphical depiction of a project's core assumption, the logical sequence linking project strategies to one or more targets. In scientific terms, it lays out hypothesized relationships.

Scope – The broad geographic or thematic focus of a project.

Strategic Plan – The overall plan for a project. A complete strategic plan includes descriptions of a project's scope, vision, and targets; an analysis of project situation, an Action Plan, a Monitoring Plan, and an Operational Plan.

Strategy – A group of actions with a common focus that work together to reduce threats, capitalize on opportunities, or restore natural systems. Strategies include one or more activities and are designed to achieve specific objectives and goals. A good strategy meets the criteria of being: linked, focused, feasible, and appropriate.

Vision – A description of the desired state or ultimate condition that a project is working to achieve. A complete vision can include a description of the biodiversity of the site and/or
a map of the project area as well as a summary vision statement.

Vision Statement – A brief summary of the project's vision. A good vision statement meets the criteria of being relatively general, visionary, and brief.

The mission of the **U.S. Fish and Wildlife Service** is working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Central to this mission, the Fish and Wildlife Service, along with state natural resource agencies, private lands partners, and other stakeholders, is dedicated to providing and protecting a healthy environment for fish and wildlife and people. The USFWS brings biological expertise and extensive experience in building broad coalitions to solve complex environmental problems to the Partnership.

The mission of the **U.S. Army at Fort Bragg** is to ensure that the Army's current and future realistic training requirements are met in harmony with our environment and natural resources through the perpetuation of all natural communities that occur on Fort Bragg and Camp Mackall. Special emphasis is placed on managing the longleaf pine and wiregrass communities that comprise the majority of the habitat found on the base, as well as the habitat for the many endangered and threatened species living there. At approximately 120,000 acres, Ft. Bragg forms the core of the Sandhills Conservation Area.

The mission of the **U.S. Army Environmental Command** is to lead and execute environmental programs and provide environmental expertise that enables Army training, operations, acquisition, and sustainable military communities. The USAEC provides technical services and products to HQDA, major subordinate commands, and installation commanders. The Army relies on the expertise of the Conservation Branch to support and achieve conservation goals. Conservation programs promote readiness, enhance training and the quality of life, and support the Army's commitment to remain strong stewards of the environment.

The mission of the **NC Wildlife Resources Commission**'s Division of Wildlife Management is to monitor the health and status of wildlife populations, develop and administer programs for their management and wise use, and when necessary help resolve human-wildlife interactions in a manner which will assure a diverse wildlife resource for future generations of North Carolinians. At over 60,000 acres, the WRC's Sandhills Game Land forms the core of habitat for the Western Essential Support population of RCW's and a number of other rare, threatened, and endangered species.

The **North Carolina Department of Environment and Natural Resources** is the lead stewardship agency for the preservation and protection of North Carolina's outstanding natural resources. The agency brings biological expertise and a wealth of experience in conservation planning to the partnership.

The mission of the **NC Natural Heritage Program** is to provide science and incentives to inform conservation decisions and support conservation of significant natural areas in our state. As part of the Office of Conservation, Planning, and Community Affairs within the North Carolina Department of Environment and Natural Resources, the program serves as an information clearinghouse in support of conservation of the rarest and most outstanding elements of natural diversity in the state.

The mission of the **NC Division of Parks and Recreation** is to conserve and protect representative examples of the natural beauty, ecological features, and recreational resources of statewide significance; to provide outdoor recreational opportunities in a safe and healthy environment; and to

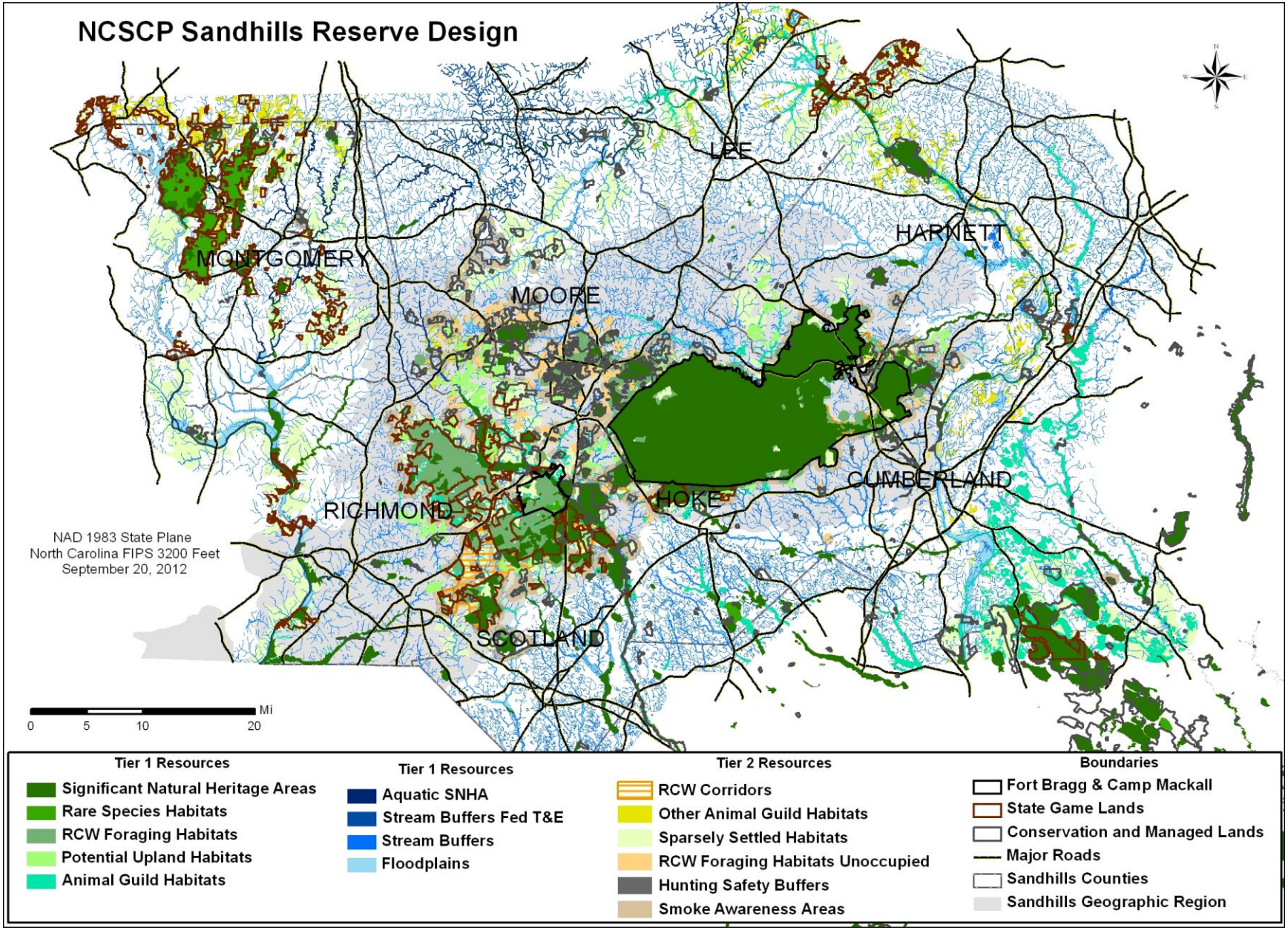
provide environmental education opportunities that promote stewardship of the state's natural heritage. The agency currently has nearly 5,000 acres in conservation between Weymouth Woods State Nature Preserve and Carver's Creek State Park.

The mission of the **NC Forest Service** is to develop, protect, and manage the multiple resources of North Carolina's forests through professional stewardship that enhances the quality of life for citizens while ensuring the continuity of these vital resources. The forest service brings expertise in landowner outreach, forestry, and management of the longleaf pine ecosystem through prescribed fire to the partnership.

The mission of **The Nature Conservancy** is to preserve the plants, animals, and plant communities that represent the diversity of life by protecting the land and water they need to survive. TNC brings expertise in scientifically driven land conservation, restoration, monitoring, and management to the Partnership.

The mission of the **Sandhills Ecological Institute** is to conduct research and monitoring studies for scientific and compliance purposes. Specifically, SEI's three primary goals are: to conduct research involving investigations of the longleaf pine and related ecosystems in North Carolina and South Carolina; to engage in and promote scientific study and education regarding the longleaf pine and related ecosystems; and, to engage in scientific studies and education regarding the red-cockaded woodpecker and its habitats.

The **Sandhills Area Land Trust** is a community-based non-profit organization whose mission is to protect land, water, open space, farmlands and historic resources in the Sandhills region of North Carolina. SALT works with private and public landowners, government agencies and host of community groups under a variety of programs, partnerships and other efforts including assistance and education about land protection, and conservation easements.


NCSCP Sandhills Reserve Design
LEE
HARNETT
MONTGOMERY
MOORE
CUMBERLAND
HOKE
RICHMOND
SCOTLAND
NAD 1983 State Plane
North Carolina FIPS 3200 Feet
September 20, 2012
0 5 10 20 Mi
Tier 1 Resources
Significant Natural Heritage Areas
Rare Species Habitats
RCW Foraging Habitats
Potential Upland Habitats
Animal Guild Habitats
Tier 1 Resources
Aquatic SNHA
Stream Buffers Fed T&E
Stream Buffers
Floodplains
Tier 2 Resources
RCW Corridors
Other Animal Guild Habitats
Sparsely Settled Habitats
RCW Foraging Habitats Unoccupied
Hunting Safety Buffers
Smoke Awareness Areas
Boundaries
Fort Bragg & Camp Mackall
State Game Lands
Conservation and Managed Lands
Major Roads
Sandhills Counties
Sandhills Geographic Region

Nested Conservation targets associated with longleaf pine habitats

Scientific Name	Common Name	Importance of Sandhills	Name Category
Aimophila aestivalis	Bachman's Sparrow	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Amblyscirtes alternata	Dusky Roadside-Skipper	Half of NC populations in Sandhills	Invertebrate Animal
Aristida condensata	Big Three-awn Grass		Vascular Plant
Astragalus michauxii	Sandhills Milk-vetch	North Carolina populations predominantly in Sandhills	Vascular Plant
Campylopus carolinae	Savanna Campylopus		Nonvascular Plant
Carex tenax	Wire Sedge	occurs nowhere else in NC	Vascular Plant
Chamaesyce cordifolia	Heartleaf Sandmat		Vascular Plant
Desmodium fernaldii	Fernald's Tick-trefoil		Vascular Plant
Dichanthelium fusiforme	Spindle-fruited Witch Grass	1 pop on Bragg 2006	Vascular Plant
Gaillardia aestivalis	Sandhills Gaillardia	occurs nowhere else in NC	Vascular Plant
Galactia mollis	Soft Milk-pea	occurs nowhere else in NC	Vascular Plant
Helianthemum carolinianum	Carolina Sunrose		Vascular Plant
Hesperia meskei	Meske's Skipper	occurs nowhere else in NC except 1-2 sites	Invertebrate Animal
Heterodon simus	Southern Hognose Snake	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Iris prismatica	slender blue iris		Vascular Plant
Liatris squarrulosa	Earle's Blazing-star		Vascular Plant
Masticophis flagellum	Coachwhip	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Mesic Pine Flatwoods			Natural Community
Picoides borealis	Red-cockaded Woodpecker	Over half of NC populations in Sandhills	Vertebrate Animal
Pine Savanna			Natural Community
Pine/Scrub Oak Sandhill			Natural Community
Pituophis melanoleucus melanoleucus	Northern Pine Snake	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Polygala grandiflora	Showy Milkwort	occurs nowhere else in NC	Vascular Plant
Pond Pine Woodland			Natural Community
Pseudognaphalium helleri	Heller's Rabbit-Tobacco		Vascular Plant
Pteroglossaspis ecristata	Spiked Medusa		Vascular Plant
Pyxidanthera barbulata var. brevifolia	Sandhills Pyxie-moss	endemic	Vascular Plant
Rhus michauxii	Michaux's Sumac	North Carolina populations predominantly in Sandhills	Vascular Plant
Ruellia ciliosa	Sandhills Wild-petunia	occurs nowhere else in NC	Vascular Plant
Salvia azurea	Azure Sage	occurs nowhere else in NC	Vascular Plant
Sandhill Seep			Natural Community
Satyrium edwardsii	Edwards' Hairstreak	North Carolina populations predominantly in Sandhills	Invertebrate Animal
Schwalbea americana	Chaffseed	occurs nowhere else in NC	Vascular Plant
Sistrurus miliarius	Pigmy Rattlesnake	About half of NC populations	Vertebrate Animal
Small Depression Pocosin			Natural Community
Small Depression Pond			Natural Community
Solidago tortifolia	Twisted-leaf Goldenrod		Vascular Plant
Stylisma pickeringii var. pickeringii	Pickering's Dawnflower	North Carolina populations predominantly in Sandhills	Vascular Plant
Trichostema setaceum	Narrowleaf Bluecurls		Vascular Plant
Tridens carolinianus	Carolina Triodia	occurs nowhere else in NC	Vascular Plant
Tridens chapmanii	Chapman's Redtop		Vascular Plant
Vaccinium virgatum	Small-flower Blueberry	occurs nowhere else in NC	Vascular Plant
Vernal Pool			Natural Community
Warea cuneifolia	Carolina Pineland-cress	occurs nowhere else in NC	Vascular Plant
Wet Pine Flatwoods			Natural Community
Xeric Sandhill Scrub			Natural Community

Nested Conservation targets associated with streamhead pocosin/seep habitats

Scientific Name	Common Name	Importance of Sandhills	Name Category
Agalinis aphylla	Scale-leaf Gerardia		Vascular Plant
Carex sp. 4	A Sedge	North Carolina populations predominantly in Sandhills	Vascular Plant
Canebrake			Natural Community
Chelone cuthbertii	Cuthbert's Turtlehead		Vascular Plant
Danthonia epilis	Bog Oatgrass		Vascular Plant
Dichanthelium sp. 9	A Witch Grass		Vascular Plant
Eupatorium resinosum	Pine Barren Boneset	North Carolina populations predominantly in Sandhills	Vascular Plant
Hypoxis rigida	Stiff-leaved Yellow Stargrass		Vascular Plant
Kalmia cuneata	White Wicky	near-endemic	Vascular Plant
Lilium pyrophilum	Sandhills Lily	endemic	Vascular Plant
Lindera subcoriacea	Bog Spicebush	North Carolina populations predominantly in Sandhills	Vascular Plant
Lysimachia asperulifolia	Rough-leaf Loosestrife		Vascular Plant
Parnassia caroliniana	Carolina Grass-of-parnassus		Vascular Plant
Streamhead Pocosin			Natural Community
Eriocaulon texense	Texas Hatpins		Vascular Plant
Hyla andersonii	Pine Barrens Treefrog	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Melanoplus nubilus	A Short-winged Melanoplus		Invertebrate Animal
Solidago verna	Spring-flowering Goldenrod		Vascular Plant
Xyris chapmanii	Chapman's Yellow-eyed-grass	occurs nowhere else in NC	Vascular Plant
Xyris scabrifolia	Harper's Yellow-eyed-grass	North Carolina populations predominantly in Sandhills	Vascular Plant
Streamhead Atlantic White Cedar Forest			Natural Community
Peatland Atlantic White Cedar Forest			Natural Community

Nested Conservation targets associated with upland depressional wetland habitats

Scientific Name	Common Name	Importance of Sandhills	Name Category
Vaccinium macrocarpon	Cranberry		Vascular Plant
Rhexia aristosa	Awned Meadow-beauty		Vascular Plant
Rhynchospora macra	Southern White Beaksedge	occurs nowhere else in NC	Vascular Plant
Carex exilis	Coastal Sedge	occurs nowhere else in NC	Vascular Plant
Dionaea muscipula	Venus Flytrap		Vascular Plant
Carex barrattii	Barratt's Sedge		Vascular Plant
Agalinis virgata	Branched Gerardia		Vascular Plant
Ambystoma mabeei	Mabee's Salamander		Vertebrate Animal
Lobelia boykinii	Boykin's Lobelia		Vascular Plant
Ambystoma tigrinum	Eastern Tiger Salamander	some occurrences, but more in the Carolina bay region	Vertebrate Animal
Deirochelys reticularia	Chicken Turtle		Vertebrate Animal
Eleocharis atropurpurea	Purple Spikerush		Vascular Plant
Eupatorium paludicola	Savanna Boneset		Vascular Plant
Hemidactylium scutatum	Four-toed Salamander		Vertebrate Animal
Ludwigia suffruticosa	Shrubby Seedbox		Vascular Plant
Muhlenbergia torreyana	Pinebarren Smokegrass		Vascular Plant
Persicaria hirsuta	Hairy Smartweed		Vascular Plant
Rana capito	Carolina Gopher Frog		Vertebrate Animal
Sagittaria isoetiformis	Quillwort Arrowhead		Vascular Plant
Scleria reticularis	Netted Nutrush		Vascular Plant
Stylisma aquatica	Water Dawnflower		Vascular Plant

Nested Conservation targets associated with blackwater stream habitats

Scientific Name	Common Name	Importance of Sandhills	Name Category
Amorpha georgiana var. georgiana	Georgia Indigo-bush	North Carolina populations predominantly in Sandhills	Vascular Plant
Callophrys hesseli	Hessel's hairstreak	Widespread, maybe one-third of Eos in Sandhills	Invertebrate Animal
Cambarus hystricosus	Sandhills spiny crayfish	Endemic	Invertebrate Animal
Carex socialis	Social sedge		Vascular Plant
Coastal Plain Bottomland Hardwoods (Blackwater Subtype)			Natural Community
Coastal Plain Levee Forest (Blackwater Subtype)			Natural Community
Coastal Plain Semipermanent Impoundment			Natural Community
Coastal Plain Small Stream Swamp (Blackwater Subtype)			Natural Community
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	Perceived Population Decline	Vertebrate Animal
Cypress--Gum Swamp (Blackwater Subtype)			Natural Community
Cyprinella sp. 1	Thinlip chub	North Carolina populations predominantly in Sandhills	Vertebrate Animal
Dry Oak--Hickory Forest			Natural Community
Eriocaulon aquaticum	Seven-angled Pipewort		Vascular Plant
Etheostoma mariae	Pinewoods darter	Near-endemic	Vertebrate Animal
Hexalectris spicata	Crested coralroot		Vascular Plant
Ilex amelanchier	Sarvis holly		Vascular Plant
Limnothlypis swainsonii	Swainson's warbler	Perceived Population Decline	Vertebrate Animal
Little River Bluff		endemic	Natural Community
Little River Seepage Bank		endemic	Natural Community
Mesic Mixed Hardwood Forest (Coastal Plain Subtype)			Natural Community
Myotis austroriparius	Southeastern myotis	Perceived Population Decline	Vertebrate Animal
Euphyes bimacula	Two-spotted Skipper		Invertebrate Animal
Piedmont/Coastal Plain Heath Bluff			Natural Community
Rana capito	Carolina gopher frog	Perceived Population Decline	Amphibian
Rhynchospora crinipes	Alabama beaksedge	occurs nowhere else in NC	Vascular Plant
Sand and Mud Bar			Natural Community
Schoenoplectus etuberculatus	Canby's bulrush		Vascular Plant
Semotilus lumbee	Sandhills chub	endemic	Vertebrate Animal
Thalictrum macrostylum	Small-leaved Meadowrue		Vascular Plant
Torreyochloa pallida	Pale mannagrass		Vascular Plant
Carex canescens ssp. disjuncta	Silvery sedge	North Carolina populations predominantly in Sandhills	Vascular Plant
Carex decomposita	Cypress knee sedge		Vascular Plant
Eleocharis robbinsii	Robbins' spikerush		Vascular Plant
Ludwigia sphaerocarpa	Globe-fruit Seedbox		Vascular Plant
Rhynchospora scirpoides	Long-beak Baldsedge		Vascular Plant
Sagittaria macrocarpa	Streamhead sagittaria	endemic	Vascular Plant
Schoenoplectus subterminalis	Swaying bulrush	occurs nowhere else in NC	Vascular Plant
Sphagnum torreyanum	Giant peatmoss		Nonvascular Plant
Utricularia geminiscapa	Two-flowered Bladderwort		Vascular Plant
Utricularia olivacea	Dwarf bladderwort		Vascular Plant
Cladium mariscoides	Twig-rush		Vascular Plant
Neonympha mitchellii francisci	Saint francis' satyr	Endemic	Invertebrate Animal

Blackwater Streams Conservation Target	Indicator	Rating (poor, fair, good, very good)
KEA: Hydrologic Regime *State of Success: A functioning hydrology that is not disrupted by artificial alteration.*		
– focused on anthropogenic impacts, drought and weather conditions vary, seasonally, and annually – point source surface water withdrawals DWQ and DWR data sets – Clearly define channel modifications – Consider flow rates as an Indicator	Degree and extent of channel modifications	**Poor:** **Fair:** **Good:** **Very Good:**
	Surface Water withdrawals	**Poor:** **Fair:** **Good:** **Very Good:**
	Presence of Impoundments	**Poor:** **Fair:** **Good:** **Very Good:**
KEA: Water Chemistry/Quality *State of Success: Water quality supports function of ecosystem.*		
– Water quality metrics to be compared to forthcoming SERDP study on black water streams – To be compared to SERDP study on BWS – Identify source of toxins and nutrient loading – Evaluate NPDES Permit Data – Define Healthy stream range (consider DWQ data and impaired stream values)	Concentration of Nitrogen, Phosphorous, and Dissolved Oxygen	**Poor:** x% of monitoring sites with concentrations above reference values **Fair:** **Good:** **Very Good:**
	Turbidity	**Poor:** x% of monitoring site w/ sediment levels outside healthy stream range **Fair:** x% of monitoring site w/ sediment levels outside healthy stream range **Good:** x% of monitoring site w/ sediment levels outside healthy stream range **Very Good:** x% of monitoring site w/ sediment levels outside healthy stream range
	Presence and frequency of Point Sources	**Poor:** **Fair:** **Good:** **Very Good:**
	Percentage of watershed with impervious surface	**Poor:** **Fair:** **Good:** **Very Good:**

KEA: Presence of natural community types *State of Success: All community targets in sufficient quantity to support appropriate diversity of plant species and composition.*		
– Stream Bioclassification metrics from Natural Heritage's Biodiversity/Wildlife Habitat Assessment – Need to define "occurrence" relative to communities – Need to define "good" condition and scale of each "occurrence" to be measured – Consider a different KEA for each community type – Consider LHIGs for community monitoring	Representation of all BW community types in Sandhills	**Poor:** <50% of occurrences of each community target remaining and in good condition **Fair:** 50-75% of occurrences of each community target remaining and in good condition **Good:** 75-90% of occurrences of each community target remaining and in good condition **Very Good:** >90% of occurrences of each community target remaining and in good condition
	Stream Bioclassification	**Poor:** **Fair:** **Good:** **Very Good:**
KEA: Representative/Indicator Species *State of Success: Viable populations of all representative/Indicator species*		
– potential species intolerant of disturbance include Sandhills chub (*Semotilus lumbee*), Pinewoods darter (*Etheostoma mariae*), Sawcheek darter (*Etheostoma serrifer*), and Piedmont darter *(Percina crassa*) – Also consider indicator species for connectivity	Species TBD by Reserve Design	**Poor:** **Fair:** **Good:** **Very Good:**
KEA: Connectivity among communities & ecosystems *State of Success: BWS habitats are connected along forested riparian corridors, and in stream habitats are not restricted by impoundments*		
– Landscape connectivity refers to the landscape context of the surrounding area and the extent of connection to other natural communities – Potential metrics include Steve Hall's rule set for connectivity of floodplain forest guild – Consider comparing 100 year flood plain area with LHIG floodplain forest layer	% intact forested riparian habitat within defined reach	**Poor:** **Fair:** **Good:** **Very Good:**
	Presence of Impoundments	**Poor:** # of river miles accessible to aquatic spp within defined basin or reach **Fair:** **Good:** **Very Good:**

Longleaf Pine Mosaic	Indicator	Rating (poor, fair, good, very good)
KEA: Representative/Indicator Species *State of success: Viable populations of all representative/Indicator species*		
– Bachman's Sparrow example of indicator species – example of indicator species, metric for ground cover conditions – New site is a location where Bachman's sparrows are documented to occur where they were not documented between 2006-2013 and is > 1 air mile from a record that was documented between 2006-2013. – For Consideration- levels of "healthy assemblage" based on how many indicator species are present. There are relatively few LL stands that contain all of those species. Perhaps approach similar to Steve's guilds with a minimum number of indicators to earn the title "healthy" but then higher rankings for more species or more specialized/rare species present.	Species TBD by Reserve Design	**Poor:** **Fair:** **Good:** **Very Good:**
	Bachman's Sparrow Persistence within sites occupied at some point between 2006-2013	**Poor:** <20% of monitoring sites occupied at least once within a 3 year period **Fair:** 20-40% of monitoring sites occupied within a 3 year period **Good:** 41-75% of monitoring sites occupied within a 3 year period **Very Good:** >75% of monitoring sites occupied within a 3 year period
	Expansion of distribution of Bachman's sparrows	**Poor:** 0 new sites occupied by 2021 **Fair:** 1-2 new sites occupied by 2021 **Good:** 3-5 new sites occupied by 2021 **Very Good:** 6+ new sites occupied by 2021
	# potential RCW breeding groups	**Poor:** <250 **Fair:** 250-300 **Good:** 300-350 **Very Good:** >350
	demographic connectivity between RCW subpopulations	**Poor:** disconnected, very little interaction **Fair:** technically disconnected, but some interaction **Good:** technically, demographically connected but weakly **Very Good:** Single connected population
KEA: Extent of longleaf ecosystem *State of success:* Intact natural longleaf pine communities restored within Reserve Design's defined core areas, buffers, and connectors		
– Need to define functional. i.e. >x% longleaf in canopy and >x% herbaceous groundcover and managed with fire at least once every x years – Can use metrics available in RCW Recovery Plan – Intact longleaf ecosystem defined as mixed age canopy, diverse wiregrass dominated groundcover,	% area of undeveloped historic extent managed/restored for functional longleaf habitat on protected lands	**Poor:** <75% **Fair:** 75-85% **Good:** 85-95% **Very Good:** >95%

diverse herbaceous ground cover, and open mid-story – Need surveying method for private lands including site locations	% area of historic extent managed/restored for functional longleaf habitat on private lands	**Poor:** <20% **Fair:** 20-40% **Good:** 40-60% **Very Good:** >60%
	Ground Cover Composition-Protected lands	**Poor:** <20% of monitoring sites contain at least 20% native herbaceous cover **Fair:** 20-40% of monitoring sites contain at least 20% native herbaceous cover **Good:** 41-60% of monitoring sites contain at least 20% native herbaceous cover **Very Good:** >60% of monitoring sites contain at least 20% native herbaceous cover
	Ground Cover Composition-Private Lands	**Poor:** <5% of monitoring sites contain at least 20% native herbaceous cover **Fair:** 5-15% of monitoring sites contain at least 20% native herbaceous cover **Good:** 16-25% of monitoring sites contain at least 20% native herbaceous cover **Very Good:** >25% of monitoring sites contain at least 20% native herbaceous cover
KEA: Fire regime - (timing, frequency, intensity, extent) *State of success: Appropriate fire regime implemented for all longleaf core areas connectors and buffers*		
– appropriate fire regime includes variable frequency, intensity, and season based on restoration status and environmental conditions – Need to assess # acres currently burned each year on private lands	% protected longleaf acres burned within 3 year period	**Poor:** <60% **Fair:** 60-75% **Good:** 75-90% **Very Good:** >90%
	% burn units with appropriate fire regime (frequency/season)	**Poor:** <20% **Fair:** 20-30% **Good:** 30-40% **Very Good:** >40%
	# acres private lands burned each year	**Poor:** <10k private acres/year **Fair:** 10-15k private acres/year **Good:** 15-20k private acres/year **Very Good:** >20k private acres/year

KEA: Connectivity *State of success: Natural Forested Connectivity between all core areas for Representative/Indicator LLP Species.*		
– For Consideration-Connectivity of individual species similar to Natural Heritage rule sets for guild connectivity – Develop appropriate measures and focus analysis/monitoring in key corridors (i.e. NE Bragg, GL to West End, Bragg to Mackall, GL blocks C-O-T-B) – Consider using LHIG Species	Natural Forested Connectivity between core areas	**Poor:** **Fair:** **Good:** **Very Good:**
	Least path analysis	**Poor:** **Fair:** **Good:** **Very Good:**

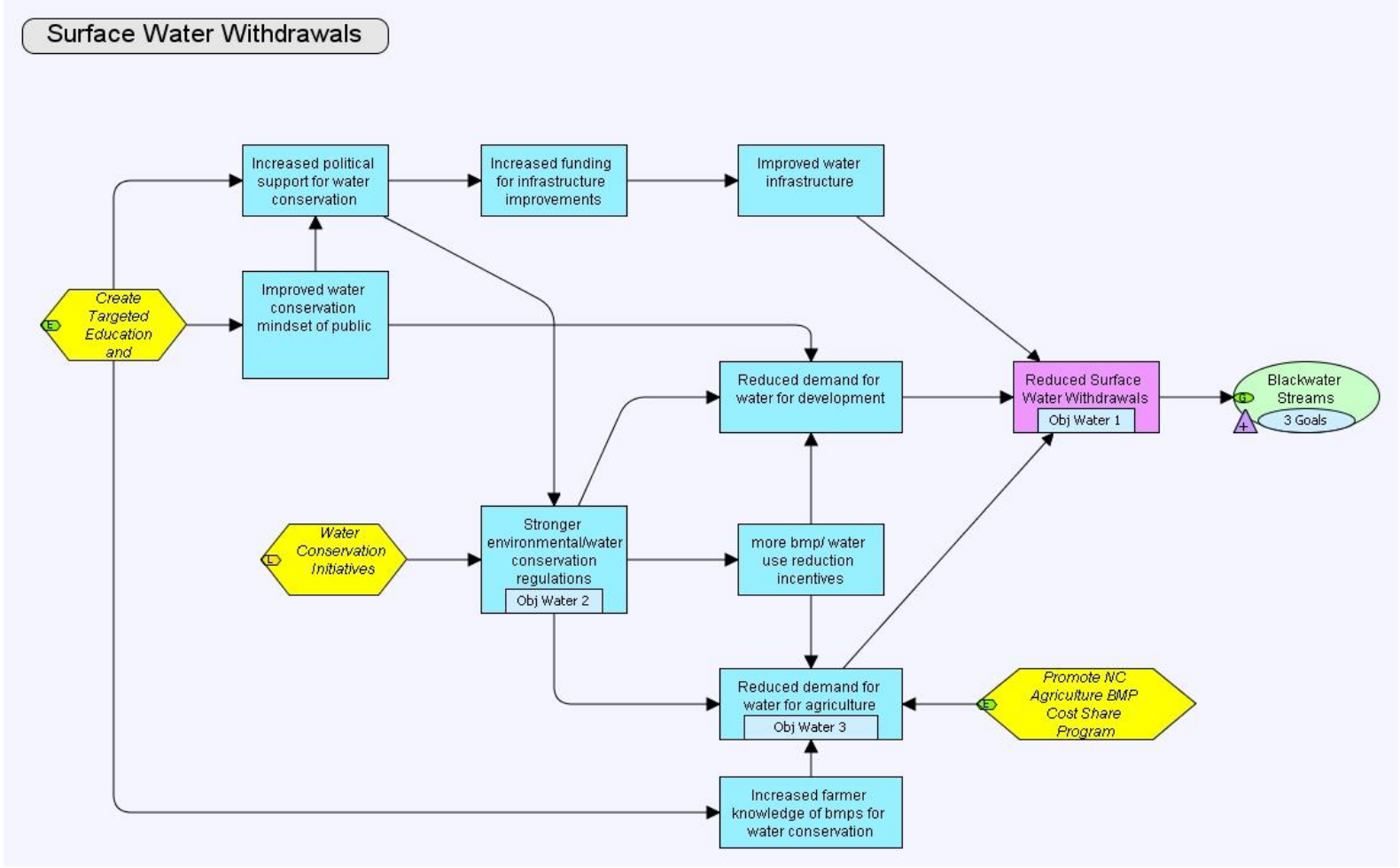
Streamhead Pocosins and Seeps	**Indicator**	**Rating (poor, fair, good, very good)**
KEA: Fire regime - (timing, frequency, intensity, extent) *State of success: Appropriate fire regime for all Streamhead Pocosins and Seeps*		
– appropriate fire regime creates optimal conditions for diverse suite of herbaceous species – Fire is a driver of pocosin vegetation dynamics with plant diversity, especially herbaceous cover, highest after fire.	% known occurrences with appropriate fire regime (fire interval/ season)	**Poor:** <75% burned on 3 year rotation **Fair:** 75-85% burned on 3 year rotation **Good:** 85-95% burned on 3 year rotation **Very Good:** >95% burned on 3 year rotation
KEA: Presence of natural communities *State of success: All community targets in sufficient quantity to support appropriate diversity of plant species and composition.*		
– need to monitor for each community type	representation of nested SPS community targets	**Poor:** <50% of occurrences of each community target remaining and in good condition **Fair:** 50-75% of occurrences of each community target remaining and in good condition **Good:** 75-90% of occurrences of each community target remaining and in good condition **Very Good:** >90% of occurrences of each community target remaining and in good condition
KEA: Representative/Indicator Species *State of Success: Viable populations of all representative/Indicator species*		

– Plants may be some of the more appropriate indicators, perhaps also pine barrens tree frog, 4-toed salamander	Species TBD by Reserve Design	**Poor:** **Fair:** **Good:** **Very Good:**
KEA: Landscape pattern *State of Success: Adequate connectivity and number of occurrences to support viable populations of target species*		
– Need to improve language and clarity – Need to define buffer widths – For Consideration- Intactness of downstream riparian corridors as an Indicator	Intactness of upland forested connectors/buffers for "X" species	**Poor:** **Fair:** **Good:** **Very Good:**
	Impervious surface within key sub-watersheds	**Poor:** >25% impervious surface in watershed **Fair:** 15-25% impervious surface in watershed **Good:** 7-14% impervious surface in watershed **Very Good:** <7% impervious surface in watershed

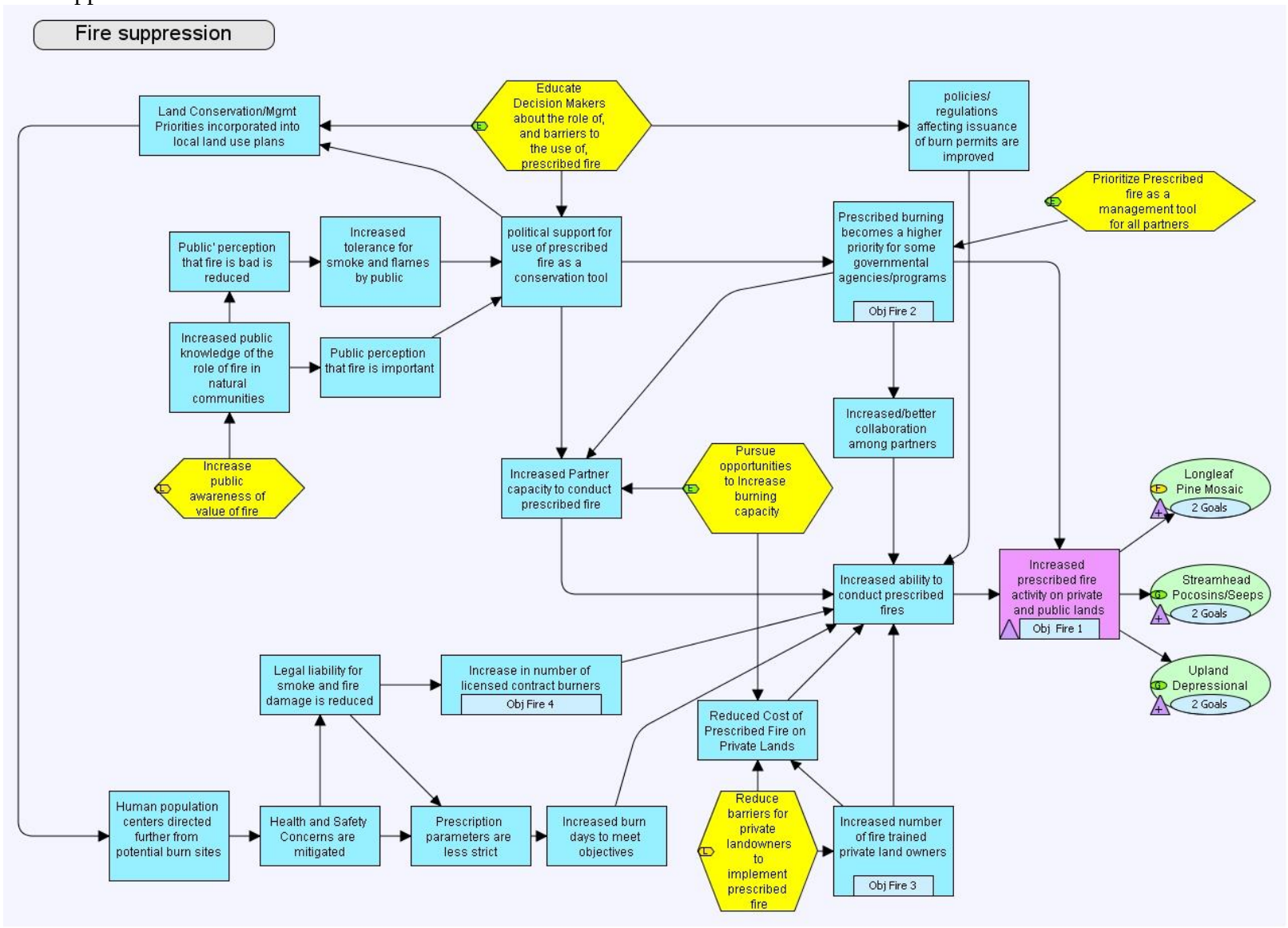
Upland Depressional Wetlands	**Indicator**	**Rating (poor, fair, good, very good)**
KEA: Presence of natural communities *State of success: All community targets in sufficient quantity to support appropriate diversity of plant species and composition.*		
– need to monitor for each community type –	Representation of nested UDW community targets	**Poor:** **Fair:** **Good:** **Very Good:**
KEA: Representative/Indicator Species *State of success: Viable populations of all representative/Indicator species*		
– indicator species for habitat quality and connectivity of UDWs – Example indicator species include Tiger	Species TBD by Reserve Design	**Poor:** **Fair:** **Good:** **Very Good:**

salamander, ornate chorus frog, gopher frog – These are conservation target species defined by the RDWG. Monitoring a select group of species that act as surrogates for the health of the suite of species w/in each community type	# of viable Gopher frog populations within Sandhills	**Poor:** 0-2 **Fair:** 3-5 **Good:** 6-7 **Very Good:** 8+
KEA: **Fire Regime-(Timing, frequency, intensity, extent)** *State of success: Appropriate Fire Regime for all UDWs*		
– appropriate fire regime creates optimal conditions for diverse suite of herbaceous species	% occurrences with appropriate fire regime (fire interval/ season)	**Poor:** <70% burned on 3 year rotation in appropriate season **Fair:** 70-80% burned on 3 year rotation in appropriate season **Good:** 81-90% burned on 3 year rotation in appropriate season **Very Good:** >90% burned on 3 year rotation in appropriate season
KEA Spatial Relationship *State of success: Adequate connectivity and number of occurrences to support viable populations of amphibians*		
–	% occurrences with adequate buffers and connectivity for native amphibian life cycle	**Poor:** **Fair:** **Good:** **Very Good:**
	Connectivity between occurrences for amphibians	**Poor:** **Fair:** **Good:** **Very Good:**
	Adequate uplands for amphibians	**Poor:** **Fair:** **Good:** **Very Good:**

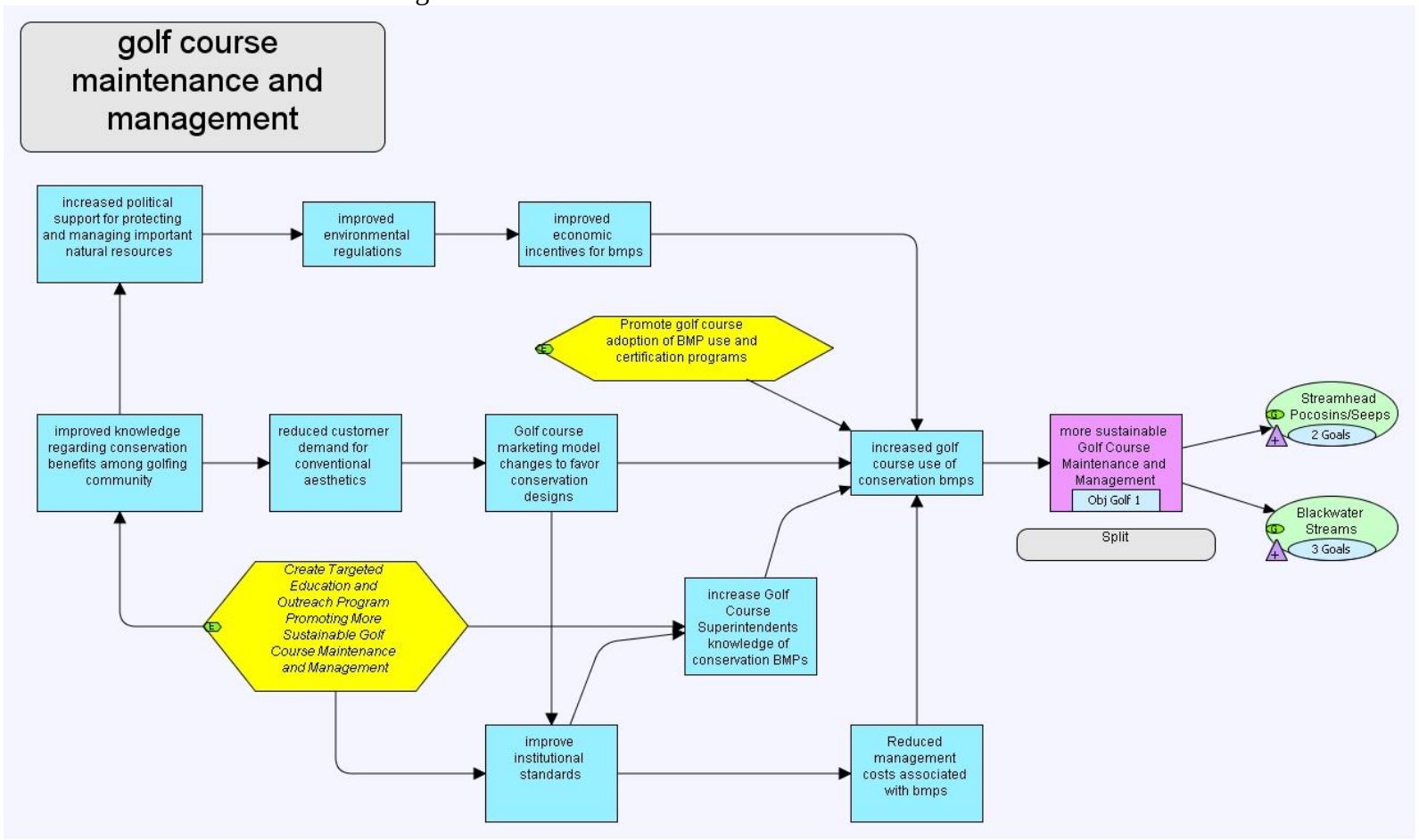
Surface water withdrawals



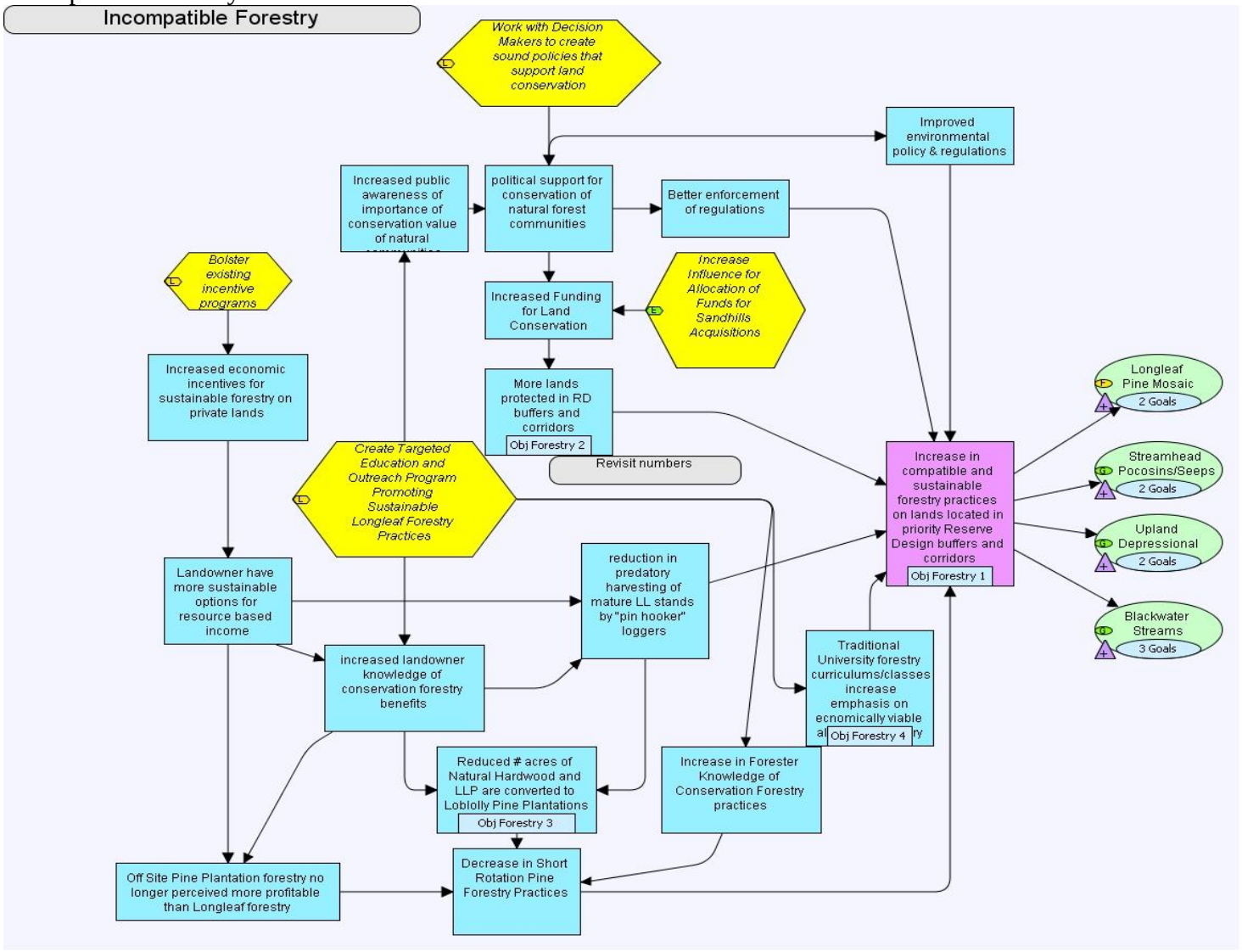
Fire Suppression



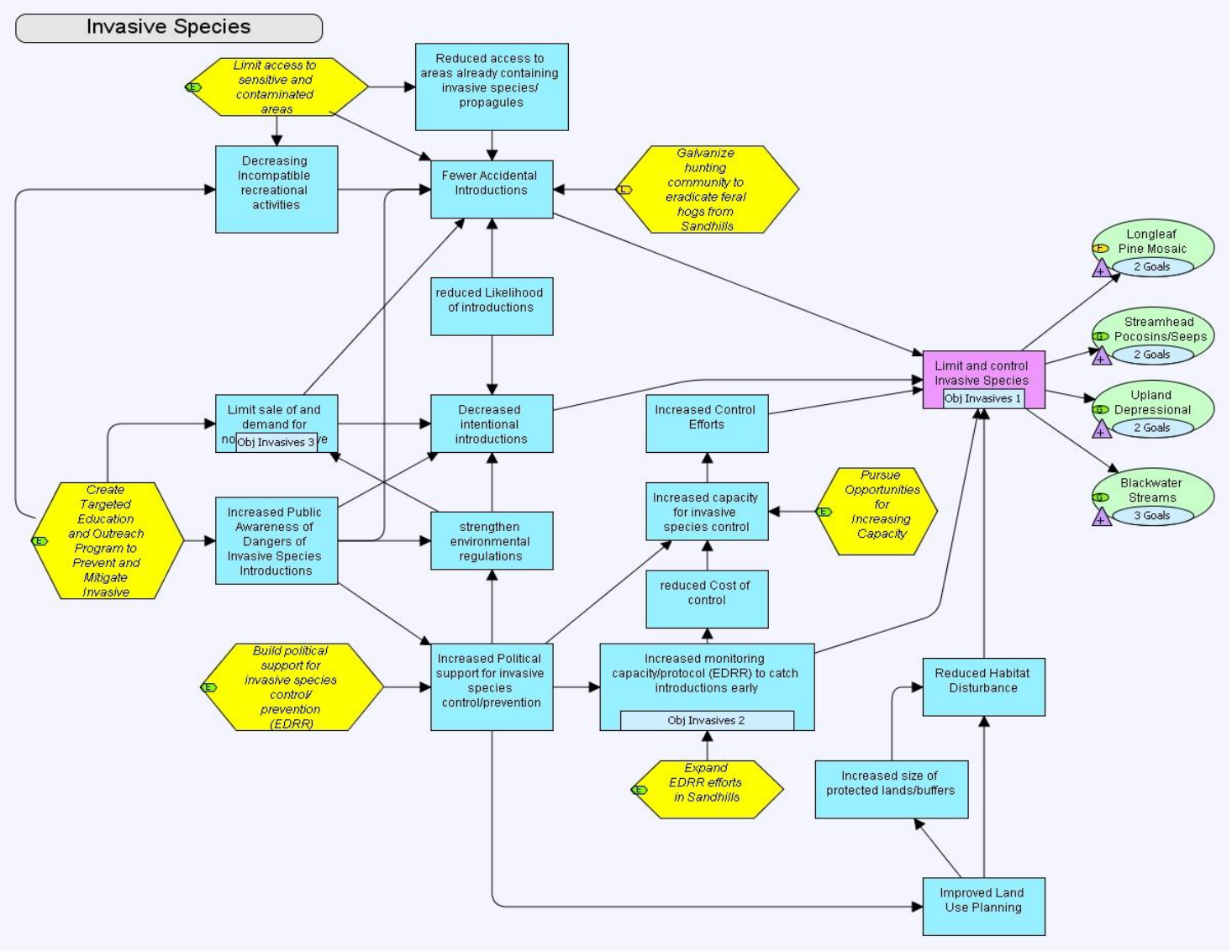
Golf Course Maintenance and Management



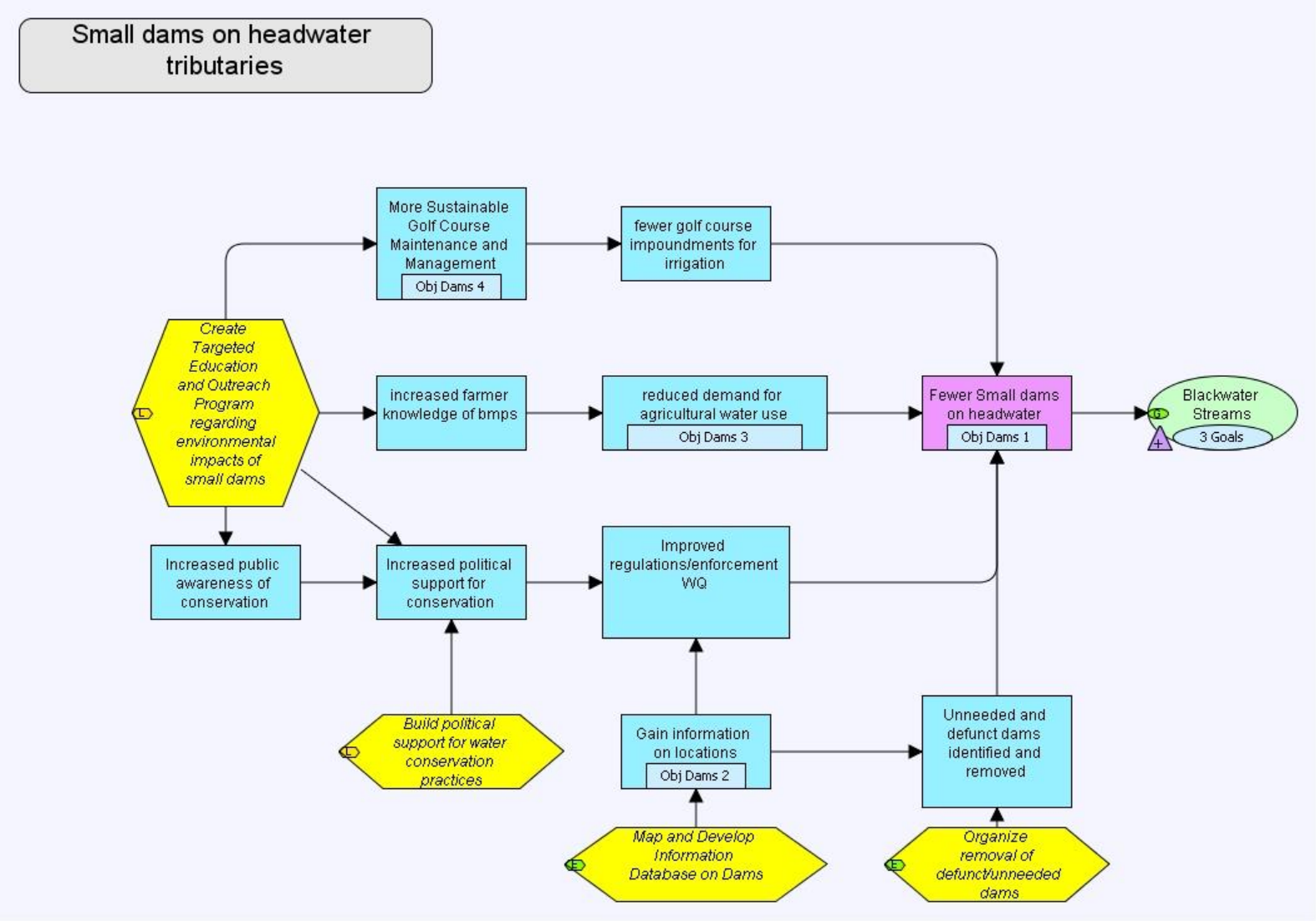
Incompatible Forestry Practices



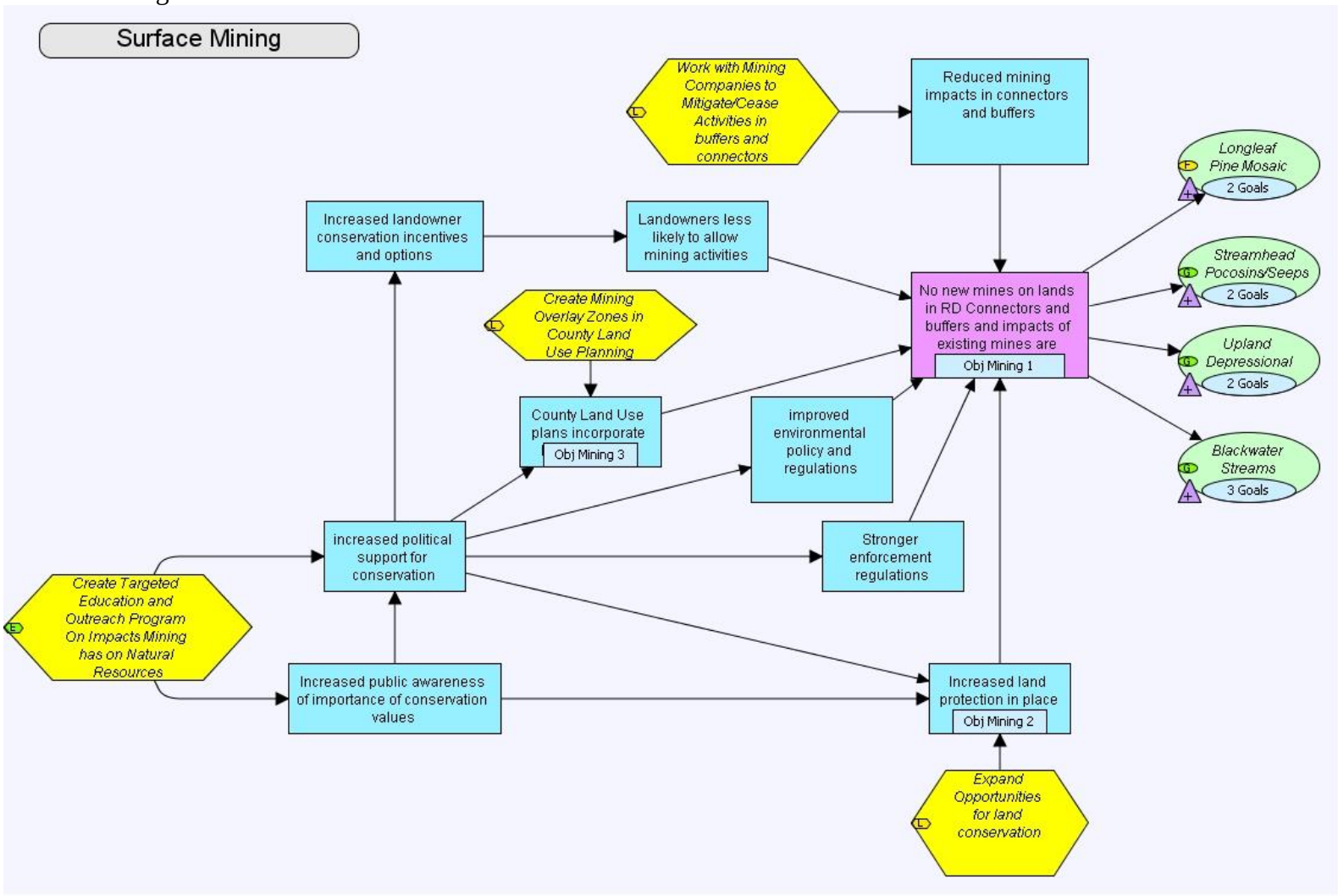
Invasive Species



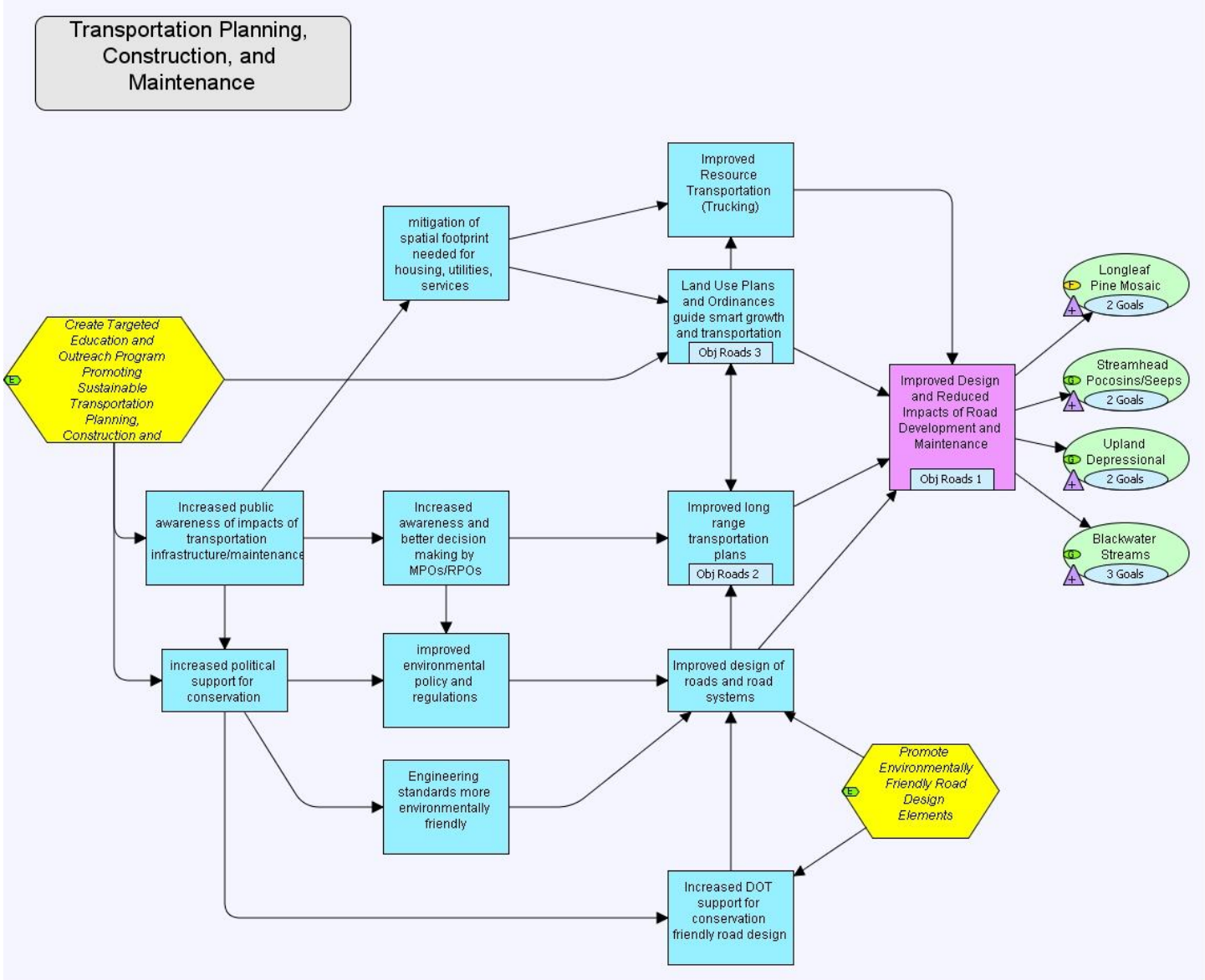
Small Dams on Headwater Tributaries



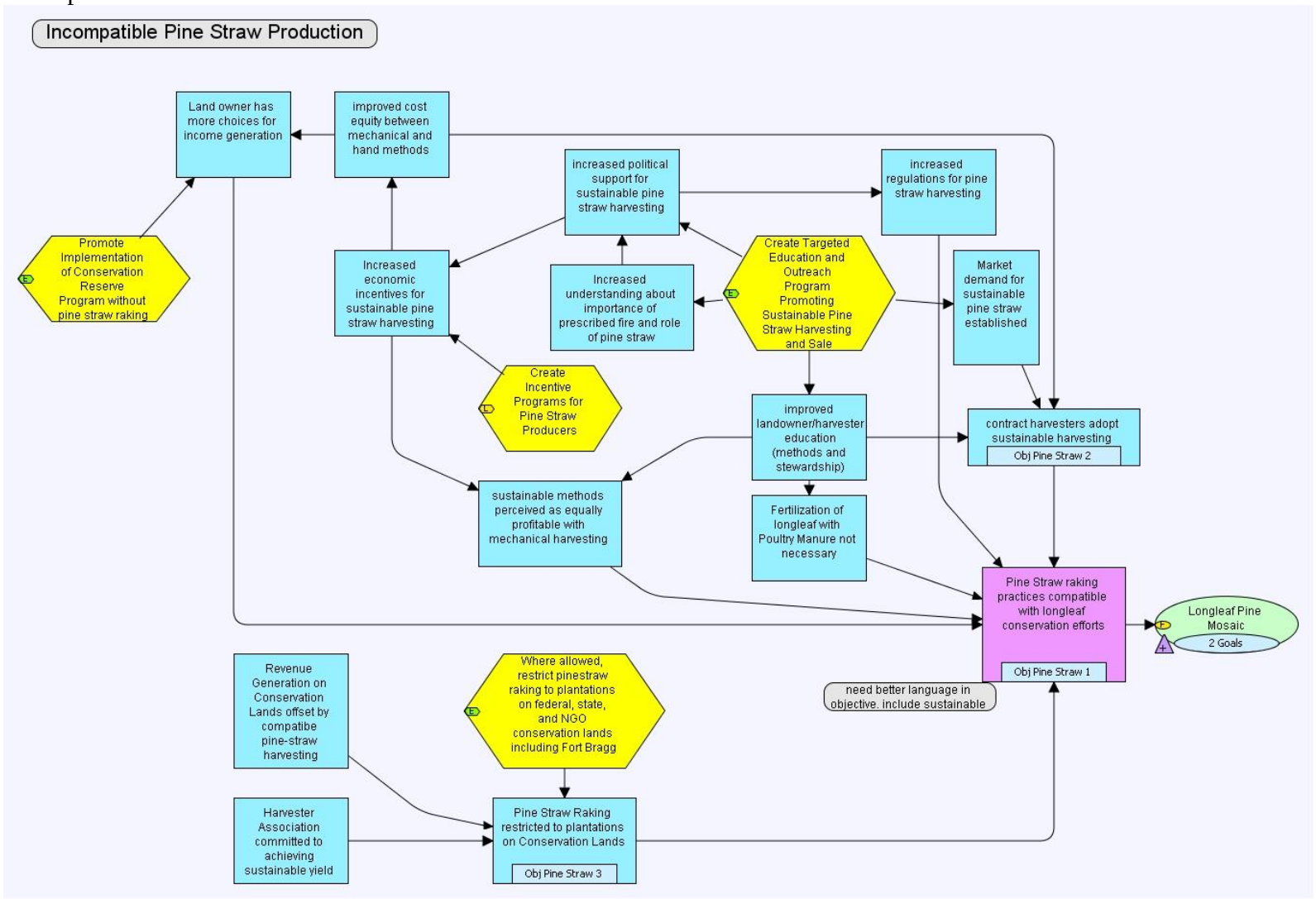
Surface Mining



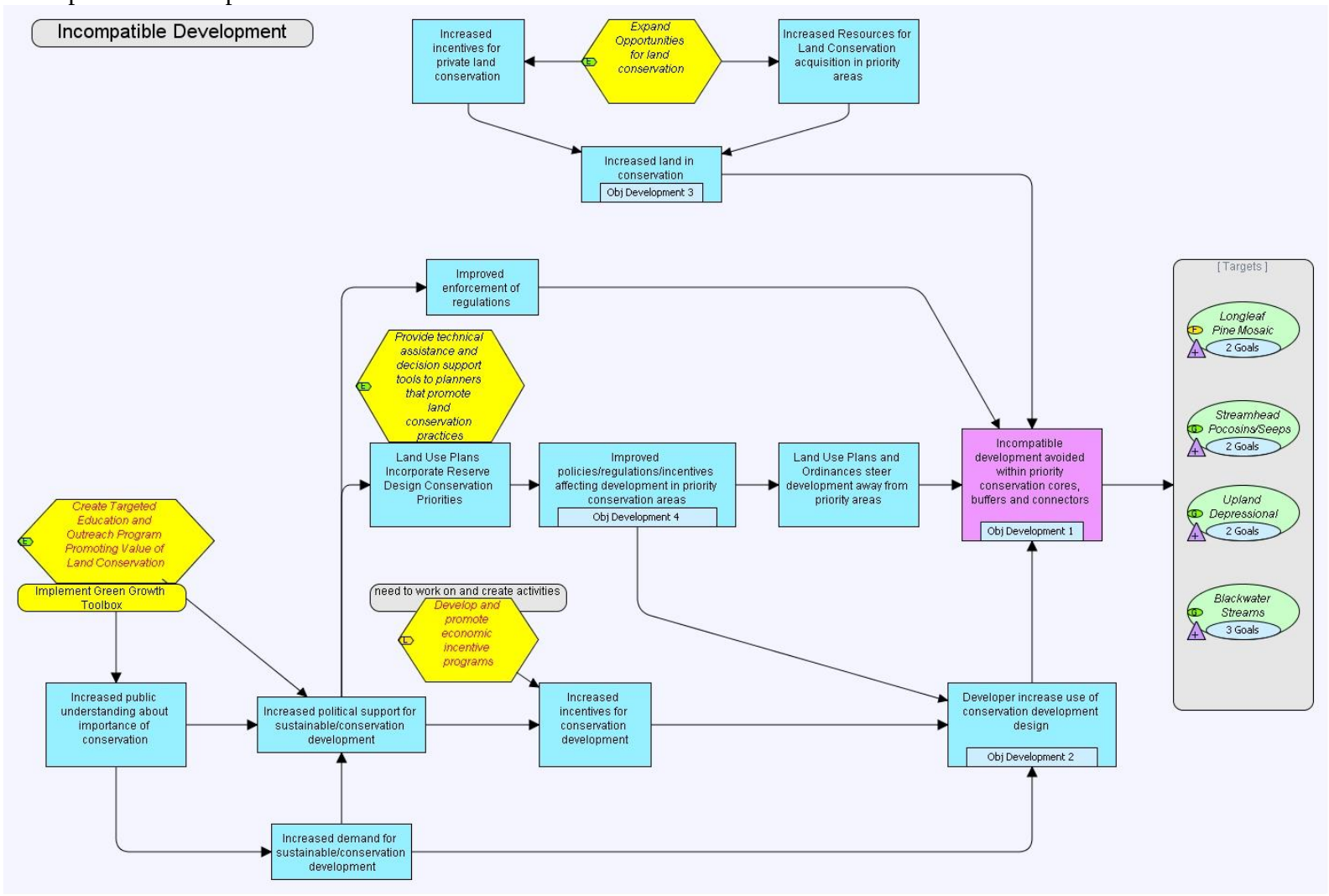
Transportation Planning, Construction and Maintenance



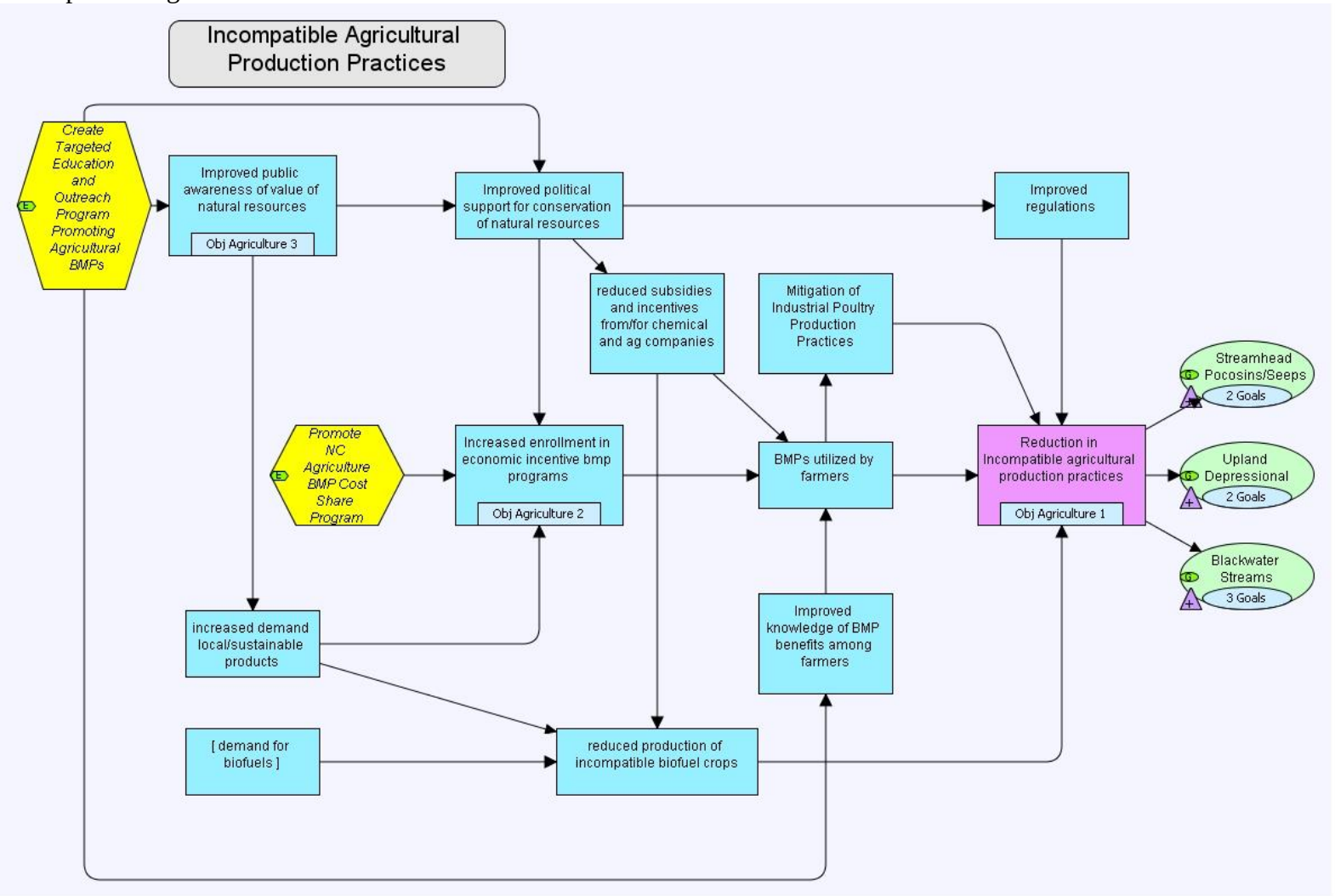
Incompatible Pine Straw Production



Incompatible Development



Incompatible Agricultural Production Practices



Objectives to Reduce Fire Suppression

Objective	Details
Fire 1.	Restore Fire Regime on Conservation Lands: By 2020, 80% of longleaf acres on conservation land are managed under appropriate fire regime, and 25% of longleaf acres on private land are managed under a 3 year burn rotation.
Fire 2.	Improve Fire Prioritization Among Partners: By 2020, all partners have committed to implementing a 3 year burn rotation on conservation lands and providing resources sufficient to carry out management activities that meet this objective.
Fire 3.	Expand Private landowner Fire Training: By 2020, hold (x) prescribed fire training workshops with (x) participants.
Fire 4.	Increase Number of Licensed Contract Burns: By 2020, increase number of licensed contract burns occurring on NCSCP lands in Sandhills by x %

Strategies to Reduce Fire Suppression

Strategy	Objective	Working Group	Activities
Increase Partner prioritization of prescribed fire as a management tool for all partners	Fire 2	RMWG, SC*	• Extol the benefits of inter-agency management MOU's and get MOU's signed between all partners • Hold NCSCP prescribed fire coordination meeting and work through barriers • Leverage Resources and Coordination among NCSCP Partners to increase acres burned cooperatively
Reduce barriers for private landowners to implement prescribed fire	Fire 3	CWG, RMWG*	• Increase awareness of cost share programs available to private landowners • Increase funding available through existing cost share programs • Educate public and increase opportunities for prescribed fire training • Work to increase the number of private qualified burners to work on private lands • Work with NC Forest Service to increase internal funding for prescribed fire on private lands
Educate decision makers about the role of, and barriers to the use of prescribed fire		CWG	• Promote a "Right to Burn" law (State or County level) • Promote ecologically sensitive land use planning at the local (city/county) level • Coordinate with local governments to develop ecologically sensitive Land Use Plans • Garner Support for Green Growth Toolbox • Work with NC Prescribed Fire Council on policies/regulations affecting burn permits

Strategies to Reduce Fire Suppression (continued)			
Increase public awareness of value of fire		CWG	• Work with NC Prescribed Fire Council to increase public awareness in the Sandhills • Promote the use of prescribed fire and minimize ground disturbance for site preparation • Educate public about NC Fire Wise program for implementation in the Sandhills • Implement fire outreach and awareness programs (including science and training for safety)
Pursue opportunities to increase burning capacity	Fire 1, Fire 2, Fire 4	FSC*, SC	• Apply for Grants to increase funding for prescribed fire • Identify and pursue non-traditional sources of funding for prescribed fire • Create initiatives to allow fire management entities to collaborate and cross boundaries • Increase training and use of volunteers • Fully funded Longleaf Task Force in place to assist NCSCP partners and private landowners • Ensure NCFS has smoke modeler(s) on staff
Increase knowledge and skill of prescribed burning community			• Support research/adaptive management to further refine understanding of timing, intensity, and scale of fire relative to the needs of priority habitats and species • Promote the application of current best practices among the entire prescribed burning community • Encourage more ecologically sensitive wildfire suppression with NCFS • Work through and support NC Prescribed Fire Council and Montgomery Community College Prescribed Fire Program to achieve these goals.

Objectives to Improve Golf Course Maintenance and Management	
Objective	**Details**
Golf 1.	**Promote Golf Course BMP Programs:** By 2020 x% of golf courses have adopted USGA Environmental Principles and x # of golf courses are enrolled in the Audubon International Cooperative Sanctuary Program or comparable programs.

Strategies to Improve Golf Course Maintenance and Management			
Strategy	**Objective**	**Working Group**	**Activities**
Create targeted Education and Outreach Program promoting more sustainable golf course maintenance and management	Golf 1	CWG	• Encourage the use of environmentally responsible design elements • Promote responsible water usage • Establish relationships with golf course managers to effect changes in management • 2014 US OPEN conservation promotion • Ensure the application of new RCW guidelines for the design and development of golf courses • International Audubon Society Golf Course Management Standards
Promote golf course adoption of BMP use and certification programs	Golf 1	CWG	• Workshops for golf course managers about various programs • Increase golf courses enrollment in Audubon International Cooperative Sanctuary Program • Promote golf course adoption of USGA Environmental Principles for Golf Courses in the United States • Promote RCW guidelines for golf courses • Hold environmental management workshop with USGA and Audubon International

Objectives to Reduce Incompatible Agricultural Practices	
Objective	**Details**
Agriculture 1.	**Promote Agricultural BMPs:** By 2025 x % of agricultural acres within Reserve Design utilizing BMPs
Agriculture 2.	**Promote Farm Bill Cost-Share Programs:** By 2025 x # of agricultural acres added within Reserve Design under Conservation Reserve Program and NC Agriculture BMP Cost Share Programs.
Agriculture 3.	**Establish Local Farm Certification Program:** By 2015, create Sandhills Grown Farm Certification Program and achieve enrollment of x# of farms

Strategies to Reduce Incompatible Agricultural Practices			
Strategy	**Objective**	**Working Group**	**Activities**
Promote NC Agriculture BMP Cost Share Program	Ag1, Ag 2	LPWG, RMWG	• Provide information on cost share Incentives, benefits of various BMPs and how to implement them.
Create targeted Education and Outreach Program promoting agricultural BMPs	Ag 1, Ag 2	CWG	• Work with NRCS, WCD, Cooperative Extension and other organizations to expand bmp implementation • Promote Green Growth Toolbox • Implement a Sandhills Grown Program • Promote Local/Sustainable Food programs in conjunction with Sandhills farmers
Work with and help organize local farmers to create the Sandhills Grown Program	Ag 3	CWG	• Work with Sustainable Sandhills to promote Sandhills Grown Program

Objectives to Reduce Incompatible Development

Objective	Details
Development 1.	**Increase Land Conservation in Reserve Design Connectors and Buffers:** By 2025, 20K acres of undeveloped lands in 2013 version of Reserve Design connectors and buffers are conserved through voluntary programs, new zoning ordinances, fee simple, and/or conservation easements.
Development 2.	**Promote Conservation Developments:** By 2020, x % of overall number of newly developed acres in Sandhills are voluntarily incorporating conservation design elements from Green Growth Toolbox.
Development 3.	**Facilitate adoption of Reserve Design in County Land Use Plans:** By 2020, one or more Sandhills counties has incorporated Reserve Design elements Into their land use plans or zoning.

Strategies to Reduce Incompatible Development

Strategy	Objective	Working Group	Activities
Create Targeted Education and Outreach Program promoting value of land conservation	Dev 3	CWG	• Encourage local governments to limit service areas for infrastructure • Implement Green Growth Toolbox • Engage DOT Long Range Planning for compatibility with NCSCP • Work with Sustainable Sandhills to engage and educate citizens and local and county planning organizations • Provide information to elected officials on the value and importance of green infrastructure • Develop outreach materials and strategy for developers and landscape architects • Work with NC Source Water Collaborative to develop outreach materials and strategy promoting value of conservation land for maintaining water quality and quantity. • Conduct Landowner Workshops to Increase Awareness of Value of Conserving Land
Develop and promote economic incentive programs	Dev 2	LPWG, RDWG, SC	• Includes Wildlife Friendly Development program, Present Use Value, Conservation Tax Credit Program, Wildlife Land Tax Credit

Strategies to Reduce Incompatible Development (continued)			
Expand opportunities for land conservation	Dev. 1	SC, LPWG, RDWG, FSC	• Diversify strategies beyond acquisition to include engagement of local and county planning agencies and public outreach to garner support for conservation • Work with Federal and State Agencies that oversee cost share programs to steer these financial resources to private lands in priority areas to promote conservation use/practices. Use Safe Harbor as one means to engage landowners. • Look for new sources of funding for land acquisition • Support adoption of County Level Working Lands Protection Programs • Work with State to Create Policies Allowing Transfer of Development Rights • Work with counties to develop conservation subdivision criteria/policies/requirements. For example, zoning overlays (conservation overlays), riparian buffer requirements, etc • Encourage Counties to Adopt Their Own Conservation Land Tax Incentive Program and accept donated conservation easements • Encourage Counties to Incorporate Reserve Design Elements into their Land Use Plans • Develop Tax Compensation Program for Poorer Counties • Investigate Opportunities for Ecosystem Services Markets
Provide technical assistance and decision support tools to planners that promote land conservation practices	Dev 3	RDWG*, LPWG	• Encourage Adoption and use of Recommendations in the Green Growth Toolbox by Counties and Municipalities • Provide current Conservation Data Layers to Planners for use in Land Use Planning • Ensure planners have access to adequate information describing conservation development practices and alternatives • Provide training opportunities for planners • Develop an award program for the NCSCP to recognize excellence in conservation by local governments

Objectives to Reduce Incompatible Forestry	
Objective	**Details**
Forestry 1.	**Transition Acreage from Short Rotation to multi-age Pine:** By 2025, less than x% of managed forests in priority RD buffers and corridors are under short rotation pine management.
Forestry 2.	**RD Buffer and Corridor Protection:** By 2025, protect 20,000 acres within the RD corridors and buffers.
Forestry 3.	**Maintain Natural Stands in RD:** By 2020, X# of landowners in RD corridors and buffers have adopted a management plan promoting long rotation pine forestry practices and retention of bottomland hardwood
Forestry 4.	**Establish Longleaf Academy:** By 2015, Establish Longleaf Academy at NCSU for NCSU and Montgomery Community College forestry students

Strategies to Reduce Incompatible Forestry			
Strategy	**Objective**	**Working Group**	**Activities**
Create Targeted Education and Outreach Program Promoting Sustainable Longleaf Forestry Practices	Forestry 1 For 3, For 4	CWG*, RMWG, SC, CWG	• Foster Partnership with Longleaf Alliance • Coordinate with NC Longleaf Pine Coalition to develop additional outreach materials • Encourage mitigation of herbicides and selection of ones with low collateral damage • Address Impacts and opportunities to Green Energy • Work with forestry schools to develop longleaf restoration/ management curricula
Bolster existing incentive programs for natural forest stewardship	For 1, For 2, For 3	SC*, LPWG	• Provide incentives, through cost share programs and Safe Harbor, to control hardwoods in longleaf pine stands • Support NC Forest Stewardship Program and Forest Legacy Programs • Work with NRCS and NCFS to direct greater investment of available funding towards priority private lands in Reserve Design core areas, buffers and corridors • Explore and promote incentives such as ecosystem services markets to encourage sound forestry by private landowners
Increase Influence for Allocation of Funds for Acquisitions	For 2	SC	• Improve proposals and NGO requests for ACUB, CWMTF, NHTF, Parks and Rec. Funds
Work with Decision Makers to create sound policies that	For 2	SC*, LPWG, RDWG	• Incorporate GGT and Reserve Design into Land Use Planning at County level

support land conservation			

Objectives to Reduce Incompatible Pine Straw Production

Objective	Details
Pine Straw 1	**Sustainable Pine Straw Harvesting on Conservation Lands:** By 2020, all pine straw harvesting on conservation lands will be coordinated with longleaf restoration activities, and limited to plantations on former agricultural lands.
Pine Straw 2.	**Sustainable Pine Straw Harvesting on Private Lands:** By 2020, x% of pine straw harvesting operations on private lands will be "sustainable" based on Partnership standards
Pine Straw 3.	**Create Sustainable Pine Straw Label:** By 2020, 75% of pine straw in Sandhills labeled conservation friendly.

Strategies to Reduce Incompatible Pine Straw Production

Strategy	Objective	Working Group	Activities
Where allowed, restrict pine straw raking to plantations on federal, state, and NGO conservation lands including Fort Bragg	Straw 1	SC*, RMWG	• Develop and implement Partnership stance on pine straw raking
Create Incentive Programs for Sustainable Pine Straw Production	Straw 2, Straw 3	CWG	• Consider promoting a tax on bales of pine straw to fund Natural Heritage Trust Fund • Create Certification Program for Pine Straw Producers that provides economic incentives for “certified” pine straw
Create Targeted Education and Outreach Program Promoting Sustainable Pine Straw Harvesting, Sale, and creation of “Sustainable Pine Straw Label”	Straw 2, Straw 3	CWG*, RMWG	• Develop Partnership Standards for and Assist Implementation of Harvesting BMPs • Maintain and Conduct Literature Reviews on Impacts of Pine Straw Production • Educate landowners, land managers and policy makers about the importance of groundcover to healthy longleaf forests and the most current BMPs including harvesting methods and fertilization • Educate Landscaping Retailers of impacts of conventionally harvested pine straw • Develop marketing strategy to increase demand for sustainable pine straw
Promote Implementation of Conservation Reserve Program without pine straw raking	Straw 2	SC*, RMWG	• Work with NRCS to increase ranking points for CP36 proposals with no straw raking

Objectives to Reduce Impacts of Small Dams on Headwater Tributaries	
Objective	**Details**
Dams 1.	**Inventory Dams:** By 2016, locate all dams within watersheds in the Reserve Design appropriate for removal.
Dams 2.	**Dam Removal:** By 2025, all dams identified for removal in the watersheds located within the Reserve Design are removed.
Dams 3.	**Promote Agricultural Water Conservation:** By 2025 x % of agricultural acres within Reserve Design under NC Agriculture BMP Cost Share Program
Dams 4.	**Promote Golf Course Water Conservation:** By 2020 x% of current golf courses have adopted USGA Environmental Principles and x # of golf courses are enrolled in the Audubon International Cooperative Sanctuary Program

Strategies to Reduce Impacts of Small Dams on Headwater Tributaries			
Strategy	**Objective**	**Working Group**	**Activities**
Map and develop information database on dams	Dams 2	RDWG*, LPWG	• Utilize recently received dams data from Duke University and American Rivers • Work with USACE and other potential partners to gather additional data on location of small dams
Create Targeted Education and Outreach Program regarding environmental impacts of small dams	Dams 1, Dams 3, Dams 4	CWG	• Educate landowners, farmers, and golf course operators about the environmental impacts of small dams on watersheds and BMPs to reduce water loss/use and the need for irrigation ponds • Work with golf course designers/maintenance personnel to utilize native plants/landscaping that require less water use
Build political support for water conservation practices	Dams 1	CWG*, SC	• Emphasize the importance of water as a shared resource as reason to regulate and reduce wasteful use/storage practices, including irrigation ponds • Identify and replace leaky water infrastructure to decrease waste/use
Organize removal of defunct/unneeded dams	Dams 1	RMWG	• Work with landowners, ACOE, American Rivers, and other parties (NGO's, consultants) to remove dams as able • Restore associated riparian habitat as much as possible • Work with landowners to help find funding to implement these activities

Objectives to Reduce Impacts of Invasive Species

Objective	Details
Invasives 1.	**Achieve Control/Eradication of Invasives:** By 2025, controllable invasive species are eradicated or under control in Core areas, buffers, and connectors as defined by the Reserve Design.
Invasives 2.	**Institutionalize Early Detection and Rapid Response (EDRR) Monitoring:** By 2018, EDRR protocols are being followed by all NCSCP partners, local governments, and private lands managers within core areas, buffers, and connectors as defined by the Reserve Design.
Invasives 3.	**Reduce Nursery Sale of Invasive Plants:** By 2020, 50% of commercial nurseries in Sandhills end sale of invasive plants listed on NC, neighboring states', and federal noxious weed lists.

Strategies to Reduce Impacts of Invasive Species

Strategy	Objective	Working Group	Activities
Expand EDRR efforts in Sandhills	Inv 1, Inv 2	RMWG	• Train more field personnel to recognize and report infestations using EDRR protocols • Continue to hold at least one EDRR workshop in the Sandhills every other year. • secure funding for Sandhills Weed Management Area staff and operations • Increase funding/size of SWMA staff to manage invasive species problems at Sandhills regional scale
Create targeted Education and Outreach Program to prevent and mitigate invasive species introductions	Inv 3	CWG	• Hold Invasive Species Workshops • Work with Cooperative Extension to Engage Nurseries and Plant Sellers to Discontinue sale of Invasives • Promote Sale and Benefits of Native Alternatives • Work with DOT regarding selection of erosion control species
Build political support for invasive species control/ prevention (EDRR)	Inv 2, Inv 3	SC, CWG	• Promote increasing capacity for EDRR and control of existing infestations by demonstrating cost of invasives on local economies • Promote passage of regulations against import, sale, and transport of known invasive species beyond just the "noxious weeds" list, as prevention is cheaper than treatment • Encourage local governments to prohibit planting of known invasive species in new development projects

Strategies to Reduce Impacts of Invasive Species (continued)			
Galvanize hunting community to eradicate feral hogs from Sandhills	Inv 1	CWG	• Create Feral Hog Eradication Programs for Conservation Lands
Increase size of core areas and sensitive habitats to reduce edge effects	Inv 1	LPWG, RDWG*	• A lower edge to core area ration reduces invasive risks Add this to the list of arguments in favor of funding land conservation
Limit access to sensitive and contaminated areas	Inv 1	RMWG*, SC	• Limit entry to sensitive areas free of invasives, or install "boot cleaners", etc. at entry points. • Encourage/require vehicles/mowing equipment to be washed before leaving infested areas and before entering areas • Areas on public lands contaminated with aggressive invasives (with many seeds) can be made off limit to avoid accidental contamination and transportation to invasive free areas
Pursue opportunities for increasing EDRR capacity	Inv 1, Inv 2	FSC	• Increase funding for SWMA to get more staff and do more detection, treatment, etc. • Utilize Longleaf Restoration Task Force for invasive treatment

Objectives to Mitigate Surface Mining

Objective	Details
Mining 1.	**Prevent New Mining in Reserve Design:** By 2025, no new surface mining will occur in the Reserve Design connectors and buffers and BMPs put in place on all existing mines.
Mining 2.	**Expand Riparian Corridor Protection:** By 2020 protect x # of miles of stream corridor within RD
Mining 3.	**Establish Land Use Plan Overlay Zones:** By 2020, Sandhills counties' zoning ordinances will incorporate mining overlay zones that exclude mining in connectors and buffers identified in the Reserve Design

Strategies to Mitigate Surface Mining

Strategy	Objective	Working Group	Activities
Expand Opportunities for land conservation	Mining 2	FSC	• Earmarked funding for Acquisition from user taxes • Diversify strategies beyond acquisition • work to expand CWMTF, NHTF, PARTF, and to create earmarked mining tax funding existing or new acquisition programs • Reinvigorate existing SALT river corridor plans
Create Mining Overlay Zones in County Land Use Planning	Mining 3	RDWG*, LPWG	• Moves mining operations outside of Reserve Design and other sensitive areas • Work with counties to create and adopt these zones
Create targeted Education and Outreach Program for mining impacts on natural resources	Mining 1, Mining 2, Mining 3	CWG	• Educate the public and decision makers on the damage mining can cause (water quality) if done in the wrong places, i.e. riparian buffers and bottomland forests • Conduct targeted outreach to landowners within connectors and buffers to increase enrollment in conservation programs
Work with mining companies to mitigate/cease activities in buffers and connectors	Mining 1, Mining 2, Mining 3	SC, RDWG, LPWG*	• Work to find agreement with mining companies to implement BMPs in connectors and buffers • Enforcement and Enhancement of BMPs for mining operations by state and local governments • Encourage conditional requirements during rezoning requests or other permitting Enforcement and enhancement of BMPs for mining operations

Objectives to Reduce Surface Water Withdrawals	
Objective	**Details**
Water 1.	**Promote Water Conservation Ordinances/Initiatives:** By 2020, x# of counties and x# of municipalities with water conservation ordinances/initiatives.
Water 2.	**Promote Agricultural Water Conservation:** By 2025 x % of agricultural acres within Reserve Design under NC Agriculture BMP Cost Share Program

Strategies to Reduce Surface Water Withdrawals			
Strategy	**Objective**	**Working Group**	**Activities**
Water Conservation Initiatives	Water 1	SC, CWG*	• Golf Course Certification Programs and xeriscaping are highlighted during workshops and meeting with course managers • Incentives Program for Minimizing Water Use
Promote NC Agriculture BMP Cost Share Program	Water 2	CWG, LPWG*	• Work with Cooperative Extension, WCD, and NRCS to promote Cost Share Programs for water conservation
Create targeted Education and Outreach Program promoting water conservation	Water 2	CWG	• Work with Cooperative Extension to Educate on Water Use/Impacts • Water conservation strategies outreach • Promote Water Conservation to County Commissioners • Xeriscaping Education/Outreach

Objectives to Improve Transportation Planning, Construction and Maintenance	
Objective	**Details**
Roads 1.	**Sustainability Included in Updated Long Range Transportation Plans:** By 2025 all counties and state DOT have new long range transportation plans incorporating GGT and environmentally friendly design elements.
Roads 2.	**Updated Land Use Plans Include RD:** By 2025 x% of Sandhills counties have incorporated Reserve Design elements Into their land use plans.

Strategies to Improve Transportation Planning, Construction and Maintenance			
Strategy	**Objective**	**Working Group**	**Activities**
Create targeted Education and Outreach Program promoting sustainable transportation planning, construction and maintenance to DOT	Trans 1		• Promote existing education and outreach programs • Present partnership viewpoints and GGT at DOT charettes and other public input opportunities. • Encourage Incorporation of GGT into all county and municipal land use planning
Promote environmentally friendly road design elements to DOT	Trans 1		• Encourage the use of Storm water BMPs such as runoff catchments to prevent direct discharge into water bodies • Improve the implementation of roadside management for rare species/ improved road crossings • Establish working relationships with DOT and MPOs/RPOs • Work with DOT to stop planting invasive species along roadsides • Expand the use of native species, where appropriate
Promote Improved local and county Land Use Planning	Trans 2		• Work with local counties and municipalities to incorporate reserve design into land use plans