Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina

Project Executive Summary
March 31, 2016

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Principal Project Members:
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The NC Foundation for Soil and Water Conservation (Foundation) obtained a USDA Natural Resources Conservation Service Conservation Innovation Grant in 2013 entitled "Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina", contract number 3A75-13-229. Collaborating partners include; NC State University's Department of Forestry and Environmental Resources, Texas A&M University's Institute of Renewable Natural Resources, Environmental Defense Fund, NC Department of Agriculture and Consumer Services, NC Farm Bureau Federation, and the NC Association of Soil and Water Conservation Districts.

Project Scope

On a national scale, mitigation for impacts to the habitats of threatened or endangered species has focused on a single species approach with a strong emphasis on permanent habitat protection. We extended this narrow approach by examining the following broader questions from North Carolina:

- Is there a way to design a program that takes into account climate change and/or multiple species benefits?
- If such a program were developed what are the economic and wildlife lifecycle dynamics to be considered?
- What types of regulatory assurances would private landowners and industry need before participating?
- What type of regulatory framework needs to be developed to support the legal aspects of such a program, including permitting?
- What organizations in North Carolina can serve as the program delivery points at the county and state level?

The focus of the project was to enhance discussions in North Carolina regarding the future promotion of the longleaf pine ecosystem and the best delivery system for ecosystem services at the county level. The project was a scoping exercise, which did not intend to enroll landowners into a crediting system or offer mitigation impact credits to industry. Partners have developed an innovative process for handling impacts to threatened and endangered species on a multiple species approach that was vetted with the existing community that supports longleaf pine habitat preservation.

Longleaf Pine Ecosystem Credit Creation Analysis

The Longleaf Pine Ecosystem Conservation Credit Creation and Development element of the Conservation Innovation Grant explored habitat metrics and credit calculation for a longleaf pine habitat exchange system, implementing knowledge of existing credit systems and species of conservation concern in the longleaf ecosystem.

Research of four existing wildlife habitat credit systems indicated that this conservation tool has not only successfully contributed to management of endangered species, but also prevented listing of species. Existing systems focus on provision of habitat for a single species, awarding more credits to properties with higher conservation value based on specific habitat needs of the species of interest. Habitat preferences shared by the seven species researched herein – mature, open longleaf stands – suggest a longleaf habitat exchange system can benefit multiple species of varying degrees of conservation concern. We proposed a credit calculation method designed to assess the conservation value of a property based on points and multiplier values assigned to 21 habitat metrics. These metrics evaluate the spatial and temporal context of habitat, stand structure, length of time managed as wildlife habitat, and total area managed as habitat. Assignment of credits based on such metrics encourages conservation of mature, open longleaf stands with native, herbaceous understories existing in large, contiguous areas managed as wildlife habitat for longer periods of time. As additional research becomes available for other open pine ecosystems, this same credit framework can be adjusted and applied to provide adequate habitat for relevant species of concern in those systems.

Longleaf Pine Ecosystem Credit Supply and Demand Analysis

The potential supply of longleaf pine habitat in Southeast North Carolina for an ecosystem based credit market was analyzed using landowner surveys and economic analyses of rural land management alternatives. Results from a logistic regression and a choice-based-conjoint (CBC) statistical analyses revealed that landowners were most influenced by program requirements such as contract length and legal obligation in a conservation contact. Short term contract agreements of 5 to 10 years were favored, as were the least land restrictions. Annual payments were somewhat less important than contract agreement or level of obligation, although higher payments were more desirable, as expected. The initial cost share rate and level of technical assistance were the least important factors affecting willingness to participate in longleaf conservation programs. The presence of longleaf pine on the landowner's property, previous

participation in a FSA benefits program, a willingness to participate in a permanent easement to promote longleaf pine, the amount required amount to accept a permanent easement, and ownership of 101 – 500 acres of forest positively impacted landowners' interest in a conservation credit program to promote longleaf pine habitat. Conversely, persons who were unwilling to participate in a permanent easement were less interested.

The financial and capital budgeting analysis indicated that for longleaf pine versus Loblolly pine, the incentive payment required for landowners to breakeven and plant longleaf in the low intensity 2011 analysis at a 4% annual discount rate, was between $7 per acre and $83 per acre per year, not including establishment costs. If establishment costs of $306 were paid, longleaf returns would exceed Loblolly returns for the higher site indexes and pine straw raking scenarios. Greater costs in our more intensive 2015 management scenarios resulted in annual incentive payment requirements of $66 to $496 per acre per year for longleaf to break even and meet the 4% discount rate when converting agricultural land, which are prohibitive at the high end. However, if the initial year costs for mature forest conversion of longleaf pine tree planting received a 50% cost share rate, required annual payment costs could decrease substantially. Also, if the very expensive $2000 to $2500 per acre shrub establishment practice were dropped, even the intensive longleaf annual payment rates for mature and planted stands could decrease to less than $100 per acre per year, which is still within current Farm Bill program payment levels. Conversion of good quality agricultural crop land to longleaf pine would be too expensive based on high 2011 crop prices, but for poor croplands and at current lower 2015 prices, conversion could be economically attractive, especially with prevailing cost share payments.

We performed a demand survey of organizations that were familiar with longleaf demand, although most were government agencies or intermediaries, not potential buyers of credits. We had a small sample of 12 returned surveys, but received thorough and conscientious answers. All the respondents were familiar with and engaged in some current conservation credit programs – wetlands, water, endangered species, or other ecosystem goods. Nearly every participant was affected and/or limited to some degree by environmental regulations ranging from the national level (ESA and CWA) to more local policies (for instance, NC Prescribed Burning Act) that often require permits, studies and/or consultations to ensure proper management and development actions, but they did not express interest in purchasing credits to promote longleaf pine habitat yet. In addition to regulatory mandates, voluntary credit markets also could be developed in anticipation of future regulatory requirements, or used for corporate social responsibility (CSR) and good will efforts by companies. By setting aside critical habitat, or purchasing such efforts on other private lands, public or private organizations can demonstrate their commitment to environmental quality and biodiversity.

Our demand survey also provides insight into how a longleaf pine habitat credit market could be designed. An ability to track, monitor and enforce credits and their standards is important to prospective buyers. Forest certification systems such as SFI and FSC can help provide a solution given their popularity and strong framework. The demand survey respondents stated a

stronger preference for permanent contracts/easements as well as shorter term contract lengths. This makes sense—people who buy credits would want more security and permanence; sellers (private landowner suppliers) would want less permanent commitments. Similarly, while landowners preferred fixed program certainty equivalents, demand responses indicated that guaranteeing such fixed government requirements for long periods would be difficult in California, and maybe other states.

These interacting and sometimes conflicting demand and supply factors would then need to be sorted out by the market where varying prices for establishing longleaf systems could be set, and buyers would see if they attracted sufficient sellers. So far, moderate federal and state longleaf incentives have been successful and well subscribed, but more funds and perhaps higher payment levels are needed to increase the supply. The modest regulatory demand and still nascent voluntary demand for longleaf ecosystems will probably continue to prompt a slow expansion in longleaf pine establishment and restoration in North Carolina rather than a quantum leap that might be prompted by a program such as the federal No Net Loss of Wetlands policy that was mandated in 1990.

Model Ecosystem Credit Program

Several conservation programs exist to offset impacts to natural resources, such as wetland mitigation banks, water quality certainty programs, and habitat exchanges. In landscapes that are dominated by smaller acreage private landholdings, like what is found in eastern North Carolina, a strong aggregator network can be critical. Aggregating credits greatly increases the successful involvement of the credit demand entities with large purchasing power.

Several different types of conservation benefits programs across the nation were evaluated related to species recovery, water quality improvements, and agricultural sustainability. Evaluations included online research and interviews with selected programs; a set of case studies and a summary chart of programs is provided.

A program's organizational structure was defined as the following; Advisory Committee, Resource Managers, Administrator, Credit Developers and Aggregators, Credit Buyers, Technical Support Providers, and Credit Verifiers. Each groups' roles were defined and North Carolina partners that can serve in those roles were recommended. The Crediting Process was defined including; credits, debits, and associated process steps. Additional assurance processes were also discussed. Overarching programmatic costs were evaluated based on similar historic program delivery costs. Costs were considered for the first year and year five, when costs would start to drop as the program moves from the active to monitoring phases.

NC Soil and Water Conservation Districts (Districts) were evaluated for their suitability as serving as Aggregators. Presentations were made at District board meetings and District boards completed a survey gauging interest. It was determined that Districts have a lack of understanding for how credit trading programs and subsequent opportunities for expand

ecosystem services could be delivered. Districts are willing to sponsor workshops and focus groups and are comfortable serving as a Verifier. Districts are currently only minimally interested in assuming an active role in threatened and endangered species management.

Model Ecosystem Credit Program Policy Review

This project proposed to advance the concept of a national streamlined model of endangered and threatened species habitat improvement efforts allowing for a landscape scale approach within the longleaf pine ecosystem. The project was designed to develop innovative data, information, methods, and partnerships to increase the longleaf pine ecosystem in North Carolina. Several factors come into play making this the opportune time to engage in landscape scale ecosystem improvement efforts including; (i) potential land usage changes in eastern North Carolina and private landowner preferences, (ii) an existing market-based project approach to open space conservation coined the Market Based Conservation Initiative, (iii) on-going longleaf pine ecosystem restoration efforts, (iv) nationally recognized habitat exchange systems and (v) state level Certainty Program efforts. All of these efforts have their own sets of merits and weaknesses, but the overarching missing piece is a national streamlined model that can work across an entire ecosystem. Project partners feel that an ecosystem crediting program is possible within the existing regulatory framework. The following guiding principles are recommended:

All programs should be created through a stakeholder driven consensus building process with representative organizations that support habitat conservation, control existing habitat, or benefit from functioning ecosystems. Locally led conservation actions have a long tradition of effectively bringing together a community, state, or region to establish proactive environmental solutions to natural resource degradation.

Framework future programs similar to the Working Lands for Wildlife Program where voluntary incentives are utilized, habitat practices benefit multiple species, and regulatory agencies allow habitat improvements to count towards delisting or preclude listing of species of concern.

Regulatory certainty is key to private landowner participation in an ecosystem crediting program. The Certainty Program framework is a viable model to adopt, leading to certified program participation in a streamlined manner. Standardized practices will ensure that habitat improvements will be obtained. Program enrollment transparency allows for both private landowners and regulators to know that obligations are being met in a uniformed manner.

Project partners support consideration of Present Use Value taxation and Voluntary Agriculture Districts enrollment for ecosystem credit program supply participants. Both tools provide an added layer of enforcement by providing enrollees additional benefits while also applying penalties for program noncompliance.

Project partners support adaptive management processes to be incorporated into an ecosystem crediting program. As technologies advance and better science is established, a process allowing for future programmatic changes needs to be in place for the program to succeed.

Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina

Project Introduction Report
Component Report 1 of 6

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Historic Partnership Efforts

The Foundation and its partners are interested in moving forward the concept of a national streamlined model of endangered and threatened species habitat improvement efforts allowing for a landscape scale approach within the longleaf pine ecosystem. Several factors came into play making this the opportune time to engage in landscape scale ecosystem improvement efforts including; (i) potential land usage changes in eastern North Carolina and private landowner preferences, (ii) an existing market-based project approach to open space conservation coined the Market Based Conservation Initiative, (iii) on-going longleaf pine ecosystem restoration efforts, (iv) nationally recognized habitat exchange systems and (v) state level Certainty Program efforts. All of these efforts have their own sets of merits and weaknesses, but the overarching missing piece is a national streamlined model that can work across an entire ecosystem.

i. Eastern North Carolina Land Uses and Private Landowner Preferences

North Carolina is a strong agricultural state with agriculture, agribusinesses and forestry as the largest contributors to the total staet economy. Mor than 90% of the land in the state is privately owned, including in eastern North Carolina. A recent major strategic planning exercise for eastern North Carolina was held in Trenton in 2012 found that population growth patterns research estimates that over one million new people could move into eastern North Carolina by 2050 (1). The projected infrastructure, land, and land value impacts of this forecast are staggering. Large increases in population, building and expansion of major roads, and other development projects will place even more pressure on scarce natural environments and habitat.

Landowner willingness to participate in innovative programs is crucial. A wealth of research information exists on the factors that influence landowners to participate in farm and forest conservation programs (3), including a study by Rodriguez et al. (3) assessing the interest in market-based conservation programs in North Carolina. In addition, during the recent economic downturn, many private landowners delayed timber harvests, waiting for prices to improve. The regional delay in timber harvests and less forestland development presents a unique

opportunity for longleaf pine ecosystem conservation. Government and nongovernment organizations have the ability to work with private landowners to manage existing longleaf pine stands and the more common southern pine species, on longer rotations to develop mature stands with an open understory improving the extent of the longleaf pine ecosystem. Extending rotations will allow a greater suite of habitat improvement options to be considered. This window of opportunity may be short lived as the economy appears to be improving and threats of land development are reemerging, especially in eastern North Carolina.

ii. Market Based Conservation Initiative

The North Carolina conservation partnership delivered a regional scale pilot program called the Market Based Conservation Initiative (MBCI), focusing conservation efforts in portions of 18 eastern North Carolina counties. The North Carolina conservation partnership cooperated with the US Marine Corps Marine Corps Installations East to promote the preservation of working forests and farms, promote sound natural resource management, and protect the airspace of a mission critical military flight training route and special use airspace. Private landowners were given the opportunity to enter into voluntary performance based contracts through a reverse auction process to obtain contracts that will restrict future non-agricultural or non-forestry development of tall structures and upward shining lights on private lands under the targeted flight path.

A newly tried framework with a delivery mechanism of local Soil and Water Conservation districts was utilized. The pilot program was an active effort to stack funding resources allowing the agricultural and forestry communities to stay economically strong while achieving regional wide conservation. Lessons learned from the pilot program informed Department of Defense efforts regarding development of a national model for the conservation of lands critical to military training and national defense not directly adjacent to the base, coined Sentinel Lands.

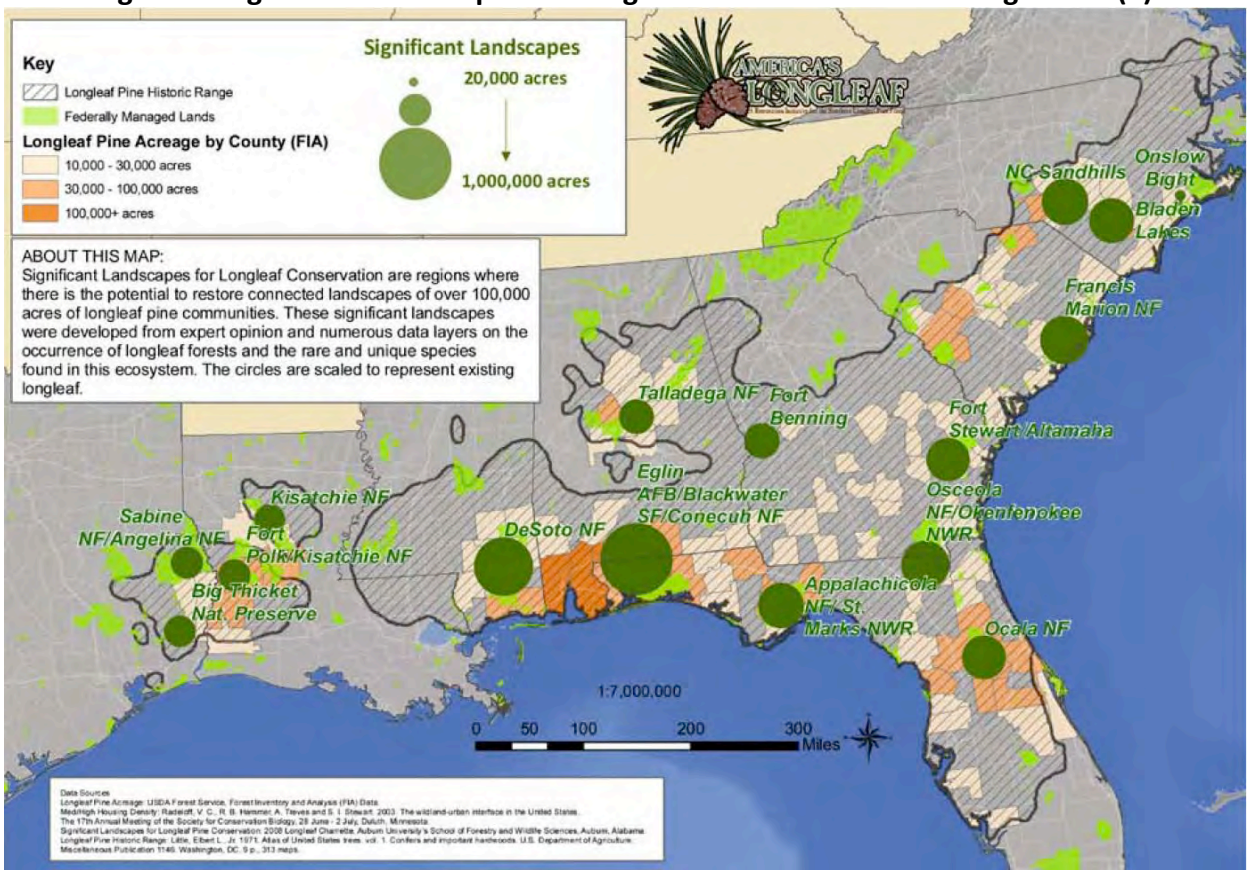
iii. Longleaf Pine Ecosystem Restoration Efforts

Longleaf pine forests historically covered a vast range, from southeastern Virginia to the coastal plains of east Texas. Longleaf pine forests once extended over 90 million acres of the southeastern United States, but today less than 4% of the habitat remains (4). These forests provide a variety of unique habitat for flora and fauna that are not available through short rotation intensively grown timber plantations or agricultural lands, including habitat for 26 federal listed endangered species such as the red cockaded woodpecker (RCW), gopher tortoise, and whorled loosestrife. Secondary ecosystem benefits include foraging habitat for game birds such as quail and turkey, pine straw for commercial use, and water quality improvement and retention.

In 2005, a group of longleaf conservationists articulated the need for a focused, range-wide restoration approach resulting in a diverse coalition named America’s Longleaf—A Restoration Initiative for the Southern Longleaf Pine Forest. Recognizing that the vast majority of forestland available for conservation and restoration is privately held; to achieve any measure of success,

private landowners across the southeast will need to be engaged to plant, restore, and improve longleaf pine habitat across the Southeast. The America's Longleaf focus area are shown in Figure 1 (5).

Figure 1. Significant Landscapes for Longleaf Pine Conservation: Range-wide (5)



Recent studies identified potential longleaf pine stands on private lands, but very little acreage has the open canopy structure needed by specific species of concern. Several federal and state cost-share conservation programs have components that encourage planting and enhancement of longleaf pine. These natural resource programs and government/nongovernment organizations contribute to the demand for longleaf or other open pine species habitat establishment or restoration.

The Endangered Species Act (ESA) makes a strict distinction between the responsibilities of federal versus private landowners. Private landowners are not mandated to participate in threatened or endangered species recovery but they are not permitted to perform any activity that results in direct harm to the species or its habitat where there are identified populations. Because of these rigid requirements, federal lands have become central to the recovery plan for many longleaf pine ecosystem dependent species such as the RCW. With much of the land in eastern North Carolina being privately owned, an opportunity exists to find market-based

approaches to working with landowners while providing participants with assurances protecting their future involvement.

iv. National Habitat Exchange Systems

Habitat exchange systems are the most innovative way to support habitat improvement for a specific species of concern. The systems focus on private landowners lacking the resources and technical skills to manage private lands for a declining wildlife population. A market is created by entities needing to mitigate impact to a species of concern as required by the ESA, and the market demand prompts private landowners to take on a voluntary role in species specific habitat improvement projects. As habitat credits are created in one location, entities anticipating an impact to the species of concern in another location can purchase those credits. These habitat exchange systems are also proving to be a valuable tool in preempting a species listing.

The majority of the created exchanges focus on one species, when habitat improvements can benefit more than one species. The habitat exchange systems have evolved from a geographic area of a small number of counties to a multi-state approach. What is missing is the integrated ecosystem approach where habitat improvement for other species of concern and secondary ecological benefits are integrated into the crediting system.

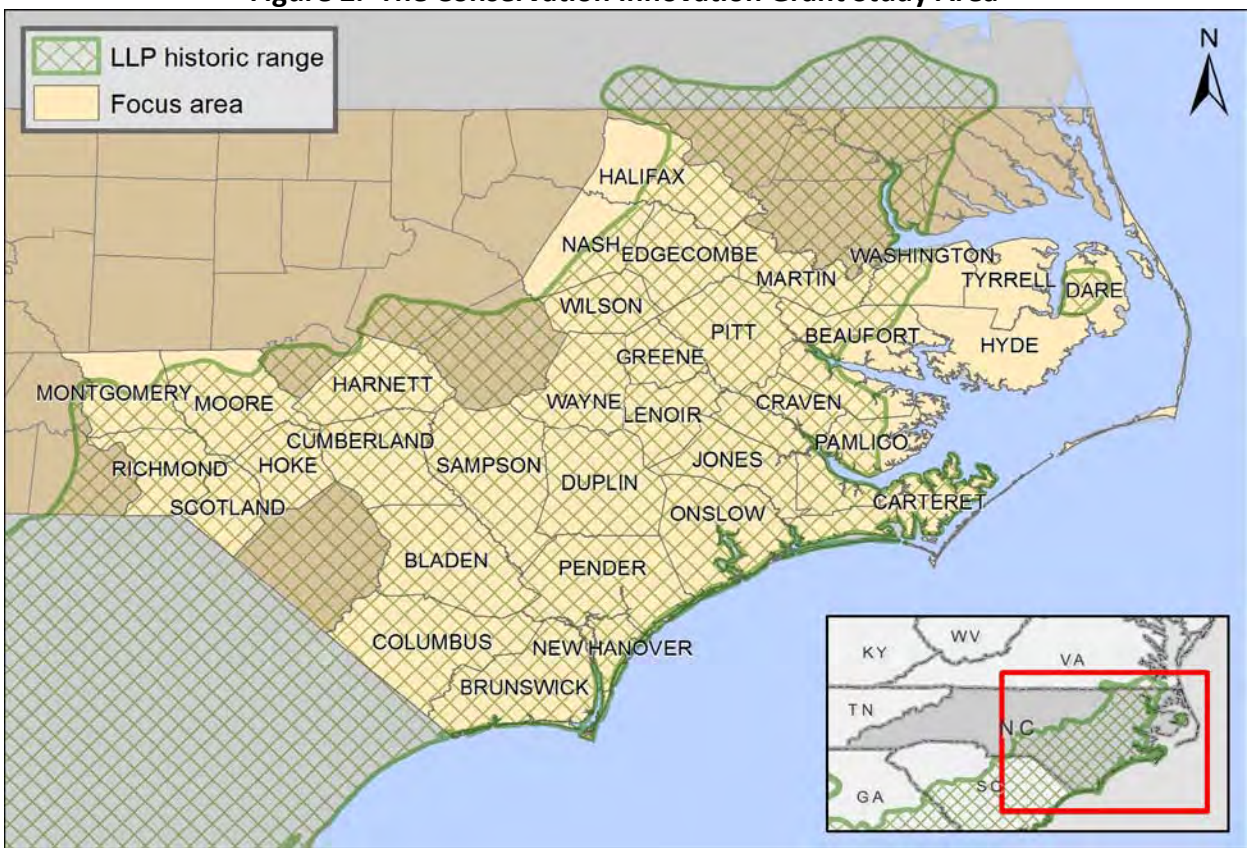
v. Certainty Programs – Conservation Candidate Agreements with Assurances

Local Soil and Water Conservation Districts are beginning to test, develop, and implement Certainty Programs. These programs which reflect the model principles of being voluntary and locally led, being based on sound science, and structured to offer incentives for participants while providing administrative and regulatory certainty that regulations and administrative requirements will not increase over time. Most of the state led soil and water conservation district efforts are focusing on water quality initiatives such as programs being implemented in the Chesapeake Bay and Minnesota. Private landowners participating are given legal compliance assurances from the Environmental Protection Agency and state programs related to Total Maximum Daily Load requirements of the Clean Water Act. Another new wildlife initiative is the Working Lands for Wildlife, a partnership of the USDA Natural Resources Conservation Service and the US Fish and Wildlife Service, which is modeled after the traditional “safe harbor” program and leads to development of Conservation Candidate Agreements with Assurances. The water quality driven Certainty Programs are being led by direct involvement from local districts across a large region, this has yet to be done for wildlife habitat or ecosystem initiatives.

Project Process

This project focused on the development of a habitat exchange system framework for wildlife species mitigation at an ecosystem level. Project partners considered market-based conservation and Certainty Program models within the traditional range of the longleaf pine ecosystem in eastern North Carolina (Figure 2). The integration of these approaches represents a substantial innovation in the delivery of wildlife habitat conservation on a landscape scale and provides a pilot model approach that can be expanded and replicated regionally within the ecosystem and nationally to address other ecosystem needs.

Figure 2. The Conservation Innovation Grant Study Area



What is missing from the current wildlife mitigation models is the integrated ecosystem approach where habitat improvements for other species of concern and secondary ecological benefits are folded into a mitigation crediting system. The proposed voluntary incentive based approach also reflects the successful methods utilized by local soil and water conservation districts in delivering locally led conservation efforts.

The project focused on several key components in order to achieve an integrated market based, certainty program as a prototype for eastern North Carolina including the following (see our separate component reports for more details):

1. Overarching Stakeholder Process – Establishment of a stakeholder advisory board that was actively engaged for the entire process with specific emphasis on science, economics, and policy aspects.
2. Longleaf Pine Ecosystem Conservation Credit Creation and Development – Development of quantifiable metrics and the framework to craft marketable credits for the conservation of specific habitats and related ecosystem services.
3. Longleaf Pine Ecosystem Conservation Credit Supply – Assessment of the willingness of private landowners to provide a supply of conservation ecosystem credits and related ecosystem services under various types of incentives and levels of regulatory certainty.
4. Longleaf Pine Ecosystem Conservation Credit Demand – Assessment of the demand and end uses for conservation credits for longleaf pine and other open forest ecosystem habitat improvements. Organizations that anticipate the need to offset impacts to specific habitat and targeted species were engaged within the public and private sector.
5. Policy Development – Development of a catalogue existing federal, state, local, and nongovernmental programs that provide incentives for the longleaf pine ecosystem as well as an evaluation of current policies and policy recommendation to overcome any private landowner adoption hindrances.
6. Program Delivery / Aggregators – Determination of how delivery of ecosystem credits for a large number of small and dispersed privately held lands can be encouraged through an innovative delivery mechanisms mirroring aggregator systems in other ecosystem service programs.
7. Third Party Tracking and Verification – Assessment of methods used in other programs to track and verify credits in order to ensure program compliance and success.

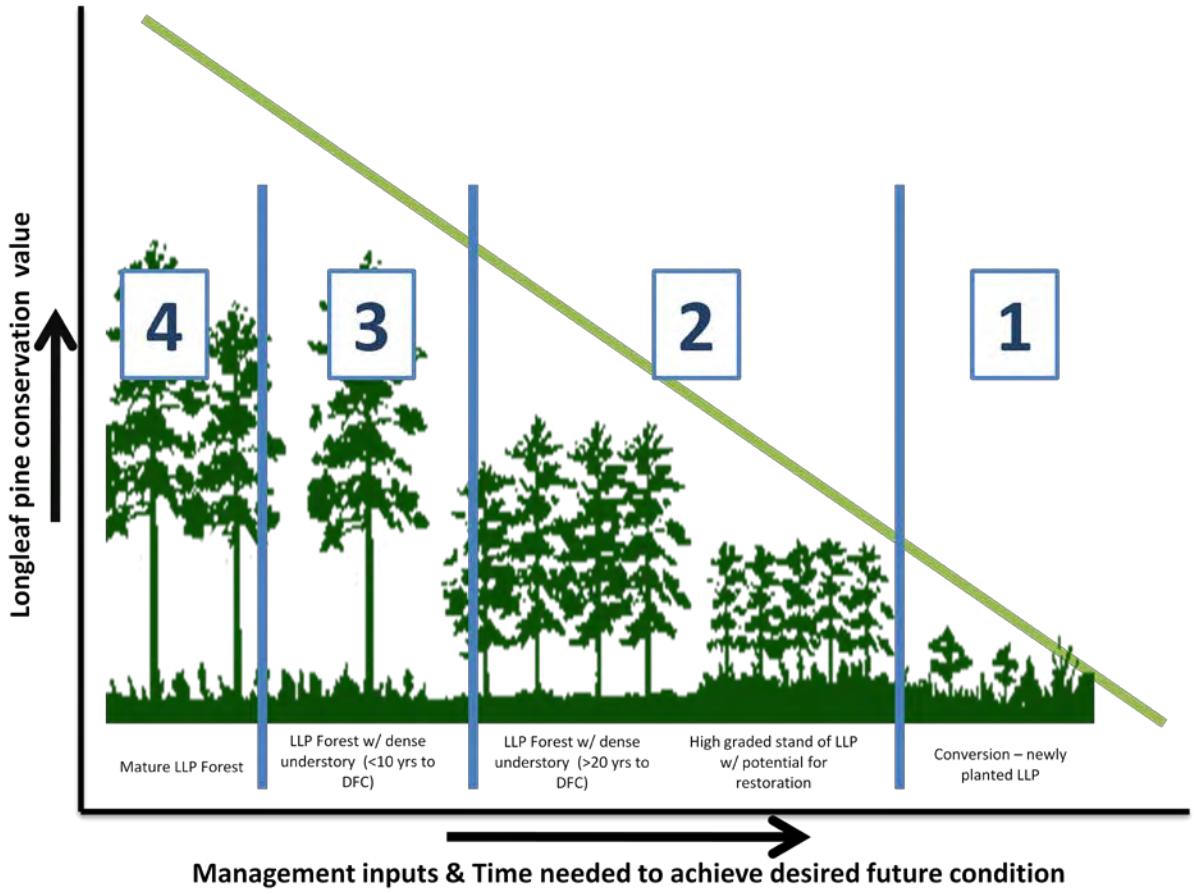
Project Process - Biological and Financial Concept Models

Current longleaf pine restoration work focuses on technical and cost share assistance as well as placing the land under permanent easements. Based on past project experiences, many landowners may not feel comfortable with considering permanent land management options. Longleaf pine is assumed to have a lower economic return than loblolly pine. Due to the perceived economic returns and the lack of understanding of how conservation easements work, less acreage is planted in longleaf pine than other pine forest systems. The question raised was how to design a program that promotes a constant revolving inventory of mature longleaf pine acreage across the landscape.

Consider the model below (Figure 3) that represents five typical stand conditions as well as the amount of time, level of management to achieve the desired future conditions along the x-axis and the relative conservation value of each group as measured along the y-axis. Four different levels of engagement based on level of commitment and incentive are required:

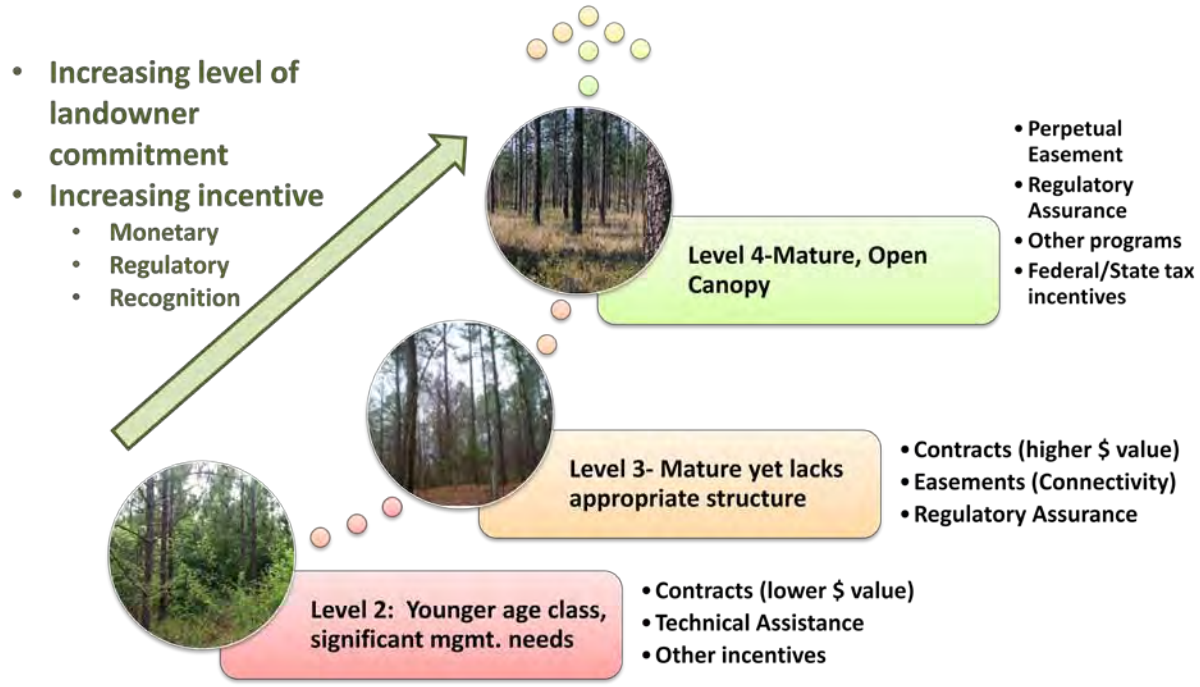
1. Mature open canopy longleaf pine forest: suitable wildlife habitat, easements
2. Longleaf pine forest with dense understory: with appropriate management (prescribed fire, understory control, thinning, etc.) potential habitat in 10 years, performance based contracts and long-term or perpetual easements based on location in landscape i.e. connectivity
3. Longleaf pine forest with dense understory (younger age structure): with appropriate management (prescribed fire, understory control, thinning, etc.) potential habitat in 20-30 years, blend of performance based contracts and technical assistance programs
4. Conversion – newly planted longleaf pine: many years of active management needed, long term investment of 50-80 years, technical assistance programs

Figure 3. The Conservation Innovation Grant Biological Concept Model



What kinds of resources and landowner assurances are needed to move a property from the younger aged trees to the more mature trees? Consideration must be given to the level of technical assistance, financial incentives, and contract obligations. The basic thought process is outlined in Figure 4.

Figure 4. The Conservation Innovation Grant Financial Concept Model



Project Process - The Stakeholder Process

Several organizations were invited to discuss the project and critique the tools as they were developed. All the information was readily accessible on a project website and detailed notes were taken at each stakeholder meeting. The meetings were not designed to reach consensus but only to explore ideas and identify areas were consensus could not be reached. Many topics discussed were considered to be beyond the scope of this project including overcoming obstacles to implementing prescribed burn and the future trends of the international biomass markets as a forest conversion pressure. A record of conversations is including in each meeting packet.

The project was organized as depicted in the following flow chart (Figure 5). Stakeholder meetings were held on a quarterly basis in Raleigh North Carolina. The Conservation Innovation Grant Project Team (Table 1) led the stakeholder engagement process; convened meetings quarterly; and performed the research, surveys, analyses and cooperative discussions that provided the substance for the discussions at the stakeholder meetings. Organizations were invited to join the process and received regular program updates by email (Table 2).

Figure 5. Conservation Innovation Grant Stakeholder Involvement Process

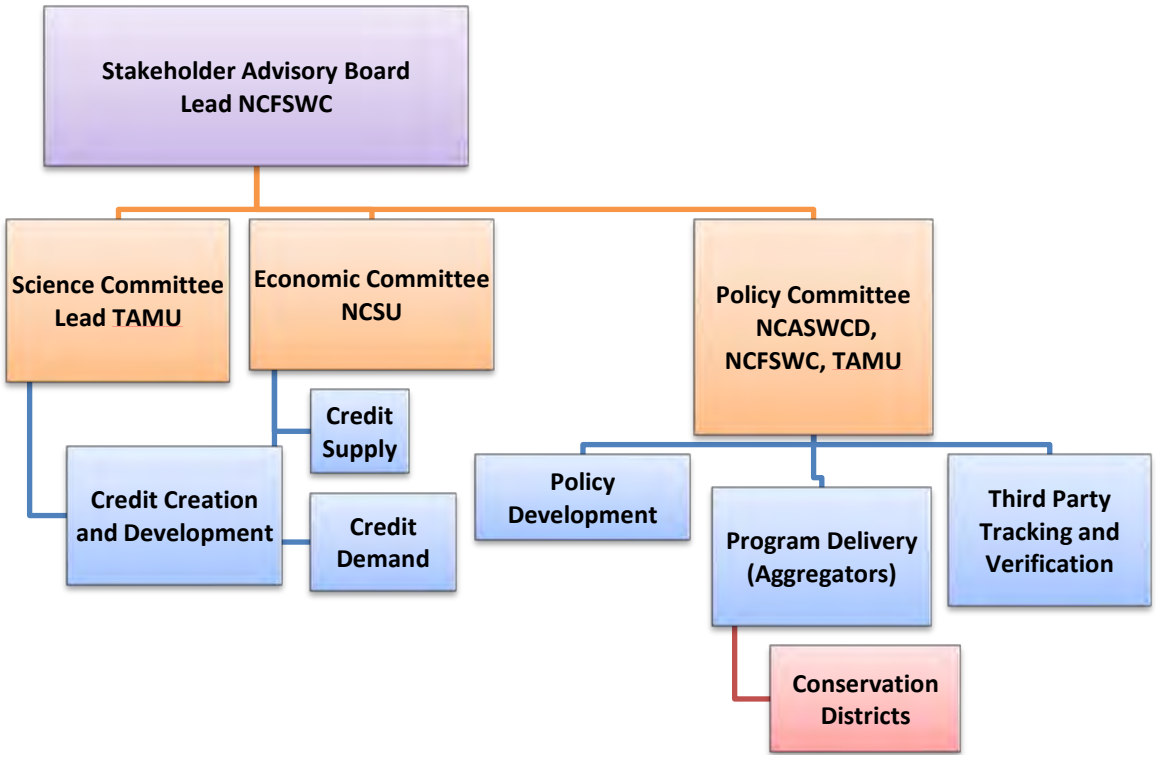


Table 1. Conservation Innovation Grant Project Team

Project Team Agencies	Project Team Personnel
NC Association of Soil and Water Conservation Districts (NCASWCD)	Dick Fowler (former) Julie Groce
NC Department of Agriculture and Consumer Services; NC Agriculture and Farmland Development Trust Fund	Dewitt Hardee
NC Farm Bureau Federation	Chester Lowder
NC Foundation for Soil and Water Conservation (NCFSWC)	Michelle Lovejoy
NC State University, College of Natural Resources, Department of Forestry and Environmental Resources (NCSU)	Dr. Fred Cubbage Dr. Nils Peterson Jessica Pope Chris Serenari Damien Singh
Environmental Defense Fund, North Carolina office	Will McDow
Texas A&M University Institute of Renewable Natural Resources (TAMU IRNR)	Todd Snelgrove (former) Brian Hays Amanda Dube Alison Lund

Table 2. Conservation Innovation Grant Invited Stakeholders

Organizational Category	Organizations
Federal Agencies	US Department of Agriculture Forest Service Natural Resources Conservation Service Office of Environmental Markets Southeast Regional Climate Hub US Department of Interior Fish and Wildlife Ecological Services Raleigh Field Office
State Agencies	NC Clean Water Management Trust Fund NC Department of Agriculture and Consumer Services North Carolina Forest Service Research Stations NC Department of Natural and Cultural Resources Division of Land and Water Stewardship NC Wildlife Resources Commission
Nonprofits	Audubon Society NC The Longleaf Pine Alliance The Nature Conservancy NC Conservation Network NC Sierra Club NC Wildlife Federation The Wildlands Network
Universities	NC Cooperative Extension Forestry Duke University Nicholas Institute for Environmental Policy Solutions
Partnerships	South Atlantic Landscapes Conservation Cooperative Regional Longleaf Pine Partnership Council

Accompanying Reports

To learn more about the project, the following reports contain the findings of the five project components. All information can also be found at www.ncsoilwater.org.

- Component Report 2 - Longleaf Pine Credit Creation and Development Report
- Component Report 3 - Longleaf Pine Credit Supply Report
- Component Report 4 - Longleaf Pine Credit Demand Report
- Component Report 5 - Model Ecosystem Credit Program Report (incl two attachments)
- Component Report 6 - Ecosystem Credit Policy Review

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3. Frost, Cecil. 1993. Four Centuries of Changing Landscape Patterns in the Longleaf Pine Ecosystem. North Carolina Plant Conservation Program, Plant Industry Division, NC Department of Agriculture.
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Longleaf Pine Ecosystem Conservation Credit Creation and Development Component Report 2 of 6

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Introduction

Wildlife associated with the once expansive longleaf pine ecosystem has experienced great loss of habitat quality, quantity, and landscape connectivity – elements that influence availability and suitability of habitat. While some wildlife species have adapted to utilize other forest types, many species that primarily depend on longleaf pine have declined to the point of requiring state or federal protection.

Recovery credit systems (RCS) provide wildlife managers with a valuable, innovative conservation tool to contribute to recovery of federally threatened or endangered species. Implementation of RCS, singly, or alongside other conservation programs (e.g., safe harbor agreements, habitat conservation plans, recovery permits, and conservation banks) grants flexibility in formulating a plan to create a "net benefit" for a species of concern (USFWS 2008). This approach is designed to increase the species' population or habitat through the exchange of credits, defined as "quantifiable [units] of measure recognized [to represent] a contribution to the recovery of a species listed under the ESA" (USFWS 2008).

The RCS model has expanded to include exchange of habitat credits for species not yet federally listed. Credit systems now exist to not only recover listed species, but also to prevent listing of species. A similar model can be used to bolster populations of wildlife associated with the once common longleaf pine ecosystem. Although only a small portion of today's landscape contains the open, mature longleaf forests that provide habitat for various species of concern, existing longleaf stands can be improved to provide suitable wildlife habitat, especially when land managers are incentivized to implement the necessary management practices over sufficient time periods to achieve suitable conditions.

Our goal in this project was to identify and develop quantifiable metrics for a longleaf credit system in eastern North Carolina which would ultimately contribute to a "net benefit" for longleaf-dependent wildlife species through development and enhancement of habitat. This specifically involved: 1) identification of past projects and ecosystem species to target, 2) development of multi-species habitat metrics, and 3) assessment of the metric system on other open pine ecosystems.

Identification of past projects and ecosystem species to target

Existing Credit Systems

Assessment of habitat metrics is used as a means to quantify the quality and quantity (i.e., conservation value) of properties enrolled in credit systems. We reviewed existing credit systems for the dunes sagebrush lizard, greater sage-grouse, golden-cheeked warbler, and Utah prairie dog, specifically examining the types of habitat metrics used and methods for calculating credits for exchange (see Appendix A for a summary). Common key components among reviewed credit systems included:

1. Credits are traded based on habitat needs for a single species.
2. Metrics used to calculate credits incorporate the best available scientific knowledge of the species and its habitat.
3. Typically, land enrolled contained existing habitat; contracts were primarily used to maintain or improve habitat.
4. Credits were calculated based on a combination of points and weights or multipliers.
5. Site-specific management plans were developed by a natural resources professional associated with the credit system; landowners were expected to follow the management plan as a condition of entering the contract.

Although all reviewed credit systems were designed to reward more credits for greater amounts of habitat quality and quantity, and therefore, greater potential to benefit the species of interest, each credit system used a unique approach for credit calculation. Additionally, metrics used to calculate credits were unique among credit systems, reflecting specific habitat needs of the species of interest. Habitat metrics deemed most important in determining habitat suitability primarily accounted for credits generated through the use of weights and multipliers. These systems were designed to maintain a net gain of habitat for the respective species by adjusting calculations for generation of credits versus credits needed for mitigation, and only releasing credits for mitigation actions after enough habitat credits were generated.

Longleaf Pine Ecosystem Target Species

Wildlife species predominantly associated with longleaf pine ecosystems have declined in number and distribution due to the reduced quantity, quality, and spatial distribution of longleaf habitat. Range-wide, longleaf ecosystems provide habitat for almost 30 federally threatened or endangered species. In North Carolina's Mid-Atlantic Coastal Plain Ecoregion alone, dry longleaf pine provides habitat to over 30 priority species identified in the State Wildlife Action Plan (NCWRC 2005). These include game animals, as well as state- and federally-identified species of concern. Improvement of longleaf habitat benefits all of these species.

We reviewed habitat preferences for seven species (Table 1) to guide formulation of and validate proposed habitat metrics for a longleaf credit system. These were chosen for the following reasons:

1. Identified as priority species in Mid-Atlantic Coastal Plain dry longleaf pine habitats, according to the NC Wildlife Action Plan (NCWRC 2005), representing various levels of conservation status.
2. Previously recognized as species with habitat preferences representative of high quality longleaf habitat known to benefit many other species (e.g., the red-cockaded woodpecker [RCW] is a well-known keystone/umbrella species).
3. Represent various taxa.
4. Utilize various canopy levels within a stand.
5. Habitat preferences are well documented in the scientific literature.

Target species utilize longleaf-dominated habitat, especially upland sites, when available; some almost exclusively require presence of longleaf pine, while others are able to utilize other forest types. Common habitat characteristics for target species include open, mature longleaf stands with high quality, native herbaceous ground cover. Creating and maintaining this habitat requires implementation of similar management practices, particularly prescribed burning at regular intervals of approximately 3 to 5 years. Although specific habitat requirements differ slightly for each species, previous research suggests that habitat preferences of a few species can represent ideal conditions for multiple longleaf-dependent species (McIntyre 2012).

Table 1. Target species used to validate proposed metrics for the longleaf credit system. Much of this assessment incorporates previous research conducted by the National Fish and Wildlife Foundation and Jones Center (McIntyre 2012). Species from various taxa, with varying degrees of conservation concern, and varying degrees of dependence on longleaf habitat are included. All species are identified as priority species in coastal plain dry longleaf pine habitat in North Carolina (NCWRC 2005). Well-understood vegetative characteristics thought to influence habitat quality are included. References for the target species habitat review are listed in Appendix B.

Species & conservation status	**Forest habitat type**	**Canopy cover**	**Midstory & understory cover**	**Pine tree age/DBH[1]**	**Fire interval**
Eastern fox squirrel (*Sciurus niger*); significantly rare (state) – regionally, game species – regionally	pine-oak forests; historically, longleaf pine forests	open	open	mature	
Northern pine snake (*Pituophis melanoleucus melanoleucus*); special concern (state)	upland pine or pine-oak forests; prefer longleaf pine-scrub, oak-wiregrass habitats				frequent
Southern hognose snake (*Heterodon simus*); special concern (state)	upland pine-dominated or pine-oak woodland; prefer pine-wiregrass flatwoods or longleaf pine-turkey oak sandhill habitats	open	open; low shrub/woody cover; established herbaceous understory	mature	frequent
Carolina gopher frog (*Rana capito*); threatened (state)	Sandhill and mesic pine flatwoods; prefer longleaf pine-turkey oak sandhill	open		Stumps with dbh[1] of 16+ inches (used as summer refugia)	frequent
Bachman's sparrow (*Aimophila aestivalis*); special concern (state)	pine savannahs, or regenerating pine stands	open	open midstory; dense coverage of grasses and forbs in understory	Age: 50 – 80 years OR early successional, cutover stands 1 – 5 years old, or regenerating stands 6 – 10 years after planting	frequent
Northern bobwhite (*Colinus virginianus*); game species (state)	Southern pine forests; hardwood forests; mixed forests	open	open; few hardwoods and shrubs in midstory; grass and forb ground cover		frequent
Red-cockaded woodpecker (*Picoides borealis*); endangered (federal and state)	pine forest or savannas; strong preference for longleaf pine	open	open; minimal hardwoods; herbaceous ground cover	Age: 30 years (foraging habitat); 60 years (nesting habitat)	frequent

[1] Diameter at breast height

Development of multi-species habitat metrics

Design of longleaf pine ecosystem metrics

Although existing credit systems tend to focus on improving and maintaining habitat for a single species, a longleaf ecosystem credit system creates the opportunity to benefit multiple species. Suitable wildlife habitat is currently limited in availability throughout the historical longleaf pine range, especially for species that require mature forests. However, opportunities exist to improve established longleaf stands, as well as reestablish longleaf.

The metrics we propose for a longleaf ecosystem credit system are designed to create habitat for a suite of species that utilize or depend on longleaf pine. Although an ecosystem-level set of habitat metrics is not all inclusive of every habitat aspect for every target species, we verified common applicable metrics with potential to provide ideal habitat for the majority of these species. Collectively, metrics can be used to calculate the amount of credit generated on a per site basis. Evaluation of lands based on these metrics serves to prioritize lands with the greatest potential conservation value by contributing to longleaf wildlife habitat.

Metrics were formulated and validated based on shared habitat preferences of target species, the Longleaf Pine Maintenance Condition Class Definitions provided by America's Longleaf (2014), and longleaf wildlife metrics collaboratively defined by the National Fish and Wildlife Foundation and Joseph W. Jones Ecological Research Center (McIntyre 2012). Additional metrics were incorporated to address suggestions from longleaf and wildlife experts in previous research regarding prioritization of long-term longleaf pine management for wildlife conservation, improvement of existing longleaf stands, and consideration of spatial context of management efforts (McIntyre 2012).

Metrics and valuation

In the proposed longleaf pine ecosystem credit system, credits are awarded based on points and multipliers assigned to metrics, which are divided into two main categories: spatial and temporal context of habitat (Table 2), and stand structure of the canopy (Table 3a), midstory, and understory (Table 3b). Four additional metrics are used as multipliers (Table 4). Points and multipliers are designed to place high value on lands with the greatest potential to contribute high quality wildlife habitat in large, spatially aggregated quantities over a long period of time.

Table 2. Spatial and temporal context of habitat metrics for the longleaf pine ecosystem credit system. Point valuations are designed to prioritize large, contiguous areas of habitat that contribute to connectivity at multiple spatial scales (i.e., property to landscape levels).

METRIC	CRITERIA	PRIORITY	POINTS
Spatial and Temporal Context of Habitat (14 possible points)			
1. Proximity to longleaf pine significant geographic area (SGA); includes Significant Landscapes and Significant Sites	Within SGA	High	4
	Adjacent to SGA		2
	Within 3 miles of SGA		1
	> 3 miles of SGA	Low	0
2. Adjacent to legally protected lands (e.g., Federal, State, conservation easement), OR lands enrolled in a longleaf management program for wildlife habitat	Yes	High	2
	No	Low	0
3. Presence of species of concern (e.g., threatened or endangered [T/E] species, state priority species)	Yes – federal/state T/E	High	4
	Yes – state priority species		2
	No	Low	0
4. Potential for urban development (based on SLEUTH Projected Urban Growth model for 2100)	Not likely (<70% probability)	High	2
	Very likely (>70% probability)	Low	0
5. Willingness to implement management treatments (e.g., prescribed burning, thinning stands, etc.)	High	High	2
	Low	Low	0

The following summarizes prioritizations for each metric included in Table 2; numbered metrics correspond with numbered explanations. Higher points awarded for:

1. Spatially aggregated conservation efforts, relative to locations of significant geographic areas (SGA; optimal areas of focus for longleaf pine conservation efforts, as identified in the America's Longleaf Range-wide Conservation Plan [2009]). Locations within 3 miles of an SGA are awarded points based on the possibility of dispersal events by certain species (e.g., red-cockaded woodpecker).

2. Proximity to legally protected lands, or lands enrolled in longleaf wildlife habitat programs, promoting concentrated conservation efforts.

3. Presence of threatened or endangered, or state priority species (e.g., priority species listed in the North Carolina Wildlife Action Plan); this suggests presence of existing habitat, and rewards continued management of that habitat.

4. Low probability of urban development/encroachment. This is based on urban growth projections according to the SLEUTH model developed for the Southeastern United States (Belyea and Terando, n.d.). Proximity to urban areas can lead to loss or degradation of habitat, and interfere with implementation of necessary management practices (i.e., prescribed burning).

5. Willingness to implement necessary management strategies to achieve desired forest conditions. Implementation of certain management practices (i.e., prescribed burning) will be necessary on all properties, while others will require more intensive management (e.g., thinning stands, planting longleaf, removing hardwood species, etc.).

Table 3a. Stand structure canopy metrics for the longleaf pine ecosystem credit system. Point valuations are designed to prioritize existing stands with open, longleaf-dominated canopies.

METRIC		CRITERIA	PRIORITY	POINTS
Stand Structure (9 possible points)				
6. Canopy	Longleaf age structure	Multi-aged	High	4
		Even-aged		2
		No existing longleaf	Low	0
	Presence of mature longleaf	Basal area of longleaf trees age 60+ years or 14" dbh ≥ 20ft^2/acre, OR presence of flat-top longleaf	High	2
		Basal area of longleaf trees age 60+ years or 14" dbh ≤ 20ft^2/acre	Low	0
	Basal area of longleaf pine	40 – 70 ft^2/acre	High	1
		> 70 ft^2/acre OR < 40ft^2/acre	Low	0
	Canopy cover/closure	40 – 60%	High	1
		< 40% OR > 60%	Low	0
	Basal area of hardwoods/off-site pine ≥ 5" dbh	≤10ft^2/acre	High	1
		>10ft^2/acre	Low	0

Table 3b. Stand structure midstory and understory metrics for the longleaf pine ecosystem credit system. Point valuations are designed to prioritize open midstory and understory conditions, with minimal hardwood presence and adequate native herbaceous groundcover.

METRIC		CRITERIA	PRIORITY	POINTS
Stand Structure (7 possible points)				
7. Midstory	Shrub cover	≤ 30% cover, average ≤ 3 feet tall	High	1
		> 30% cover	Low	0
	Midstory cover of hardwoods or off-site pines	≤ 20%	High	1
		> 20%	Low	0
	Fire-intolerant hardwood/off-site pine species cover	< 5% over 16 ft tall	High	1
		≥ 5% over 16 ft tall	Low	0
8. Understory	Presence of native pyrogenic species in herbaceous cover	> 35%	High	1
		≤ 35%	Low	0
	Contiguous herbaceous cover	≥ 65% with ≥ 20% graminoid composition	High	1
		< 65% or < 20% graminoid composition	Low	0
	Longleaf regeneration	Advance regeneration cover (grass stage or dbh < 2") is 5-15% of stand	High	1
		Advance regeneration cover < 5% OR > 15%	Low	0
	Non-native invasive species	Exotic invasive plant cover ≤ 1%	High	1
		Exotic invasive plant cover > 1%	Low	0

The following summarizes prioritizations for each metric included in Tables 3a and 3b; numbered metrics correspond with numbered explanations. Higher points awarded for:

6. Multi-aged stand structure, and adequate basal area of mature longleaf trees. This provides habitat for various species, and promotes continued recruitment of pines into older age classes, as well as eventual natural regeneration of the stand.

7. Minimal shrub, hardwood, or off-site pine. This provides optimal wildlife habitat, and facilitates effectiveness of regular management activities (e.g., prescribed burning) to maintain suitable habitat.

8. Native herbaceous cover and presence of grass-stage longleaf, indicating continued recruitment of younger longleaf into the stand.

Table 4. Multipliers for longleaf pine ecosystem credit calculation. Multiplier values are designed to prioritize enrollment of lands with larger quantities of habitat, with potential to contribute suitable habitat for long periods of time.

MULTIPLIER	CRITERIA	MULTIPLIER VALUE
9. Maximum age of existing longleaf (representing majority of enrolled land)	60 years	1.50
	40 years	0.75
	20 years	0.50
	< 20 years	0.25
	No existing longleaf	0.10
10. Length of contract	Perpetual	1.50
	50+ years	0.75
	25 - 50 years	0.50
	10 - 25 years	0.25
11. Years under contract longleaf is managed at minimum target age (60 years)	50+ years	1.50
	25 - 50 years	0.75
	10 - 25 years	0.50
	<10 years	0.25
12. Total area managed as longleaf habitat	150+ acres	1.00
	100 - 150 acres	0.75
	50 - 100 acres	0.50
	10 - 50 acres	0.25

The following summarizes prioritizations for each multiplier value included in Table 4; numbered multiplier categories correspond with numbered explanations. Higher points awarded for:

9. Presence of older ages of longleaf pine. This suggests increased suitability of habitat, especially for species of conservation concern (e.g., RCW, Bachman's sparrow, Carolina gopher frog). An age of 60 years was chosen based on RCW nesting tree requirements (USFWS 2003). This is a minimum age when longleaf stands begin to reach a mature stage.

10. Continued management of habitat under longer contracts. Potential to develop more habitat of higher quality increases over time with proper management.

11. Lands enrolled over longer time periods, with presence of longleaf pine at or above the target age of 60 years (RCW minimum nesting tree age [USFWS 2003]). These lands provide opportunities to develop suitable habitat as quickly as possible, and maintain habitat over an extended period of time.

12. Larger areas of contiguously managed habitat, which hold greater conservation value. Potential to support more species and/or larger populations increases with area of managed habitat. Area thresholds correspond with findings in previous research for acreage requirements for the Bachman's sparrow, Northern bobwhite, and red-cockaded woodpecker (McIntyre 2012).

Point and multiplier values emphasize rewarding credits for large areas of older longleaf pines, able to provide suitable habitat the soonest, and continue providing habitat well into the future. Existing stands rarely exhibit the open, mature canopy characteristics required to support suitable habitat, especially for imperiled species. However, management of existing longleaf gives the best short-term opportunity to create suitable habitat with proper application of proven management techniques (e.g., prescribed burning, thinning, and hardwood removal), which can improve habitat suitability in relatively short time periods. Metrics in the longleaf credit system should be refined as more research (e.g., "Open Pines Project" conducted by NatureServe, U.S. Fish and Wildlife Service, and the East Gulf Coastal Plain Joint Venture) concerning longleaf metrics for different community types and geographic locations becomes available.

Some of these metrics can be evaluated via geographic information systems (GIS), when the appropriate data is available (e.g., location relative to SGAs or protected lands, potential for urban development, and area managed as habitat). On-site evaluations, conducted by a natural resources expert knowledgeable of the credit system, will be necessary for assessment of other metrics (e.g., structural metrics for canopy, midstory, and understory). Further revision of metrics may be needed to address evaluation of properties with multiple stands of differing conditions (e.g., stands of different ages or structural qualities). Considering historical land use could also aid in evaluating a property's potential value as longleaf wildlife habitat.

Credit calculation

None of the existing credit systems reviewed use the exact same method of calculating credit. This creates flexibility in assigning credits based on the unique biology and habitat preferences of the respective species. Each credit system did include common elements in credit calculation: area of land enrolled, points assigned for habitat characteristics, and weights or multipliers to ensure the most important habitat factors had the greatest influence on credits generated.

The formula proposed to calculate longleaf credit incorporates the same major elements:

$$\text{acres enrolled} \times (\text{total points} \div \text{maximum points}) \times \text{multipliers} = \text{TOTAL CREDIT}$$

Examples of credit calculation are given in the following scenarios:

Scenario 1: 75 acres of habitat, which scores 19 out of 30 total points, with 60 year-old longleaf stands, enrolled for 30 years.

Scenario 2: 200 acres of habitat, which scores 9 out of 30 total points, with 40 year-old longleaf stands, enrolled for 25 years.

Scenario 3: 350 acres of habitat, which scores 8 out of 30 total points, with 20 year-old longleaf stands, enrolled for 10 years.

Scenario	Acres	Metrics score	Age multiplier value	Contract multiplier value	Target multiplier value	Area multiplier value	**TOTAL CREDIT**
1	75	0.63	1.50	0.50	0.75	0.50	**13.29**
2	200	0.30	0.75	0.50	0.25	1.00	**5.63**
3	350	0.27	0.50	0.25	0.25	1.00	**2.95**

These scenarios illustrate the prioritization of enrolling land with the greatest potential to contribute high quality habitat as soon as possible, and maintain that habitat for as long as possible, by awarding more credits. For example, Scenario 1 receives substantially more credits compared to Scenario 2 or Scenario 3 despite enrolling far less land. The higher conservation value of management of older, existing longleaf for a longer period of time beyond the target age of 60 is reflected in the amount of credit generated. Detailed example "score sheets" and credit calculations associated with these scenarios are given in Appendix C.

Assessment of total credits can similarly be used as a means to rank properties based on their perceived conservation value as measured through habitat metrics. Although this is useful in evaluating the relative potential of a property to contribute to wildlife habitat, contracts may not always be awarded for properties with the highest ranking (i.e., highest number of credits). For example, properties enrolled in the Golden-cheeked Warbler Recovery Credit System were sometimes selected due to their location relative to Fort Hood, despite ranking lower than other properties. In addition to the amount of generated credits, dynamic management priorities should guide decisions to enroll properties.

Assessment of Metric System on Other Open Pine Systems

The longleaf credit system model proposed herein is applicable to other open pine systems. Many of the same structural metrics can be used to define the desired forest condition in other pine systems. However, metric criteria and valuation should be adjusted to appropriately reflect that condition. Findings of the "Open Pines Project", an ongoing joint effort between NatureServe, U.S. Fish and Wildlife Service, and the East Gulf Coastal Plain Joint Venture, will be particularly useful in this regard as it contains structural metrics and criteria for eight pine ecological system types, including five longleaf forest types, and three shortleaf-loblolly forest types. Additionally, metrics would need to be updated based on target species' habitat preferences.

With the appropriate updates, credit systems developed for other open pine systems can contribute to habitat conservation. Similar to the proposed longleaf ecosystem credit system, implementation of an ecosystem-level credit system framework for open pines can be used to quantify the conservation value of lands, and promote efficient prioritization of lands with potential to provide habitat for target species over adequate spatial and temporal scales.

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Appendix A – Existing Credit Systems Overview

Program, Species, and Conservation Status	Requirement for Enrollment/Award of Credits	Calculation of Credits	Length of Contract
Utah Prairie Dog Habitat Credits Exchange Program Developed for the Utah prairie dog (UPD), downlisted to federally threatened in 1984.	Requires a minimum of 40 acres and 20 UPDs for enrollment. Maintain UPDs on property; follow customized management plan developed by the program administrator and landowner to protect habitat values for UPD, while allowing continued agricultural activities.	Calculated based on acres enrolled, metrics for habitat quality, landscape context, and existing UPD population on property.	Permanent
Texas Conservation Plan for the Dunes Sagebrush Lizard Developed for the dunes sagebrush lizard (DSL), proposed federally endangered in 2010.	Conduct approved recovery activities which encourage maintenance or improvement of habitat.	Calculated based on acres targeted for conservation, likelihood of DSL occurrence, value of recovery activities, and proximity to DSL habitat.	Varies with management activities
Golden-cheeked Warbler Recovery Credit System Developed for the golden-cheeked warbler (GCWA), federally endangered since 1990.	Manage, at minimum, 20 acres "verified as meeting the TPWD criteria for areas that are likely to be inhabited by GCWAs." Must be within an identified priority landscape for GCWA recovery, and an integral part of a larger block of continuous habitat.	Calculated based on number of conservation units (20-acre units), priority of location according to recovery regions, proximity to existing GCWA populations, and extent of surrounding GCWA habitat.	Determined by landowner
Nevada Conservation Credit System Developed for the Greater sage-grouse, federal listing warranted in 2010, precluded for higher priority species; due for review in 2015.	Site must meet minimum habitat function requirements, and must be located within the "service area". Credits are awarded for meeting or maintaining habitat performance standards, defined in the management plan for the site.	Calculated based on acres of functional habitat for breeding/brooding/wintering (measured at multiple spatial scales), incorporation of biological factors, and proximity between credit and debit sites.	Minimum of 10 years, up to perpetuity (in 5 year increments)

Appendix B –References for Target Species Habitat Review

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Appendix C – Credit Score Calculations

NOTE: No on-site property evaluations were conducted for the purposes of this report. Pictures associated with scenarios are intended to offer a visual representation of sites and potential credit scores.

Scenario 1: 75 acres of habitat, which scores 19 out of 30 total points, with 60 year-old longleaf stands, enrolled for 30 years.

75	×	(19	÷	30)	×	1.50	×	0.50	×	0.75	×	0.50	=	**13.29**
Acres		*Assigned points*		*Possible points*		*Age multiplier*		*Contract multiplier*		*Target multiplier*		*Area multiplier*		**CREDITS**

Scenario 1 Score Sheet:

METRIC			
Spatial and Temporal Context of Habitat – 14 possible points		**Current Condition**	**Points Assigned**
	Proximity to longleaf pine SGA	2.5 miles from SGA	1
	Adjacent to legally protected lands OR lands enrolled in longleaf wildlife habitat program?	No	0
	Presence of species of concern?	No	0
	Potential for urban development?	No	2
	Willingness to implement management treatments?	Yes	2
		SUBTOTAL	5
Stand Structure – 16 possible points			
Canopy	Longleaf age structure	Multi-aged	4
Canopy	Presence of mature longleaf?	Yes	2
Canopy	Basal area of longleaf pine	60 ft^2/acre	1
Canopy	Canopy cover/closure	60%	1
Canopy	Basal area of hardwoods/off-site pine ≥5” DBH	7 ft^2/acre	1
Midstory	Shrub cover	20% cover, ≤ 3 feet tall	1
Midstory	Midstory cover of hardwoods/off-site pines	5%	1
Midstory	Fire-intolerant hardwood/off-site pine species cover	1% over 16 ft tall	1
Understory	Presence of native pyrogenic species in herbaceous cover	45%	1
Understory	Contiguous herbaceous cover	70%, ≥ 20% graminoid	1
Understory	Longleaf regeneration	cover 20%	0
Understory	Non-native invasive species	cover 10%	0
		SUBTOTAL	14
MULTIPLIERS		**Current Condition**	**Multiplier Value**
	Maximum age of existing longleaf	60 years old	1.50
	Length of contract	30 years	0.50
	Years under contract longleaf is managed at minimum target age (60 years)	30 years	0.75
	Total area managed as longleaf habitat	75 acres	0.50

Scenario 2: 200 acres of habitat, which scores 9 out of 30 total points, with 40 year-old longleaf stands, enrolled for 25 years.

200	×	(9	÷	30)	×	0.75	×	0.50	×	0.25	×	1.00	=	**5.63**
Acres		*Assigned points*		*Possible points*		*Age multiplier*		*Contract multiplier*		*Target multiplier*		*Area multiplier*		**CREDITS**

Scenario 2 Score Sheet:

METRIC			
Spatial and Temporal Context of Habitat – 14 possible points		**Current Condition**	**Points Assigned**
	Proximity to longleaf pine SGA	3 miles from SGA	1
	Adjacent to legally protected lands OR lands enrolled in longleaf wildlife habitat program?	Yes	2
	Presence of species of concern?	No	0
	Potential for urban development?	No	2
	Willingness to implement management treatments?	Yes	2
		SUBTOTAL	7
Stand Structure – 16 possible points			
Canopy	Longleaf age structure	Even-aged	2
	Presence of mature longleaf?	No	0
	Basal area of longleaf pine	30 ft^2/acre	0
	Canopy cover/closure	80%	0
	Basal area of hardwoods/off-site pine ≥5” DBH	60 ft^2/acre	0
Mldstory	Shrub cover	25% cover, ≤ 3 feet tall	0
	Midstory cover of hardwoods/off-site pines	30%	0
	Fire-intolerant hardwood/off-site pine species cover	10% over 16 ft tall	0
Understory	Presence of native pyrogenic species in herbaceous cover	30%	0
	Contiguous herbaceous cover	65%, < 20% graminoid	0
	Longleaf regeneration	cover 1%	0
	Non-native invasive species	cover 10%	0
		SUBTOTAL	2
MULTIPLIERS		**Current Condition**	**Multiplier Value**
	Maximum age of existing longleaf	40 years old	0.75
	Length of contract	25 years	0.50
	Years under contract longleaf is managed at minimum target age (60 years)	5 years	0.25
	Total area managed as longleaf habitat	200 acres	1.00

Scenario 3: 350 acres of habitat, which scores 8 out of 30 total points, with 20 year-old longleaf stands, enrolled for 10 years.

350	×	(8	÷	30)	×	0.50	×	0.25	×	0.25	×	1.00	=	**2.95**
Acres		*Assigned points*		*Possible points*		*Age multiplier*		*Contract multiplier*		*Target multiplier*		*Area multiplier*		**CREDITS**

Scenario 3 Score Sheet:

METRIC			
Spatial and Temporal Context of Habitat – 14 possible points		**Current Condition**	**Points Assigned**
	Proximity to longleaf pine SGA	> 3 miles from SGA	0
	Adjacent to legally protected lands OR lands enrolled in longleaf wildlife habitat program?	No	0
	Presence of species of concern?	No	0
	Potential for urban development?	Yes	0
	Willingness to implement management treatments?	Yes	2
		SUBTOTAL	2
Stand Structure – 16 possible points			
Canopy	Longleaf age structure	Even-aged	2
	Presence of mature longleaf?	No	0
	Basal area of longleaf pine	> 70ft^2/acre	0
	Canopy cover/closure	> 60%	0
	Basal area of hardwoods/off-site pine ≥5” DBH	≤10ft^2/acre	1
Mildstory	Shrub cover	≤ 30% cover, ≤ 3 feet tall	1
	Midstory cover of hardwoods/off-site pines	< 20%	1
	Fire-intolerant hardwood/off-site pine species cover	< 5% over 16 ft tall	1
Understory	Presence of native pyrogenic species in herbaceous cover	< 35%	0
	Contiguous herbaceous cover	40%, < 20% graminoid	0
	Longleaf regeneration	cover < 5%	0
	Non-native invasive species	cover > 1%	0
		SUBTOTAL	6
MULTIPLIERS		**Current Condition**	**Multiplier Value**
	Maximum age of existing longleaf	20 years old	0.50
	Length of contract	10 years	0.25
	Years under contract longleaf is managed at minimum target age (60 years)	0 years	0.25
	Total area managed as longleaf habitat	350 acres	1.00

Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina

Longleaf Pine Credit Demand Component
Component Report 4 of 6

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31 March 2016

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Introduction

This USDA Conservation Innovation Grant (CIG) project was designed to examine "Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina." This report is a summary of that project with the component of assessing the possible demand for conservation credits to support Longleaf pine habitat. To draw on the proposal this report examines potential credit purchasers and their motivations.

Environmental credit markets can only function if there is sufficient demand from public and private sector actors who seek to offset environmental damages, fulfill program mandates, achieve investment returns or conduct positive public relations activities. Therefore, a survey was conducted of government agencies, non-profit organizations (NPOs), cooperatives, private companies, developers, utilities and credit certification systems to observe how they engage in environmental issues, regulations and other credit markets and whether they anticipate needing credits (including those to promote Longleaf pine habitat) in the future. Our results suggest prospective buyers are impacted by environmental regulations and familiar with and/or participate in credit markets. In addition, an ability to monitor and enforce credits and their standards are important to prospective buyers.

Methods

The survey consisted of 18 questions (17 open ended and one multiple choice) designed to elicit information on the participant's previous, current and prospective knowledge, participation and engagement with land management regulations/requirements, certifications and credit programs as they relate to wetlands, endangered species, water pollution and other environmental issues. Approximately 50 public and private sector entities were notified of the survey by three emails (one initial and two follow up). The survey was administered online by surveymonkey.com and remained open between September 14, 2015 and December 21, 2015. Of those contacted, seven government agencies, two NPOs, one agricultural cooperative and two private companies from around the United States completed the survey.

Responses were collected, analyzed and reported here in narrative format due to the open-ended nature of the questions. The results section provides each question along with a description of survey participant responses.

Results

Would you classify your organization as a: (a) government agency (b) non-profit organization (c) real estate developer (d) investment firm (e) consulting firm (f) private company/corporation and/or (g) other (please specify).

Of those who participated in the survey, seven were from government agencies, two from NPOs, two from private companies and one from an agricultural cooperative.

Do you perform or fund land management practices that are limited by wetlands, endangered species, water pollution, or other environmental regulations? If so, what are those land management practices and their requirements?

Six out of the seven government agencies that participated in the survey performed and/or funded land management practices that were limited by wetlands, endangered species, water pollution or other environmental regulations. While three reported being impacted by the Endangered Species Act (ESA), each agency appears to be affected by different regulations that include the Clean Water Act (CWA), NC Prescribed Burning Act and California Environmental Quality Act.

Four agencies specified involvement with conducting forest and/or water management activities, including abiding by forest practice guidelines for harvesting timber, mid-rotation forest management, repairing or removing roads on nonfederal forestlands that deliver sediment to streams with listed salmonid species, improving in-stream habitat for salmonid species (placement of large logs or root wads in streams), thinning forest stands to reduce fire, reducing insect and disease susceptibility, increasing climate change resilience, increasing growth of retained trees, improving reforestation of fire damaged or understocked areas, providing stream bank stabilization using natural channel design principles, and providing wetland restoration and wetland habitat enhancement. Such activities have received various state and federal funding from cost-share programs such as Forest Development Program (FDP), Southern Pine Beetle Prevention Program (SPBPP) and various others from the California (CA) Department of Fish and Wildlife, CA Department of Forestry and Fire Protection and CA State Water Board.

One agency specified that in addressing impacts associated with streams and wetlands, the program was limited to in-kind mitigation per federal agency requirements and this has restricted the program's ability to implement practices.

The agricultural cooperative performed land management practices that were limited by environmental regulations. One NPO indicated they acquired land for conservation agencies and managed that land until it was transferred to an appropriate agency. One private company financed land clearing and construction activities that were limited by wetland requirements and the other performed all aspects of forest management activities including harvesting, site preparation, and fertilization. The agricultural cooperative, NPOs and private companies did not specify which environmental regulations affected them.

Do you currently have any "green" certification or sustainability ranking programs that you participate in or require for your loans and investments? If so, what are those programs?

Of those who indicated participating in any green certification or sustainability ranking programs, one government agency identified the Forest Stewardship Program (FSP) and American Tree Farm System (ATFS), two NPOs indicated Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC) and one private company indicated SFI. One of the non-profits helps develop SFI forest certification guidelines.

Do any environmental regulations or constraints require permits for your management or development actions? If so, please explain.

Six government agencies that responded were affected by varying regulations/constraints. These include permits for wetlands, sediment and erosion control, CWA (including section 401/404), open burning and streambed and lake alteration. In addition, they conducted hydrology studies for Flood Insurance Flood Map (FIRM) map revisions, Endangered Species Act (ESA) consultations and surveys, and silvicultural exemption under CWA Section 404(f). The agricultural cooperative stated environmental regulations constrained their lending practices, particularly regarding poultry and livestock, but did not specify which ones. Finally, the private companies indicated having a general permit for herbicide applications and that for those projects funded by the Farm Bill Programs and the Farm Service Agency (FSA), wetland issues could be a deal breaker.

Are you familiar with wetlands banking?

All government agencies, one NPO and both private companies indicated being familiar with wetland banking. One government agency purchased credits from existing wetland banks and one NPO operated a number of mitigation banks across the US (but none in North Carolina).

Are you familiar with conservation credit systems?

Six government agencies, one NPO, one private company and the agricultural cooperative were familiar (three indicated somewhat familiar) with conservation credit systems.

Do you currently buy, sell or require any wetland bank or conservation credits?

Three government agencies and one private company bought, sold and/or required wetland bank or conservation credits during the study. One government agency and the one private company sold wetland bank credits.

Do you anticipate a need to buy, sell, or require any wetland bank or conservation credits?

Two government agencies and one NPO anticipated a need to buy, sell or require wetland or conservation credits. The NPO mentioned that North Carolina has a relatively mature mitigation market with a number of successful private bankers already participating. In addition, the NPO stated that the General Assembly continues to consider policies that weaken state protections of wetlands, streams and riparian buffers, and thus makes future investments uncertain and risky.

Do you anticipate a need to purchase endangered species credits?

One government agency foresaw a future need/benefit for purchasing endangered species credits (though not within its existing programs) while another indicated it uses its existing programs to accomplish this need. While both NPOs indicated no, one was interested in developing species banks.

Do you anticipate a need to purchase water pollution credits?

Nearly every participant indicated that they do not anticipate a need to purchase water pollution credits. One government agency said "potentially" and one NPO mentioned that while nutrient trading was a good idea, regulatory uncertainty and high nutrient caps make it difficult and risky.

Do you anticipate a need to purchase other conservation credits? If so, please specify.

Every participant responded that they did not anticipate a need to purchase other conservation credits (one government agency responded "not at this time" and another "not beyond those mentioned above").

What sort of land tenure terms (contracts vs. easements) and lengths (10, 15, 20, 30 years to permanent) arrangements would you participate in?

Five government agencies participated in land conservation programs, three of which used permanent/perpetual easements and two of which used 10-year contracts. The programs specifically cited were Forest Legacy, FDP, California Forest Improvement Program and Fire Protection. One agency supported efforts to keep lands in uses that were compatible with the state's military presence and mission. This agency did not own land but funded conservation land treatment and easement projects that could be credit worthy. One NPO expressed interested in permanent over term easements as they viewed the latter as too expensive (the other NPO does not own or manage land). One of the private companies indicated a length of 10-years while the other stated that they had two permanent conservation easements, but would be much more likely to participate in term easements.

Would various certification systems and products be an attractive part of the conservation credit package? If so, which systems or products?

Two government agencies indicated certification systems and products would be an attractive part of the conservation credit package. They expressed interest in mitigation activities, bundling/stacking compliance-grade credits, the need for a robust tracking system to ensure

credits are functioning as intended and implementing checks and balances to ensure standards are met. One NPO would require land trust alliance standards and practices. Another NPO suggested SFI because it has a standing mechanism for tracking and verification and has been tested in the marketplace and for actions on the ground (they went on to state that conservation credit assurances could reach further, but SFI certification could provide fundamental verification of certain conservation and sustainability actions).

What kind of "certainty" requirements would you require to participate in prospective conservation credit programs? For example, these can include no new regulations after enrollment (no green creep); safe harbor/habitat conservation plan protections; exemptions from future administrative changes; hold harmless clauses; and/or payment guarantees despite budget cuts.

Only one government agency indicated a specific requirement. It expressed a need for assurance that alternative conservation credit methods could be applied for stream and wetland functional impacts and an up-front multi-agency agreement as to the number of conservation credits that could be applied for an identified impact. Two other agencies mentioned that, while they do not participate in credit purchases, certainty and assurances are helpful and "no green creep" or safe harbor protections will become increasingly difficult to sustain in California given both political and dynamic biophysical realities. One NPO stated certainty is critical when analyzing risk and financing. The other NPO stated third party verification, as employed by forest certification programs, would go a long way toward such assurances and that continued evolution of program requirements, done systematically and periodically, would ensure conservation actions keep pace with current knowledge and understanding.

Would you be interested purchasing conservation credits that managed Longleaf pine on private lands in North Carolina for wildlife habitat?

Every survey participant indicated they would not be interested in purchasing conservation credits that managed Longleaf pine on private lands in North Carolina for wildlife habitat. One government agency expressed interest in helping to facilitate/support its market development and one NPO showed interest in selling conservation credits.

Are there any specific outcomes or land management practices you would prefer to have included in a conservation credit for Longleaf pine and wildlife habitat management? If so, please explain.

One government agency identified native ecosystem restoration (including habitat functions) as a specific outcome or land management practice to include for Longleaf pine and wildlife habitat management. Another agency provided more detail and recommended prescribed burning every 3-5 years, the majority of credits be given to areas already providing good habitat or areas that can more easily and quickly be improved to provide good habitat (restoring existing mixed pine stands with a Longleaf component rather than establishing new plantations, especially plantations on old agricultural fields) and restrictions on the frequency of pine straw harvest (if allowed).

One NPO indicated SFI and FSC certification would help program development and the other stated it would be good to ensure the ability of land managers to manage for a variety of products and recognize the value of long-rotations in Longleaf for both economic and conservation reasons (it went on to say that various species associated with Longleaf are well-known and should be accounted for and that "embedded" microhabitats, such as pitcher-plant bogs, should be protected). One private company expressed concern that the emphasis on Longleaf detracts from the enormous potential for managing existing loblolly stands in an open stand condition with a fire regime as it creates the understory conditions that the majority of the endangered species need.

Do you have concerns, criticisms, or reservations about conservation credit systems and their liability? If so, please explain.

Two government agencies expressed concern, one regarding the length of time (60 or more years) it takes for Longleaf pine ecosystems to mature and become viable habitat for certain species and the other the need to ensure proper organizational structures and oversight to ensure integrity of the system—which while not specified, could refer to both biological and administrative structures. One of the NPOs believed we're missing opportunities to engage private landowners and private capital in conserving working lands and conservation lands.

Longleaf Pine ecosystems provide habitat for several endangered species including the Red Cockaded Woodpecker (RCW). If you anticipate needing to purchase RCW credits, approximately how many would you demand per each price listed below: $10,000, $25,000, $50,000, $75,000, $ 100,000, $125,000, $150,000, $175,000, $200,000, $225,000, $250,000, $275,000 and $300,000.

None of the survey participants answered this question.

Discussion and Conclusions

Our survey obtained a considerable amount of information about the prospects for Longleaf credit demand programs. We had a small sample of 12 respondents, but received thorough and conscientious answers. All the respondents were familiar with and engaged in some current conservation credit programs – wetlands, water, endangered species, or other ecosystem goods. To date, there was little perceived need for an expanded Longleaf Pine Conservation Credit program. The larger population of all private companies and government organizations may have more current interest, but we could not ascertain that from our sample.

Environmental credit markets will only function if there is sufficient demand from public and private sector actors. This analysis assessed demand as it related to supporting Longleaf pine habitat by looking at how agencies, organizations, companies and cooperatives understood and engaged in environmental issues, regulations and other credit markets. We sent the survey to a wide range of entities. Those that participated were largely government agencies so the sample does not reflect many private organizations that might buy credits at some point in the future. Nonetheless, we received many useful and insightful responses, which do a good job of capturing the key issues and opportunities for Longleaf pine system restoration.

The survey results suggest nearly every participant is affected and/or limited to some degree by environmental regulations ranging from the national level (ESA and CWA) to more local policies (for instance, NC Prescribed Burning Act) that often require permits, studies and/or consultations to ensure proper management and development actions. The analysis also indicates environmental credit markets are fairly well understood and used moderately. While survey participants did not express interest in purchasing credits to promote Longleaf pine habitat yet, this may be due to the dominance of government agencies among the respondents, which would be more likely to be helping develop and administer programs, not actually market participants.

In addition, wetland bank, conservation and species credit markets are driven by mostly by regulatory requirements, which do not exist specifically for Longleaf pine habitat. However, the substantial requirements for threatened and endangered species protection have created markets for ESA species and habitats, such as many discussed in other sections of our report. The California Air Resources Board (CARB) credits follow a similar pattern of the state regulatory law prompting a national market for carbon credits. If such requirements existed for Longleaf pine habitat demand would presumably increase.

In addition to regulatory mandates, voluntary credit markets also could be developed in anticipation of future regulatory requirements, or used for corporate social responsibility (CSR) and good will efforts by companies. By setting aside critical habitat, or purchasing credits on other private lands, public or private organizations could demonstrate their commitment to environmental quality and biodiversity. For example, the American Forests Global ReLeaf program has many voluntary corporate sponsors seeking to support planting forests and environmental benefits throughout the world. One of their recent 2016 projects even includes restoring Longleaf pine on Tyndall Air Force base (see http://www.americanforests.org/blog/restoring-the-Longleaf-pine-on-tyndall-air-force-base/).

Our survey also provides insight into how a Longleaf pine habitat credit market could be designed. An ability to track, monitor and enforce credits and their standards was important to prospective buyers. Certification systems such as SFI and FSC can help provide a solution given their popularity and strong framework. Interestingly, preference for land tenure terms and lengths appeared varied with roughly an equal amount taking part in temporary and permanent contracts/easements. Certainty requirements may also be a useful tool as they provide needed assurances that landowners who supply credits do not become subject to increasing regulations over time.

One survey respondent did note the political support to regulate environmental goods and services is more limited in North Carolina, and there are some limits to the amount of scarce land available. Nonetheless, national ESA mandates for listing and protecting endangered species are increasing substantially. For example, a recent ESA federal court settlement has required the Fish and Wildlife Service to consider whether to list about 1700 species in the U.S., which could increase regulatory demand dramatically. Requirements to protect the gopher tortoise and the Red cockaded woodpecker already have prompted substantial regulatory desire for military lands to protect those species, and private land development also could be affected in the future.

Voluntary credit market systems for forest carbon or tree planting, or broad conservation program initiatives, including the farm Bill, North Carolina Forest Development Program, will continue to offer considerable opportunities for providing funds for the demand for Longleaf Pine restoration and maintenance, as they have in the last decade.

Overall, we would conclude that Longleaf Pine Conservation Credit Demand in North Carolina is still in a nascent state. Military and National Forest lands already protect RCWs and establish and manage Longleaf habitat, as does the North Carolina Forest Service and North Carolina Wildlife Resources Commission. The previous report on Longleaf supply indicated that for reasonable subsidy prices, Longleaf pine could be economically attractive for private forest landowners. The voluntary Farm Bill programs for Longleaf and the North Carolina Forest Development Program Longleaf programs also have usually been fully subscribed, spending all the funds available for the Longleaf components.

The Supply report also indicated that while land may appear scarce, there are millions of acres of suitable forest and farm lands that could enroll in providing supply. It does not appear that more state level regulations to force Longleaf conservation are likely, but federal mandatory offsets are still quite possible. These interacting demand and supply factors will probably continue to prompt a slow expansion in Longleaf pine establishment and restoration in North Carolina rather than a quantum leap that might be prompted by a regulatory program such as the Non Net Loss of Wetlands policy created in 1990.

Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina

Longleaf Pine Credit Supply Component Final Report
Component Report 3 of 6

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Table of Contents

	page
Executive Summary	3
Introduction	4
Brief Literature Review	6
Landowner Interest in Longleaf Conservation Programs	7
Landowner Survey Methods	8
Statistical Analysis	10
Regression Analysis	10
Choice-Based-Conjoint Analysis	11
Landowner Survey Results	12
Descriptive Statistics	12
Regression Analysis	14
Choice-Based-Conjoint Analysis	15
Financial Analysis and Capital Budgeting for Alternative Investments	17
Management Assumptions, 2011	17
Capital Budgeting Methods	19
Financial Results, 2011	20
Sensitivity Analysis: Changes in Stumpage Prices and Cost Share Payments, 2011	24
Management Costs and Present Values for RCW Habitat, 2015	26
Practices Required for Longleaf Pine Conversion or Existing Stand Management	26
Discounted Cash Flow Value of Costs	28
Required Incentive Payments	29
Increasing Existing Longleaf Pine Habitat	32
Discussion	34
Limitations and Conclusions	36
Literature Cited and References	38
Appendix 1. Management Activity Descriptions and Associated Costs for Low and High Intensity Management Regimes, 2015	43

Executive Summary

This component of our Conservation Innovation Grant analyzed the potential supply of Longleaf pine habitat in Southeast North Carolina for an ecosystem based credit market using landowner surveys and economic analyses of rural land management alternatives.

Results from a logistic regression and a choice-based-conjoint (CBC) statistical analyses revealed that landowners were most influenced by program requirements such as contract length and legal obligation in a conservation contact. Short term contract agreements of 5 to 10 years were favored, as were the least land restrictions. Annual payments were somewhat less important than contract agreement or level of obligation, although higher payments were more desirable, as expected. The initial cost share rate and level of technical assistance were the least important factors affecting willingness to participate in Longleaf conservation programs. The presence of Longleaf pine on the landowner's property, previous participation in a FSA benefits program, a willingness to participate in a permanent easement to promote Longleaf pine, the amount required amount to accept a permanent easement, and ownership of 101 – 500 acres of forest positively impacted landowners' interest in a conservation credit program to promote Longleaf pine habitat. Conversely, persons who were unwilling to participate in a permanent easement were less interested.

The financial and capital budgeting analysis indicated that for Longleaf pine versus Loblolly pine, the incentive payment required for landowners to breakeven and plant Longleaf in the low intensity 2011 analysis at a 4% discount rate, was between $7 per acre and $83 per acre per year, not including establishment costs. If establishment costs of $306 were paid, Longleaf returns would exceed Loblolly returns for the higher site indexes and pine straw raking scenarios. Greater costs in our more intensive 2015 management scenarios resulted in annual incentive payment requirements of $66 to $496 per acre per year for Longleaf to break even and meet the 4% discount rate when converting agricultural land, which are prohibitive at the high end. However, if the initial year costs for mature forest conversion of Longleaf pine tree planting received a 50% cost share rate, required annual payment costs could decrease substantially. Also, if the very expensive $2000 to $2500 per acre shrub establishment practice were dropped, even the intensive Longleaf annual payment rates for mature and planted stands could decrease to less than $100 per acre per year, which is still within current Farm Bill program payment levels. Conversion of good quality agricultural crop land to Longleaf pine would be too expensive based on high 2011 crop prices, but for poor croplands and at current lower 2015 prices, conversion could be economically attractive, especially with prevailing cost share payments.

Introduction

This USDA Conservation Innovation Grant (CIG) project is designed to examine "Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina." This section of the report is a summary of that project with the component of assessing the possible supply of Longleaf pine forests that landowners could provide for Longleaf ecosystem habitat under various conservation market incentives. To draw from the proposals, this report examines two principal questions: (1) assess landowner willingness to supply habitat/species conservation; and (2) analyze the economics of alternative forest investments and the economic returns and opportunity costs for conservation management.

The supply component of the project built on our prior research on conservation programs to identify key components of a successful program. This work was continued with further surveys of landowners in the key counties to assess their willingness to plant Longleaf pine, work with nontraditional partners seeking habitat credits, interact with farm and forestry support agencies, gauge their knowledge of Endangered Species Act issues, and determine cost-share payment rates that might be required to foster credit creation. A map of the counties is shown below. We used one large survey and two statistical methods to examine the interest of landowners in participating in various conservation programs to create, enhance, or restore Longleaf pine ecosystems—a choice based conjoint (CBC) analysis and a regression analysis—as described below.

The economics of returns to setting aside lands for Longleaf pine conservation, or converting other lands to Longleaf, were also estimated in prior research, and updated in this component of the project. In order to increase Longleaf pine habitat, the credit buyers will need to make adequate incentive payments to make supplying credits as attractive when compared to other potential income from higher valued land uses. Economic analyses of Longleaf pine versus alternative land uses were made to estimate the "delta" required—the difference between economic value of current land uses and prospective land uses. This would provide the amount that would be needed to be paid for conservation payments required to increase the Longleaf pine ecosystem as compared to Loblolly pine or agriculture land uses.

Conservation markets need a supply of a product or service—landowners who will supply the service—and demand from some entity to buy the conservation good or service. In the case of conservation credit markets, private landowners may enter into temporary contracts or permanent easements directly with buyers or with brokers to create and ultimately supply credits to individuals, businesses or government entities seeking an investment opportunity, positive public relations coverage and/or to offset damages to the environment. Such agreements can vary in their provisions; however, they generally place stringent land management and legal requirements on the participant in return for financial compensation, regulatory assurances, and program assistance.

Private lands are crucial for ecosystem services and habitat conservation. In the United States, 914.5 million acres of land were classified as farmland (40% of the total area), and there were 2.1 million farms (USDA NASS 2014). In the lower 48 states, about 70% of the *total* land area is in private ownership, and about half of all the land is managed as cropland, pastureland, and rangeland by private landowners (Heard et al. 2000, cited in Gray and Teels 2006). Approximately 65% of *all* land in the United States is owned privately.

For the 766 million acres of *forest* land in all states, the public sector owns a greater share at 321 million ha (42%). There are 445 million acres of private forest land, or 58%, with about 10 million forest land owners. Private noncorporate owners hold 39% (298 million acres) of the nation's forest land and private corporate owners hold 19% (147 million acres). In the South, private non-corporate and family forest owners hold 60% of the forest land, and private corporate owners hold 27% (Oswalt et al. 2014).

Public assistance for natural resource conservation by individuals on private lands is an objective of government and nongovernment organizations, ranging from international, to national, to state, to local scales. There are literally thousands of financial and technical assistance programs and cooperative programs that provide economic incentives for sustainable use, conservation, and protection of natural resources, including land, water, fish and wildlife, forests, rangelands, and croplands.

Various conservation programs provide payments to encourage private landowners to perform conservation practices on their land. The structure of the payments required, contract of easement terms, and technical assistance required influence the enrollment in and success of the programs. Longleaf pine has become an important conservation

priority in the South in last decade or so, and we examined the economics and program characteristics that would encourage private landowners to plant or restore more Longleaf. Approximately 4.7 million acres of Longleaf pine (LLP) exist in the Southeast region, of which 61% are on private lands (ALRI 2014). Given these conditions, successfully promoting LLP habitat through the implementation of a credit market hinges on its widespread adoption by private, non-industrial landowners. LLP is most noted for its ability to provide habitat for the endangered red cockaded woodpeckers (RCW), but has many other broad biodiversity and ecosystem functions and values that would make it attractive as a credit market opportunity.

This section of the report is divided into three parts. First, we review current literature on landowner interest in conservation in southeastern U.S. Second, we analyze a survey conducted of landowners in 38 eastern North Carolina counties to examine how they prioritize provisions of a theoretical performance contract and the variables associated with interest in Longleaf pine (LLP) conservation. Finally, we evaluate three traditional income generating activities (LLP for timber, Loblolly for timber, and agriculture production) to better understand the level of compensation needed to attract market participants.

Brief Literature Review

Considerable research has examined landowner views and interest in conservation in the Southeast U.S. in North Carolina. Rodriquez et al. (2012) found landowners prefer contracts to permanent easements and while many were interested in protecting endangered species, it was the lowest priority among conservation issues. They also found interest in conservation was negatively correlated with age and positively correlated with past participation in conservation programs, positive perceptions of endangered species protection, and lower property requirement scores. Golden et al. (2012) studied North Carolina landowners and found that they are more likely to be interested in wildlife conservation if they resided on their property, hunt and/or have a family member that hunts and were younger and male.

Although the terms of conservation performance contracts may vary, they usually contain several common attributes including, but not limited to: length; legal obligation to maintain land during and after contract; financial assistance to help with establishment costs; incentive payments to compensate for potential loss in income; and level of

program assistance received prior to and during the contract period. Some research has used novel approaches to shed light on how landowners prioritize such conditions. For instance, Sorice et al. (2013) studied family-forest landowners in southeast U.S., using a choice model to determine preferences for participation in a program to protect the gopher tortoise. They found a strong aversion to strict regulatory programs, or ones that require permanent easements, or put landowners at risk of future regulation.

In general, conservation programs may provide contracts, which are temporary legal agreements between the program's managing agency and a landowner, and easements, which are permanent changes in the rights to use the land. Conservation contracts usually provide a specific cost-share payment for establishing a conservation practice, and usually have annual payments for maintaining those practices. The cost-share payment covers a portion of the costs that landowners incur when performing a practice, ranging from 50% to 100% depending on the needs, the practice, the state, and the type of landowner. The annual payments may occur for a decade or more for conservation contracts, where the landowner agrees to keep a practice in place for the duration of the contract. Landowners also may enter into a long term or permanent easement—which is a specific legal instrument that mandates they perform a practice or restricts their land use rights, and is registered on the title to their land. This may include some establishment costs, and then a fixed payment for the easement rights, usually as a lump-sum up-front payment (Cubbage et al. 2016).

Easement agreements are more expensive than conservation contracts, and less common, but still prevalent. Most landowners are apt to prefer short-term easements with payments for a fixed term, so they can break a contract if need be, or simply wait until it expires before changing the conservation practice or land use. However, landowners who truly want to protect and conserve their land use in perpetuity, and receive a greater payment for themselves, not their heirs, may prefer to sell their land with a permanent conservation easement, or just sell the conservation easement and retain the land (Cubbage et al. 2016).

Landowner Interest in Longleaf Conservation Programs

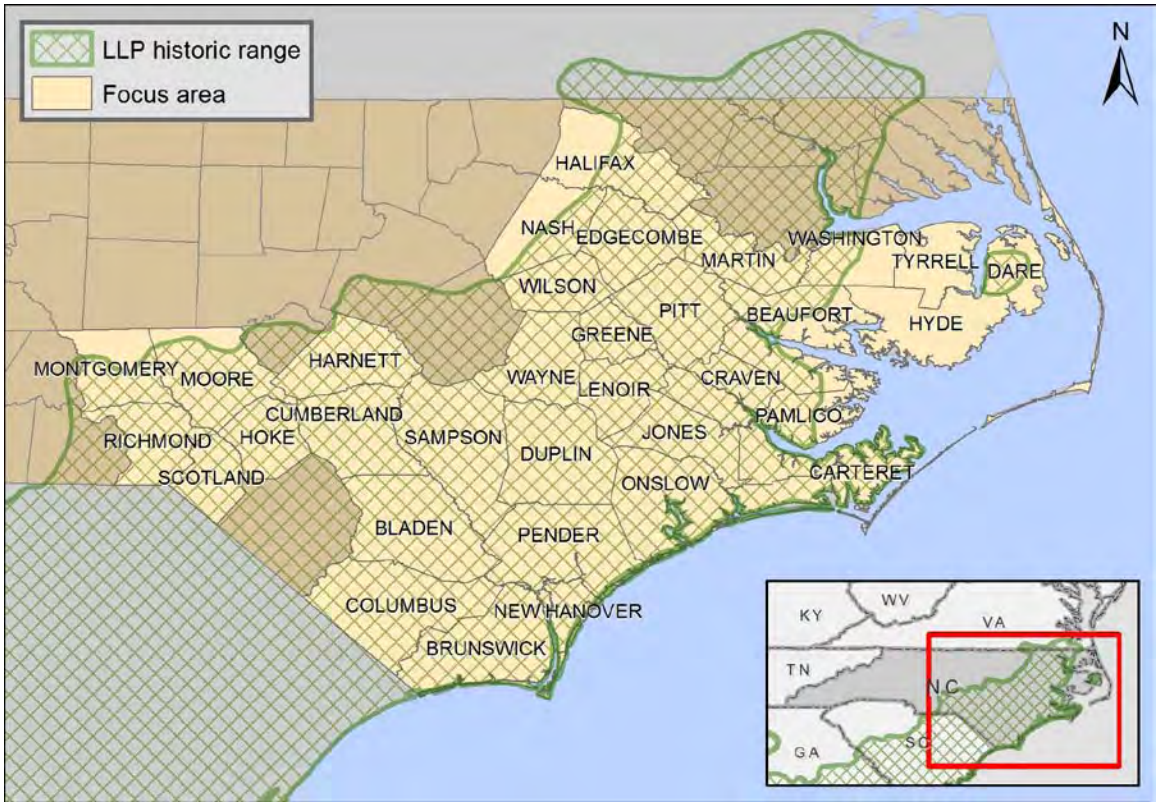
Per the objectives of this Conservation Innovation Grant, we used two broad methods to gauge the interest of landowners in establishing Longleaf pine conservation programs. First, we performed a survey of landowners to estimate their interest and the factors that

influenced that interest. Second, we calculated the economic returns to growing Longleaf pine versus Loblolly pine or agriculture crops. These efforts are described below.

Landowner Survey Methods

We conducted a survey of landowners in 38 counties in eastern North Carolina that fell within the historical Longleaf pine range as identified by the Longleaf Alliance strategic plan (Figure 1).

Figure 1. Map of Conservation Innovation Grant Longleaf Pine Project Area



Working with various forest and agriculture associations and cooperative extension agents, we developed a sampling list and frame composed of (1) individuals for whom the research team has secured personal email addresses, and (2) organizations who would rather not share internal information, but agreed to send our emails with links to the survey directly to landowners on our behalf. Many drafts of the survey were developed, reviewed by the project personnel, presented for discussion at CIG stakeholder meetings,

and revised for the final survey instrument. The surveys were reviewed by the NC State University Institutional Review Board and approved before sending them out.

Data were collected from respondents through a pre-tested questionnaire constructed and administered on an online server hosted and maintained by North Carolina State University. Approximately 1,000 survey requests we sent electronically and another 2,000 via regular postal service mail. These requests asked landowners to go to the web site to complete the survey, since part of the survey specifically required web replies. Our sample included 374 landowners (only 243 completed the entire survey) who owned forest, agriculture land or a combination thereof with acres ranging from less than 50 acres to more than 5,000 acres.

The survey consisted of two parts. First, it asked one open ended question (age) and 25 multiple choice questions related to respondents' demographics, land characteristics, interest in conservation programs and easements, having management plans, participation in the North Carolina deferred tax program based on agriculture, forestry or wildlife usage (present use value (PUV)), and using Natural Resource Conservation Service (NRCS) and Farm Service Agency (FSA) benefits/cost-share programs. We also included a question on their willingness to participate (WTP) and the amount required to participate (willing to accept: WTA) in making a permanent conservation easement. Table 1 summarizes the independent variables measured from the survey.

Table 1. Independent Variables Measured

Variable	Options
LL Cons Interest	Yes, No, I don't know
Currently has LLP	Yes, No, I don't know
Present Use Value Registered	Yes, No, I don't know
Receives FSA Benefits	Yes, No, I don't know
Receives NRCS Benefits	Yes, No, I don't know
Agriculture Management Plan	Yes, No, I don't know
Forest Management Plan	Yes, No, I don't know
Conservation Program for Ag Land	Yes, No, I don't know
Forest Management Plan, Who Helped	NC Forest Service, NC Wildlife Resources Comm, Consultant, Yourself, Other
Age	Years
Gender	Male, Female
Education	High School, Tech, Associates, Bachelors, Graduate
Acres Forest Owned	1-49, 50-100, 101-500, 501-999, 1,000-4,999, 5,000+
Acres Ag Owned	1-49, 50-100, 101-500, 501-999, 1,000-4,999, 5,000+
Income	<$24,999, $25-$49,999, $50-$74,999, $75-$99,999, $100,000+
WTP Perm Easement	Yes, No, Depends on Payments/Property Requirements, Not Sure
WTA Perm Easement	$500, $1,000, $2,000, $2,500, Other (please specify)

Statistical Analysis

We analyzed the data using regression analysis and conjoint-based choice analysis. Using these two methods provided a means to triangulate on landowner interest and opinions using two approaches, providing more robust results.

Regression Analysis.—We analyzed the data from the survey using SAS JMP Pro Version 12.0.1. First we developed a correlation matrix to examine the relationships of variables measured and identified those with a correlation coefficient with the variable Interest in a Longleaf Pine Conservation Program (LLPInterest) greater than 0.1. These were organized into four conceptual categories based on landowner's wealth, past participation in a benefits program, interest in participating in a future credit program, and land characteristics. We then ran separate Ordinary Least Squares (OLS) regressions taking the variable Interest in a LLPInterest as a function of all the others and recorded their parameter estimates and p-values.

Based on the OLS models and correlation matrices, we used the best selected variables in a logistic regression model using SAS JMP procedure Nominal Logistic to estimate those that had the most impact on LLPInterest—the likelihood that landowners would be interested in planting or restoring Longleaf pine.

The regression model forms then were:

Ordinary Least Squares:

$$P = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_3 X_n$$

Logistic Regression

$$P = \beta_o X_1^{\beta 1} X_2^{\beta 2} \ldots X_n^{\beta n}$$

Where:

P = willingness to participate in a Longleaf pine conservation program
X_i = various land and landowner characteristics

Choice-Based-Conjoint Analysis.—The second part of the survey required respondents to select an ecosystem credit program scenario among those presented in 12 choice tasks (a choice task consisted of two different randomly generated scenarios and one 'I don't know'). Table 2 shows the five attributes included in each scenario along with their descriptions and possible levels. This portion of the survey, or the choice-based-conjoint (CBC) analysis, was analyzed using Sawtooth Software version 8.2.0, Orem, UT. CBC poses questions in a way that reflects how people make choices and enabled us to examine landowners' underlying values and preferences as they relate to environmental, land use, and economic concerns.

Table 2. Attributes with Importance Scores and Descriptions

Attribute	Levels	Description
Contract Length	5, 10, 20, 30	Number of years required by contract
Obligation	None, Baseline, Full	Landowner's legal obligation to maintain habitat
Annual Payment	$25, $50, $75, $100	Payment per acre received by landowner
Cost Share	25%, 50%, 75%, 100%	Percent of $300/acre establishment cost
Assistance Level	None, Prior Consult, Full Consult	Outside help to manage the land under contract

Most of the choice-based-conjoint analysis values are self explanatory, including contract length, annual payment, cost share rate, and assistance level. Obligation covers how the landowner is to manage their land once the contract ends. It has three values: none means there are no restrictions; baseline would require continued management based on some identified level of wildlife animal or plant species abundance; and full would have landowner manage per contract terms until the endangered species is delisted. The cost share percentage represents the possible program benefits to provide financial compensation to establish the forest.

Landowner Survey Results

Descriptive Statistics.—Table 3 summarizes the descriptive statistics of the survey data. Respondents averaged 62 years of age and were predominately male (82%) and retired (42%) or employed full time off property (34%). Households with annual earnings of $50,000 and $100,000 and greater than $100,000 made up 46% and 39% of the sample, respectively. Some landowners resided outside of project area, but would have to owned land or attended conservation programs that in the area in order to be included in our survey.

Table 3. Descriptive Statistics for Survey Participants

Survey Participants	Completed (244) Started but did not complete (132)
Sex	Male (81.8%) Female (18.2%)
Employment	Full-time (33.6%) Part-time (3.1%) Unemployed (.4%) Disabled (1.3%) Retired (42.4%) Self-employed (19.2)
Education	<High School (.4%) High School/GED (12.8%) Vocational/Tech (10.7%) Associates (14.5%) Bachelors (37.2%) Graduate/Professional (24.4%)
Household Earnings	<$24,999 (4.6%) $25-49,999 (11.1%) $50-74,999 (23.6%) $75-99,999 (22.2%) $100,000+(38.4%)
Presence of LLP on Property	Yes (57.7%) No (28.3%) Not Sure (14%)
Forest Management Plan	Yes (67.9%) No (29.1%) Not Sure (3%)
Ag Conservation Plan	Yes (27.5%) No (60.4%) Not Sure (12.2%)
Present Use Value	Yes (68.1%) No (13.4%) Not Sure (18.5%)
FSA Benefits Program	Yes (52.1%) No (34.5%) Not Sure (13.4%)
NRCS Benefits Program	Yes (38.7%) No (50.4%) Not Sure (10.9)
County Participant Resides	B Bertie (.4%) Bladen (3%) Brunswick (1.7%) Carteret (1.7%) Cabarrus (.9%) Caswell (.9%) Columbus (1.7%) Craven (.4%) Cumberland (10.3%) Dare (.4%) Davidson (.4%) Duplin (2.6%) Halifax (.9%) Harnett (8.6%) Hoke (2.6%) Gatson (.4%) Guilford (.9%) Johnston (6%) Jones (1.3%) Lee (.4%) Lenoir (1.3%) Mecklenburg (1.3%) Montgomery (3.9%) Moore (11.6%) New Hanover (.4%) Onslow (2.6%) Pender (3.9%) Pitt (1.7%) Randolph (1.3%) Richmond (1.3%) Robeson (.4%) Sampson (6.5%) Scotland (1.3%) Union (.4%) Wake (3.9%) Watauga (.4%) Wayne (10.3%) Wilson (.9%)

A large share of respondents reported having Longleaf pine on their property (58%), a forest management plan (68%), PUV (68%) and to a lesser extent a conservation plan for their agricultural land (28%). Finally, 52% and 39% have participated in a FSA and NRCS benefits program, respectively. These are high rates of Longleaf forests and farm programs due to the fact that we obtained our survey samples from existing program participants. This may provide some upward bias in the landowners' willingness to participate in Longleaf programs, but was unavoidable in order to get an adequate sample at all.

Table 4 provides a breakdown of respondents by land ownership type. For instance, 80% of landowners with 1-49 acres of forest also own 1-49 acres of agriculture land. Similarly, 50% of landowners with 1-49 acres of agriculture land also own 1-49 acres of forest. However, there are very few large forest landowners that own large amounts agriculture land. But the large agriculture landowners tend to own large amounts of forest as well. One might expect this since the state is 60% forested, and forests will tend to rest in streamside zones, swamps, or hillsides on almost any farm in the state.

Table 4. Land Characteristics of Survey Participants

Forest Landowners by Acres with Agricultural Land							
Acres of Ag	1-49	50-100	101-500	501-999	1000-4999	5000+	
1-49	80%	33%	37%	26%	19%		
50-100	15%	39%	30%	26%	14%		
101-500	5%	26%	27%	32%	48%	100%	
501-999		2%	5%	11%	10%		
1000-4999			2%	5%	10%		
5000+							**Total**
Forest Owners with Ag / Total Forest Owners	59/84	51/69	60/92	19/23	21/29	2/2	**210/299 (70.2%)**

Agriculture Landowners by Acres with Forests							
Acres of Forest	1-49	50-100	101-500	501-999	1000-4999	5000+	
1-49	50%	16%	6%				
50-100	18%	36%	26%	13%			
101-500	23%	33%	32%	38%	25%		
501-999	5%	9%	12%	25%	25%		
1000-4999	4%	6%	20%	25%	50%		
5000+			4%				**Total**
Ag Owners with Forest /Total Ag Owners	95/103	55/57	50/50	8/8	4/4		**212/222 (95.5%)**

Regression Analysis.—Tables 5 and 6 provide information on the relationship of those variables that affected interest in Longleaf pine conservation programs (LLPInterest). The p-value measures the significance of the results, and generally those less than .05 are considered strong, between .1 and .05 significant, and greater than .1 weak. Since p-values can be very small, the statistical package provides a Logworth value which can help more clearly interpret the significance and, if necessary, graph the results (P-values and Logworths are inversely related). The Logworth estimator provides information about the magnitude of the variable and how much it positively or negatively impacts the dependent variable, in this case LLPInterest.

Table 5 shows that presence of Longleaf pine on the landowner's property, previous participation in a FSA benefits program (FSABenefits), a willingness to participate in a permanent easement to promote Longleaf pine (a yes or no answer, depending on the property requirements; variable WTP Depends on Property Requirements), the actual required amount to accept a permanent easement ($2,500), and ownership of 101 – 500 acres of forest positively impacted landowners' interest in a conservation credit program

to promote Longleaf pine habitat. Conversely, Table 6 shows that those less likely to be interested included persons who were unwilling to participate in a permanent easement.

Table 5. Positive Significant Variables, LLPInterest

Variable	P-Value	LogWorth	Est.
CurrentLLP (Yes)	0.00459	2.338	0.5154
WTA ($2,500)	0.01828	1.738	0.4983
FSABenefits (Yes)	0.03864	1.413	0.3805
WTP (Depends Property Req.)	0.04367	1.36	0.4917
Acres Forest (101-500)	0.10482	0.98	0.3374

Table 6. Negative LLPInterest Correlation

Variable	P-Value	LogWorth	Est.
WTP (No)	0.00006	4.23	-0.8093

These all make intuitive sense—existing program and FSA participants were likely to be interested in Longleaf programs as well, and higher payments for easements would encourage more participation. Owners with medium sized forest tracts of 101 to 500 acres were the most likely to be interested; small and large forest owners were not. However, ownership size of agricultural land had no effect on interest in program participation. Similarly, education, employment, income, and gender had no effect on landowners' interest in participation. Neither did having forest or farm management plans or being enrolled in PUV programs. NRCS program participation may have been influential as well, but less so than FSA use, so it was eliminated in the first OLS regressions in order to avoid a high correlation between independent variables in the logistical regressions.

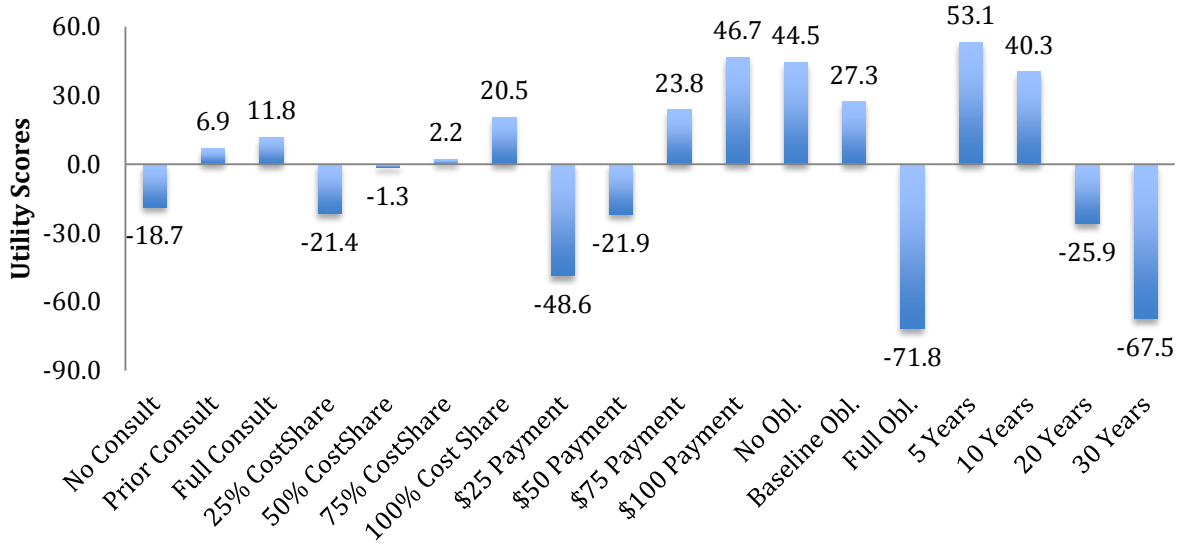
Choice-Based-Conjoint Analysis.—The CBC analysis provides insight into how landowners prioritize the program scenario attributes by assigning relative importance scores to each, as seen in Table 7. A higher score represents a greater value placed on the attribute by the respondents. Contract length, level of obligation and annual payments were identified as the most important factors to landowners. Conversely, cost share and technical assistance level both scored comparatively low.

Table 7. CBC Attributes with Importance Scores

Attribute	Score
Contract Length	28.40%
Obligation	25.90%
Annual Payment	20.80%
Cost Share	12.40%
Assistance Level	11.40%

This CBC analysis also enables us to examine how values within each attribute fared by providing total zero-centered utility values for each (only levels within an attribute can be compared), as seen in Figure 2. Again, higher scores represent a greater preference by the survey respondent. Generally speaking, there is a linear relationship as we move among the attributes' values. For instance, respondents showed a steady decreasing preference for greater contract lengths. Conversely, preference steadily increased with greater assistance levels, cost share percentages and incentive payment amounts. Obligation preference decreased slightly between no obligation and baseline obligations, but dropped radically for full obligation.

Figure 2. Utility Scores for CBC Attributes



Financial Analysis and Capital Budgeting for Alternative Investments

We performed another analysis of the interest that landowners might have in Longleaf pine using economic discounted cash flow analyses of potential investment returns for Longleaf versus Loblolly pine or agriculture crops. Glenn (2011) performed a financial and capital budgeting analysis of Longleaf pine management that we updated here for another perspective on landowner requirements to establish Longleaf habitat. This analysis examines managing for Red Cockaded Woodpecker habitat (LLP RCW) compared to managing Longleaf pine for timber (LLP Timber) in comparison to Loblolly pine for timber (Loblolly Timber) and agricultural crop production. The differences between Longleaf pine and the other two land uses provide an estimate of the discounted costs that a landowner would have to receive in order to shift from the generally more profitable uses to Longleaf pine.

In addition to the work by Glenn based on 2011 prices, we estimated new investment returns as well for more intensive Longleaf pine management alternatives and 2015 prices. We did not update the Glenn results for inflation, but that still should be less than 10% different than in 2015. Updating them without recalculating all the discounted cash flows would have been more arbitrary than keeping them in their original form. The management assumptions and results from Glenn were essentially a low intensity approach to Longleaf pine management, without any extremely detailed or expensive efforts to create perfect Longleaf ecosystem habitat for RCWs. The objective was mostly to plant and grow Longleaf, either for short (45 year timber) or long (80 year timber/RCW) rotations, with the presumption that the longer rotations would be most conducive to RCW. The 2015 estimates assumed a much higher level of management intensity, including understory restoration, foresters' fees, timber inventory, and timber marking. Thus this led to much higher costs, and less profits for Longleaf pine. The opportunity costs of growing Longleaf pine versus Loblolly or crops also were higher.

Management Assumptions, 2011

We defined the opportunity cost of implementing a land management regime to support Longleaf pine ecosystem credits as the transaction costs necessary to meet RCW habitat

requirements plus the foregone revenue from timber production or row crop agriculture. Assumptions on prescribed burning and thinning frequencies, as seen in Table 8, were based on literature review and discussions with Ron Myers from the North Carolina Forest Service (NCFS) in 2011. Although LLP Timber could be managed to accommodate lower amounts of RCW habitat and natural pine ecosystems, we assumed it was managed for maximum timber and thus ineligible for credits.

Table 8. Land Management Scenarios Examined for Discounted Cash Flow Analysis

Management Type	Rotation	Prescribed Burning	Thinning Schedule
Longleaf RCW	80 years	Every 5th year in years 45 to 80	40/60 years, 80ft2/60ft2 basal area
Longleaf Timber	40 years	Years 12 and 29	28 years, 80ft2per acre basal area
Loblolly Timber	25 yeas	NA	Year 7
Agriculture Crops	Every Year	NA	NA

Annual growth and volume for Longleaf were estimated using three Longleaf pine growth and yield models: NATYIELD (1986), Farrar (1985), and Lohrey and Bailey (1977). All three provided comparable yield curves, so we used NATYIELD because it was based on North Carolina data. It does have coefficients and yields similar to those specified by Lohrey and Bailey (1977). Land management practices and costs for Longleaf pine such as site preparation, tree planting, stand stocking and maintenance reflect prevailing practice rates and were taken from NCFS (2011). The first thinning contained 25% pulpwood and 75% chip-and-saw and the second thinning and final harvest contained 20% chip-and-saw, 50% sawtimber, and 30% large sawtimber.

Using a conventional Loblolly pine scenario, the thinning and harvest volumes and management regime were based on prior research by Siry et al. (2001) and Cubbage et al. (2012), which used the TAUYIELD growth and yield model. The planting rate was 600 trees per acre with a site index (SI) of approximately 80 feet at age 50. Thinning volume was 475 ft^3 per acre at age 17, comprised of 75% pulpwood and 25% chip-and-saw. The final harvest volumes were 2,225 ft^3 per acre at age 25, comprised of 23% chip-and-saw wood, 67% small sawtimber, and 10% large sawtimber.

Agriculture yields were based on model farm budgets for the Coastal Plain of North Carolina derived from NC State Cooperative Extension Service (2012, 2016) data for corn and soybeans. The average yields were 110 bushels of corn per acre and 35 bushels of soybeans per acre in both analyses, with corn selling for about $8 per bushel and beans for $12 per bushel in 2011. These returns assumed that farmers could plant the same field in corn or beans in perpetuity. This is of course not possible, but making a simulation with various crop rotations and returns would be even more difficult to understand and estimate.

The base 2011 crop analysis assumed constant excellent crop prices and good weather patterns, with no droughts, floods, hurricanes, or other disturbances. Prices since then also have dropped significantly. Thus for sensitivity analyses, we recalculated the returns for 2015, based on the latest (still only 2012) crop budgets and the 2015 Coastal Plain prices of $4.50 per bushel of corn and $8.50 per bushel of soybeans (USDA Agricultural Marketing Service 2016).

Thus the 2011 crop budget comparisons provide an upper range of possible crop yields and agriculture land profits. Mixed crop production systems and more typical wide weather variations would be more apt to reduce these agricultural land value estimates and opportunity costs than they would for timber and Longleaf pine in particular, which are much better adapted for weather stress. In addition, while timber prices fluctuate, and indeed were at a low level in 2011, crop prices have dropped in greater amounts since 2011, and have more price risk in free markets without government crop insurance subsidies.

Capital Budgeting Methods

We used a standard capital budgeting approach to assess the present value (PV) and Land Expectation Value (LEV) of each land management option to determine their economic values (Klemperer 2003, Wagner 2012). LEV provides a measure of the value of a management regime into perpetuity and allows one to compare multiple regimes with different time frames (e.g., 25 years of active Loblolly management vs. 80 years at a Longleaf stand). We used a 4% real discount rate, which is consistent with other forest economic and investment analyses that have examined Longleaf pine financial returns (Cubbage et al. 1989, Johnson 2011, Roise et al. 1991, Kessler et al. 1991, Row et al. 1981).

Calculated values were organized by Site Index (SI) at age 50 and pine straw value within each land management scenario. Longleaf pine SI 70 is representative of sites in the eastern coastal plain region and reflects realistic returns from good sites in North Carolina. Pine straw was assumed to be harvested every three years from ages 16 to 40. We used three pine straw revenue scenarios: (1) no harvest (zero value), (2) conservative value ($75/acre per harvest) and (3) moderate value ($125/acre per harvest), representing low to mid-range literature estimates and local pine straw sales in North Carolina (Dickens et al. 2012).

For comparison, Bladen Lakes State Park 2011 pine straw sales ranged from $150 to $300 per acre (Michael Chesnutt, personal communication), and are harvested almost every year. Thus we were relatively conservative in our estimates of pine straw value, but this should be more consistent with RCW habitat management in order to transition the stands from mixed timber and straw production into RCW conservation uses.

The LEV of LLP RCW was compared to those of LLP Timber, Loblolly Timber and agricultural crop production to determine the opportunity cost associated with adopting this land management regime. From this, we calculated the annual payment to landowners, in a theoretical 10-year contract, necessary to make them indifferent between LLP RCW and the other scenarios. This payment is equivalent to common conservation programs such as the Conservation Reserve Program (CRP). Rodriguez et al. (2012) identified ten years as the contract length that landowners preferred for conservation programs in counties in eastern North Carolina.

Financial Results, 2011

For the 2011 low intensity management analysis, the LEVs of LLP RCW and LLP Timber were calculated using the different pine straw values mentioned above, an $8 annual property tax, and stumpage prices averaged from 4th Quarter 2011 Forest2Market and Timber Mart-South reports that include $7.93/ton for pulpwood, $14.88/ton for chip-and-saw, $25.41/ton sawtimber and $56.32/ton for large sawtimber (Forest2Market 2011, Timber Mart-South 2011).

Table 9 compares the 2011 LEVs for Longleaf pine with a timber production focus and a RCW conservation at the selected 4% discount rate. It also shows the difference in the LEVs between the two scenarios, with a range of three pine straw production options. This difference between the returns then provides a net cost to grow Longleaf pine for RCW conservation. This total difference in the LEV amount was then converted to the value of a 10 year annual annuity contract, which is typical for Farm Programs like the Conservation Reserve Program (CRP).

Table 9. Longleaf Pine for RCW Habitat Opportunity Cost per Acre versus Longleaf Pine for Timber Production Revenue, 2011, 4% Discount Rate

Site Index	Pine Straw Value	LLP RCW LEV	LLP Timber LEV	Opportunity Cost LEV	10-year Contract Annual Payment
60	None	-$498	-$140	$358	$42
	Conservative	-$218	$105	$323	$38
	Moderate	-$54	$303	$357	$42
70	None	-$398	-$3	$395	$47
	Conservative	-$124	$243	$367	$44
	Moderate	$40	$441	$401	$48
80	None	-$283	$143	$426	$51
	Conservative	-$19	$387	$406	$48
	Moderate	$145	$585	$440	$52

This annual payment value would represent the “breakeven” opportunity costs and the annual payments necessary to make landowners equally willing to grow Longleaf pine for RCW conservation versus for timber production. Converting existing Longleaf stands to longer rotations is probably the easiest of the potential land use changes that owners may consider. It of course might take even greater annual payments to actually induce landowners to shift from existing Loblolly pine or agriculture systems to Longleaf pine systems.

To illustrate the opportunity cost comparison, at Site Index 70 with a conservative pine straw raking system, Longleaf for timber production would yield a LEV of $243 per ac; Longleaf for RCW habitat would “lose” $124 per acre. Thus the LEV opportunity cost would be $367 per acre, which would require an annual payment of $44 per acre for 10 years at a 4% discount rate to make the LLP RCW habitat regime as profitable as the LLP timber production regime.

One generic base level LEV was calculated for planted Loblolly pine timber, Site Index 80, 25 year rotation. Loblolly pine would not have a pine straw component. We used the same prices as Longleaf pine for each product class, and a $242 establishment cost, $8 annual tax, $103 income at Year 17 from thinning and $1,305 income at year 25 from harvest. Table 10 compares the LEVs of the LLP RCW and the base Loblolly Timber scenarios, their opportunity costs and the required payments to landowners under a 10-year contract.

Again, an example helps clarify the opportunity cost concept for Loblolly pine versus Longleaf pine for RCW habitat. Loblolly pine had an LEV of $221 per acre; conservative Longleaf, SI 70 had a LEV of -$124 per acre. Thus the net difference is $325 per acre, which converts to a ten year annual payment of $71 per acre at the 4% discount rate.

Table 10. Longleaf Pine RCW Opportunity Cost per Acre versus Loblolly Pine for Timber Production with an LEV of $201 per Acre, 2011, 4% Discount Rate

Site Index	Pine Straw Value	LLP RCW LEV	Opportunity Cost LEV	10-year Contract Annual Payment
60	None	-$498	$699	$83
	Conservative	-$218	$419	$50
	Moderate	-$54	$255	$30
70	None	-$398	$599	$71
	Conservative	-$124	$325	$39
	Moderate	$40	$161	$19
80	None	-$283	$484	$58
	Conservative	-$19	$220	$26
	Moderate	$145	$56	$7

The best case agricultural scenarios assumed average North Carolina Coastal Plain crop returns for corn and soybean farms each year into perpetuity, with annual profits of $67.57 and $159.92 per acre, respectively (NCSU 2012). As noted, these assumptions were optimistic and assumed that farmers would get average yields, maintain the current high crop prices, and encounter no weather or climate issues. LEVs for corn and soybeans were $1,757 and $4,158 respectively using 2011 prices, indicating opportunity costs of between nearly $2,000 to more than $4,000 per acre to make LLP RCW returns equal to agriculture returns when direct costs are included.

These best case agricultural returns are much higher than the highest Longleaf pine versus Loblolly pine forestry opportunity cost of $699 per acre. However, this would be a theoretical upper bound of the opportunity costs for crop farming given there are few sites in North Carolina that grow corn or beans forever.

As one more recent comparison, net crop returns based on the much lower 2015 prices would be approximately $42 per acre for corn and $26 per acre for soybeans. Capitalized in perpetuity at the 4% discount rate, these would be values of $1050 per acre for corn and $650 per acre for soybeans. Thus these opportunity costs between a $-124 for Longleaf pine and corn would be $1174 per acre; for soybeans it would be $774. These are obviously less daunting than in 2011.

Poorer agriculture land, or even quite common variations in weather, would reduce these theoretical annual crop returns greatly, and might make at least even marginal agricultural lands in North Carolina more possible to convert to forestry or to Longleaf pine using incentive payments. A more detailed analysis of dozens of different agriculture crop rotation, weather, and price fluctuations would be necessary to examine these prospects.

Marginal agricultural lands may be more attractive for conversion to RCW habitat. An economic analysis of marginal farmland in North Carolina found that between 2007 and 2012 both corn and soybean crops generated negative returns, averaging annual losses of -$174 per acre for corn and -$41 per acre for soybeans (Cubbage et al., 2012). If these losses were repeated annually, as the positive returns were repeated in the simplified agricultural analysis, they would lead to LEVs of -$4,524 to -$1,066 per acre. These findings would be even worse in 2015. Thus when compared with annual risks and potential losses from agricultural crops, forestry investments can produce suitable positive investment returns on poor agricultural sites that may not be as fertile or that are more susceptible to drought and flooding. In fact, for poor agricultural lands and current 2015 prices, Loblolly pine and even Longleaf pine would be more profitable in the long run than corn or beans, even without cost share payments.

Sensitivity Analysis: Changes in Stumpage Prices and Cost Share Payments, 2011

A sensitivity analysis was conducted to examine the effect of timber prices on the opportunity costs for Longleaf RCW habitat scenario. The preceding analyses are based on timber prices from fourth quarter of 2011, which were at modern historical low levels for the southern U.S. Thus we increased stumpage prices by a factor of 1.5; this increased the conventional Loblolly LEV to $635 per acre (compared to $201). Longleaf timber prices also were increased, but one would need to wait longer to realize these returns than for the shorter rotation Loblolly pine.

Table 11 presents the 2011 Longleaf pine LEVs, opportunity costs, and payments. Although the value of each Longleaf pine investment improved with higher timber prices, the difference between it and the conventional Loblolly income, and thus the opportunity cost, grew because timber became a more important part of total revenues than pine straw, and the Loblolly timber revenues occurred sooner.

Again, for the Conservative SI 70 example, Longleaf RCW LEV was $11 per acre; the Loblolly base LEV was $635 per acre; the opportunity cost was $624 per acre; and the ten year annual payment required was $74 per acre. This pattern could be expected to emerge for LLP Timber as well given that proportional timber revenues would outpace fixed pine straw revenues. Pine straw prices could increase as well, although we did not analyze this because they were at historic high prices, not low ones like timber.

Table 11. Longleaf Pine RCW Opportunity Cost per Acre versus Loblolly Pine for Timber Production, with an LEV of $635 per Acre, 4% Discount Rate, Timber Prices of 1.5 Times more than in 2011

Site Index	Pine Straw Value	LL RCW Habitat LEV	LEV Opportunity Cost	10-year Contract Annual Payment
60	None	-$382	$1,017	$121
	Conservative	-$129	$764	$91
	Moderate	$36	$599	$71
70	None	-$233	$868	$103
	Conservative	$11	$624	$74
	Moderate	$176	$459	$54
80	None	-$61	$696	$83
	Conservative	$170	$465	$55
	Moderate	$334	$301	$36

North Carolina provides state and federal cost share programs that offer financial assistance for planting Longleaf pine. These programs can have a tremendous impact on financial returns, especially when compared to Loblolly pine since its cost share rate is lower. An example of such a program is USDA's NRCS Environmental Quality Incentives Program (EQIP) that has cost shared up to 100% of establishment and maintenance activities for Longleaf pine (USDA NRCS 2012a, 2012b). Assuming a minimum payment from EQIP, the opportunity cost between Longleaf and Loblolly pine was greatly reduced and in many cases disappeared.

Table 12 presents opportunity cost and payments when a cost share of $306 per acre, to cover establishment costs, is included. The same SI 70 Longleaf conservative pine straw case would then have a positive LEV with cost share payments of $195 per acre, versus the Loblolly base case of $201 per acre. Thus the RCW Longleaf LEV opportunity cost would be only $6 per acre, or essentially require no annual conservation payment (e.g., $1 per year for 10 years).

In fact, landowners would receive a conservation payment of $50 per acre or so for 10 years in the EQIP program, generating a LEV of $456 per acre at 4% discount rate. So Longleaf for RCW habitat actually would become a much preferred alternative to Loblolly pine—$450 per acre better in fact with the EQIP cost share payment and annual payments. This helps explain why landowners have been eager to enroll in the Longleaf

programs for planting Longleaf pine, and the EQIP program has been fully enrolled of even oversubscribed when it has been available.

Table 12. Longleaf Pine RCW Opportunity Cost per Acre with $306 per acre Cost Share Payment for Planting versus Loblolly Pine for Timber Production with an LEV of $201 per Acre, 2011, 4% Discount Rate

Site Index	Pine Straw Value	LL RCW Habitat LEV	LEV Opportunity Cost	10-year Contract Annual Payment
60	None	-$178	$379	$45
	Conservative	$102	$99	$12
	Moderate	$266	NA	NA
70	None	-$79	$280	$33
	Conservative	$195	$6	$1
	Moderate	$359	NA	NA
80	None	$36	$165	$20
	Conservative	$301	NA	NA
	Moderate	$465	NA	NA

[1]NA- In several cases the Longleaf pine LEV with establishment costs being paid now exceed Loblolly pine's LEV ($201) and opportunity cost is not applicable.

Management Costs and Present Values for RCW Habitat, 2015

Managing Longleaf pine stands specifically for RCW habitat require specific practices and their associated costs vary depending on site conditions. This analysis of a higher intensity of management with 2015 costs compared two more scenarios: (1) artificial replanting on agricultural lands—such as shown above for the 2011 input costs and prices—and (2) conversion of existing mature stands.

Practices Required for Longleaf Pine Conversion or Existing Stand Management.— Our high intensity scenarios for converting agriculture lands into Longleaf pine habitat for RCW or for managing mature existing stands that have a Longleaf pine component for RCW were significantly more involved. For conversion from agriculture, there were seven distinct management steps, including:

- Scalping, burning and applying broad-spectrum herbicides to eliminate Bermuda grass, fescue, or whatever common field grass is growing on the site;

- Machine or hand planting (associated costs include seedlings, labor and the periodic application of herbicide while planting);

- Prescribed burns, herbicide treatments or both until trees grow out of their grass stage and obtain height (it may be necessary to do two prescribed burns and one application of herbicides after planting, but before age five);

- Introducing fire on a rotational basis when trees begin to average 2.5 to three feet in height and over 1.5 inches in diameter (one fire per stand every three years until year 75);

- Conducting understory restoration (old agricultural fields are usually void of original native understory plants);

- Conducting two to three thinnings, timber marking and inventorying every 10 to 15 years; and

- Depending on landowner characteristics and preferences,

    - Hiring a forester (for larger landowners) or retaining a consultant, based on the amount of work required and the skill of the forester;
    - Hiring a third party contractor to track, monitor and inventory RCWs to meet the requirements of US Fish and Wildlife Services; and/or
    - Maintaining such things as roads and gates, property taxes, and boundary marking.

In contrast to planting bare fields, converting mature stands with the target age class structure (assumed here to be 75 years old with 45 to 75 square feet of basal area per acre), or potential for it, requires less intensive management activities. On the other hand, replanting cutover forest sites requires more management activities to clear a site and prepare it for planting.

Appendix 1 provides a list of the activities required to convert agriculture land for RCW habitat (assumed to occur in year 50) and to maintain mature stands at a basal area of 60 sq. ft. /acre; their associated descriptions for low and high intensity management regimes; and their associated cost estimates for each of the practices required, at a high and low end of the range for those costs.

Discounted Cash Flow Value of Costs.—Table 13 provides a breakdown of both the present value of costs to convert agricultural land and the LEV to manage mature forests into perpetuity. It also provides the LEV for annual fees that occur in both management scenarios.

Table 13 values were calculated using the same 4% real discount rate to determine the total value of converting, then managing, agricultural lands into RCW habitat into perpetuity. The conversion cost is added to the discounted cost of managing mature forests in order to calculate the total present value of the costs for our analysis for costs in 2015. Also, for comparison, the costs of management discussed in the previous section from the low intensity approach modeled in 2011 are included.

Note that the costs for intensive management that were assumed for the 2015 analysis were far greater than the low intensity management scenarios analyzed in 2011. The costs for more frequent prescribed burns, earlier stand treatments, more herbicide treatments, and especially the $2000 to $2500 per acre understory restoration costs in 2015 scenarios were extremely expensive. Note that if one did not spend the extra funds to plant and restore the understory, the costs in 2015 would be less, at $884 per acre at the low input cost levels and $1364 per acre for the high cost levels. However, all of these costs are still much more than just planting Loblolly pine, which is probably less than $400 per acre at most for the initial costs, and requires less burning and no understory establishment costs to establish and maintain a stand.

Using the basic low intensity/low costs scenarios we employed for the 2011 analysis, the present value of the costs for converting agricultural land to Longleaf pine stands was $548 per acre at the 4% discount rate. The costs to manage the mature forests then was $447 per acre, discounted to the first year of that mature forest analysis. Thus the combined cost of these scenarios—converting it Longleaf pine, then managing it from that point on (50 years) into perpetuity—would be $665 per acre. Note that the $665 per acre is less than the sum of the above two components, because it is the discounted sum of $548 per acre, already to year 0, plus the $447 per acre discounted from year 50 back to year 0 (e.g. $548 +$447/$(1.04)^{50}$).

Table 13. PV and LEV for Costs to Convert and/or Manage Land for RCW Habitat, 4% Discount Rate

Activity	PV Costs/acre, 2011 (Low Intensity)	PV Costs/acre, 2015 (High Intensity)	
		Low Price	High Price
Converting Land from Agriculture			
Scalping	$40	$40	$60
Herbicide Site Preparation	$80	$80	$120
Pre-plant Prescribed Fire	$20	$20	$30
Longleaf Seedlings	$80	$80	$200
Planting Labor	$40	$40	$60
Herbicide Treatments	None	$50	$70
Early Stand Treatments	$34	$99	$144
Prescribed burns	$14	$139	$209
Understory Restoration	None	$2,000	$2,500
Timber Marking	$14	$14	$20
Timber Inventory	None	$97	$97
Managing Mature Forests			
Prescribed Burns	$92	$160	$240
Herbicide Treatments	None	$104	$156
Timber Marking	$29	$29	$36
Timber Inventory	None	$75	$120
Annual Costs			
Forester Fee	$100	$100	$175
Land Maintenance Fee	$125	$125	$175
RCW Monitoring	$100	$100	$150
PV Cost to Convert Agricultural Land*	**$548**	**$2,884**	**$3,860**
LEV Cost to Manage Mature Forests	**$447**	**$694**	**$1,053**
LEV Cost to Convert Agricultural Land and Manage it into Perpetuity**	**$665**	**$3,036**	**$4,088**
LEV Cost to Replant a Cutover Site with Longleaf Pine & Manage into Perpetuity**	**$800**	**$3,121**	**$4,196**

*Excludes RCW Monitoring Cost

**To calculate this, the costs for managing mature stands were discounted 50 years and then added to the conversion and uniform costs

Required Incentive Payments.—The capital budgeting analysis for 2011 discussed above indicated that the LEV for managing forests for Longleaf pine timber, including both management cost and timber revenues, compared to Loblolly pine timber ranged from $56 to $699 per acre. For agriculture, the 2011 differences between Longleaf pine and optimistic agriculture returns were $1,757 to $4,158 per acre. These results led us to conclude then that landowners were very unlikely to convert average quality agriculture

land to forest land. The 2015 data indicate that crop production profits decreased substantially, reducing the differences between agricultural and Longleaf pine returns for the low intensity scenario to about $900 to $1200 per acre.

Based on our input cost data for individual practices, total costs for management of existing mature stands ranged from $447 per acre for low intensity management in 2011 to $1,053 per acre for high cost, high intensity management. Converting agricultural land was more expensive and ranged from $548 per acre in 2011 to $3,860 per acre in 2015. The LEV for replanting cutover forest sites was slightly higher, ranging from $800 in 2011 to $4,196 per acre in 2015.

The net discounted benefits of the timber and pine straw harvests for Longleaf pine forest rotations in 2011 were $156 per acre (Glenn 2011). Subtracting these returns from the total costs in Table 13 provides an estimate of the LEV of costs plus returns for restoring or establishing Longleaf pine habitat for the 2011 and 2015 scenarios. Note that the greater costs shown for 2015 are mostly caused not by price differences, but rather by a more expensive set of practices, including shrub establishment and more frequent burning and herbicide applications.

Table 14 then summarizes the calculations we made and the annual incentive payments that would be required to pay the opportunity cost between the current land use and converting those lands to Longleaf pine under our low intensity and high intensity management regimes.

So, the bottom line of Table 14 is that high costs for Longleaf establishment will require greater incentive payments to break even. The low intensity management regime with annual cost share payments and a 50% establishment cost rate, which has fewer management inputs and costs, might require incentive payments of about $27 to $79 per acre per year for 10 years to establish and grow Longleaf pine. In addition, converting mature forests also might possibly have incentive payments that are reasonable, ranging from $27 to $98 per acre per year for 10 years plus 50% of establishment costs.

Table 14. Annual Incentive Payments Required to Pay the Opportunity Cost Between the Current Land Use and Converting those Lands to Longleaf Pine

Management Scenario	**Low Intensity**	**Hi Intensity/ Low Price**	**Hi Intensity/ High Price**
	- - - - - $/acre - - - - -		
LEV of Costs/Scenario			
Mature Forest	447	694	1053
Ag Land Conversion	665	3036	4088
Cutover Forest Replanting	800	3121	4196
LEV of Costs + Longleaf Pine Returns of $156			
Mature Forest	291	538	897
Ag Land Conversion	509	2880	3932
Cutover Forest Replanting	644	2965	4040
Required Incentive Payment for 10 Years at 4% Discount Rate			
Mature Forest	36	66	111
Ag Land Conversion	63	355	485
Cutover Forest Replanting	79	366	498
Cost Share Payments			
Mature Forest Burn + Herbicide Base Costs	70	70	105
Cost Share Rate at 50% of Initial Base Cost	35	35	53
Establishment Costs in Year 0	300	2300	2800
Cost Share Rate at 50% of Establishment Costs	150	1150	1400
Required Incentive Payment for 10 Years at 4% Discount Rate + 50% Cost Share			
Mature Forest	27	58	98
Ag Land Conversion	44	213	312
Cutover Forest Replanting	79	366	498
Annual Payment Multiplier at 4% Times Cost =		0.123290944	

The high intensity management regimes, even with payment of 50% of establishment costs, would require much greater annual incentive payments, ranging from $213 to $498 per acre per year. Establishing the understory is by far the greatest expense in these costs,

at the initial costs of $2000 to $2500 per acre. Not performing understory establishment, however, would lop off $250 to $300 per acre per year of the required payments for low intensity and high intensity management, respectively. These annual payment costs would also then be less than $100 per acre per year in all but the high intensity, high cost regime.

Increasing Existing Longleaf Pine Habitat in Mature Stands

As noted before, prior to European settlement, Longleaf pine occupied approximately 92 million acres (37 million hectares) of the Southeast U.S., of which 74 million acres were Longleaf dominant and 18 million acres were mixed-species stands. Such activities as agriculture, open range grazing by livestock, logging, production of turpentine and elimination of naturally occurring wildfires have reduced this amount by approximately 97% over the last 400 years (Frost 1993). The current Forest Inventory and Analysis (FIA) data can be accessed to estimate the actual Longleaf pine areas now, using the EVALIDator forest inventory data set building tool (USDA Forest Service 2015).

We used EVALIDator to estimate the amount of Longleaf pine habitat within the counties covered by the landowner survey. There are approximately 191,500 acres of Longleaf pine (sampling error of 16.05%). Table 15 provides a summary of old growth forest that could be suitable for RCW habitat and converted as mature forests with the treatments described above. This includes both Longleaf pine types and for Loblolly pine types for age classes between 41 and 80 years old. The Longleaf estimates do have considerable variability, but the standards errors are approximately 20% or less.

Table 15. Mature Longleaf and Loblolly Forest Types in the 38 Study Counties, 2015

Forest Type/Age	41-50 Years	51-60 Years	61-70 Years	71-80 Years	Total
	- - - - - - - Acres - - - - - -				
Longleaf Types	35,481	64,685	21,427	52,713	174,306
Loblolly Types	247,366	229,431	129,838	109,114	715,749
Total	282,847	294,116	151,265	161,827	890,055

Source: EVALIDator 2016. Longleaf type data include Longleaf pine, Slash pine, Longleaf pine/oak, and Pond pine. Loblolly type data include Loblolly pine and Loblolly pine/hardwood.

These data indicate that there are about 174,000 acres of mature Longleaf forest types within the 38 landowner survey counties that could be improved for red cockaded woodpecker (RCW) habitat. Similarly, there are about 716,000 acres of mature Loblolly pine forest types. These two types would then total about 900,000 acres of potential older growth stands that could be useful for RCW habitat in the 38 counties. Most scientists believe that old Loblolly pine also could serve as adequate, if not ideal, habitat for RCWs if that were the primary purpose of habitat restoration. This would provide a much greater total area for RCW opportunities. However, if one were seeking to establish the full range of ecosystem benefits provided by Longleaf, there are fewer mature forest to work with.

One could also estimate the costs of these different treatments times their number of acres times the cost of conversion to estimate a supply curve for converting mature stands. In fact, we also could do the same for estimating the total acres of Loblolly pine forests in the region, total Longleaf pine forests, and total agriculture land. The study proposal indicated that we would do this, but in the end the result was astronomical, so we have eschewed reporting these details. For reference, the 38 counties had a total of (EVALIDator 2015, USDA NASS 2015):

Forest land	4,242,055 acres
Longleaf pine forest land	191,523 acres
Loblolly pine forest land	2,950,424 acres
Farm Land	3,588,032 acres
Total Farm and Forest Land	7,830,087 acres

The total estimated cost of converting all the mature lands and replanting all the longleaf and loblolly pine lands and all the agriculture land literally totaled more than $30 billion, which is of course far beyond any reasonable cost that could be subsidized in 38 counties by the Farm Bill or other private programs. So maybe the bottom line on the land area/supply is that there is plenty of land in the counties that could be restored or converted to Longleaf ecosystems if landowners were interested, land management hurdles could be overcome, and adequate inventive payments could be made.

Longleaf Supply Discussion

Environmental credit markets are voluntary programs that engage private landowners through economic incentives in order to promote habitat conservation. Their success largely depends on the ability of policy makers, landowners, extension agents, or perhaps credit brokers to understand and accommodate the participants' needs and craft payments and contracts accordingly. This component of our CIG grant provides a multifaceted analysis of the supply side of a potential ecosystem based credit market to promote Longleaf pine habitat in Southeast U.S.

In brief, our results indicate that previous experience in cost-share benefit programs and specific landownership traits may lead to greater interest in a conservation credit program to promote Longleaf pine. Both the logistic regression and choice based conjoint (CBC) statistical analyses revealed that landowners are very concerned about program requirements such as contract length and legal obligation in a conservation contact. This makes intuitive sense because landowners seldom want to tie up their land with permanent easements to restrict their opportunity to sell part or all of their land for a profit, or bequeath it to their heirs. Much of the sampled population was at or near retirement and may be concerned with inheritance in particular. Some may still prefer to conserve the land into perpetuity, but that was less common based on our sample.

The CBC analysis also revealed the relative role that key factors play in encouraging participation. Short term contract agreements were favored, with 5 and 10 year contracts each being the most highly rated of all factors identified, and 30 year agreements being the least favored. No obligation and the baseline obligation were acceptable; increasing obligations were not. Annual payments were somewhat less important than contract agreement or level of obligation, and higher payments were more desirable as expected. The initial cost share rate and type of assistance were the least important factors affecting willingness to participate in Longleaf conservation programs. More technical assistance

and higher cost share rates were favored, but had a much smaller CBC attribute score payments, obligations, or contract length.

The surveys and statistical analyses revealed that agricultural land size, farm/forest plans, and present use valuation were not statistically important factors determining interest in a new Longleaf pine program. Nor were age, gender, income, education significant. Some "lack" of significance of planning and demographic factors may be due to sample bias toward assisted and engaged landowners. This is mostly good news. Program factors we can control are key to getting landowners to enroll. Demographics not problematic. Thus we mostly need to find interested landowners, with medium forest owners as better prospect, and get the policy right and funding levels high enough to attract landowners, while minimizing the legal obligations and length of commitment required.

The financial and capital budgeting analysis expanded on this by providing insight into the opportunity cost of managing for conservation as compared to timber or agriculture production. For Longleaf pine versus Loblolly pine, the incentive payment required for landowners to plant Longleaf in the 2011 analysis at a 4% discount rate, was between $7/acre and $83/acre per year, not including establishment costs. If establishment costs of $306 were paid, Longleaf returns would exceed Loblolly returns for the higher site indexes and pine straw raking scenarios.

Costs were much more expensive for the more intensive 2015 Longleaf economic analyses, being several times greater than the low intensity 2011 costs. The 2015 analysis also examined costs to convert mature pine forests to high quality Longleaf or even Loblolly habitat for open grown pine conditions that would favor RCW habitat. The 2015 intensive management costs ranged from $694 to $1053 for conversion of mature forests to open grown systems, up to $4196 for planting cutover forest sites. The required incentive payment for these management regimes would be $66 to $496 per acre per year, which are prohibitive at the high end. However, if the initial year costs for mature forest conversion of Longleaf pine or for tree planting received a 50% cost share rate, required annual payment costs could decrease somewhat. And last, if the very expensive shrub establishment practice were dropped, even the intensive Longleaf annual payment rates for mature and planted stands could decrease to less than $100 per acre per year, which is at least in the Farm Bill Program ballpark.

Limitations and Conclusions

The project findings discussed above help clarify the current program and economic factors that affect landowners in converting their forest or farm land into longleaf pine habitats. Various assumptions in the analyses, or broader regional economic, macroeconomic, and social factors could affect these conclusions, so bear mentioning.

The findings suggest that the low intensity establishment and management costs such as we found in 2011 could be used first to get Longleaf plantations in the ground. The higher 2015 high intensity approaches are more expensive, but could be acceptable with high enough cost share payments. Shrub establishment is the biggest cost by far in our 2015 analyses. So perhaps one could use low intensity approaches such as analyzed in 2011, and get the trees established first. Landowners could even rake pine straw in the initial years in order to generate and income and attract them to Longleaf, then convert to conservation uses later in the stand life. In 30 or 40 years, one could come back and work on shrub establishment as part reforestation of more mature stands. This could break up the costs into manageable components, for landowners and for government programs.

One microeconomic caveat is that we used a standard 4% real discount rate (4% greater than inflation) in our economic analyses of comparisons, which should be pretty good based on comparable stock market and average agriculture returns in North Carolina. However, if landowners used a higher alternative rate of return, it would probably take a higher cost share rate and annual payments for Longleaf to break even with other uses. On the other hand, lower discount rates would tend to favor Longleaf land uses more. A related microeconomic change in the returns due to increased pressure for short rotation Loblolly pine or hardwood crops to supply fiber for wood pellets also could make conversions to Longleaf less attractive based on higher opportunity costs.

The microeconomics of fast grown timber for wood pellets presages a broader issue for a host of macroeconomic factors or exogenous shocks that could alter our project findings. Longleaf investments, like any others that occur for 40 years are subject to technology and social changes that are impossible to predict. Thus to ensure the Longleaf habitat is maintained in face of these shifts, we might suggest that efforts to make sure that it can yield financial returns to landowners—such as pine straw, RCW payments, or stacking

some other benefits—is important. In the long run, there is good reason to believe that Longleaf could prosper more because of its adaptability to warmer climates and fire, and even extend its range in the future. These long run factors all might suggest that efforts for long term easements and opportunities for credit stacking should be favored more if there are limited funds and enough willing landowners to commit for longer time periods.

The location and additional value of any lands enrolled also would be important. We talk about conservation credits in the policy component of this report. If a credit ranking system is developed, setting minimum conservation benchmarks and priorities for selecting the best lands—e.g., large areas, near existing RCW colonies—would be important. Even for more traditional incentive programs, these location and habitat characteristics could be incorporated more in making funding decisions.

As noted, restoring old growth stands or establishing new stands without a new shrub component have the best Longleaf financial returns. Purposeful shrub establishment, however, is of course more likely to produce a broad range of ecological and biodiversity benefits. Reviewers noted that species such as Southern hognose snake or Carolina gopher frog are likely to require broader ecological systems than a Longleaf pine straw stand. Thus the higher payments should be used if possible to achieve broad ecosystem benefits soon, rather than just planting Longleaf trees with the hope for natural brush regeneration sometime in the future.

Longleaf might offer other benefits not directly measured in this study. Voluntary incentive programs provide a potentially effective means of encouraging environmental conservation among private, non-industrial landowners. Compared to Loblolly pine or crops, it provides a different income stream and markets for risk reduction purposes; it may prosper more in droughts or even floods; and it provides broad ecosystem benefits. It also does provide pine straw, and can produce higher returns than the conservative estimates we used here. It also can produce superior timber and poles that fetch higher prices than those we used.

Our specific results also can be complemented by knowledge of existing landowner behavior. Landowners have been more than willing to enroll in Farm Bill and state Longleaf pine planting programs, and our findings help suggest preferred contract, payment, and assistance factors. While it is anecdotal, it appears that a recent increase in

tree planting in the South also has a much larger Longleaf pine component than in the past.

As noted, the economic analyses estimated the annual payments and initial cost share rates that represent "breakeven" opportunity costs and the annual payments necessary to make landowners equally willing to grow Longleaf pine for RCW conservation versus for timber production. Converting existing Longleaf stands to longer rotations is probably the easiest of the potential land use changes that owners may consider. It might take even greater annual payments to actually induce landowners to shift from existing Loblolly pine or agriculture systems to Longleaf pine systems, and we could not estimate what the range of that "Longleaf adoption premium" actually is.

However, since landowners are planting lots of Longleaf under the current incentive programs, it might suggest that our 4% discount rate and those incentive programs are already approximating an acceptable level of cost share payments. If so, it is again just more funding that is needed, at least for the landowners in the current segment of the Longleaf habitat supply curve. Like any economic supply, it is probable that higher payments will be needed do landowners at the high price segment of the supply curve, who are not presently considering planting or restoring Longleaf.

Other practical factors—such as likelihood that Longleaf is harder to plant and manage then Loblolly, or that agriculture returns on poor lands have such huge variations and much higher risk—may also have large negative or positive impacts on economic decisions to whether to plant or restore Longleaf. Program delivery and implementation also will. Getting the message right, making applications easy, and providing certainty to landowners that any program strings will not escalate all are important factors that could provide fodder for future projects.

We will continue this line of innovation grant analyses, and work with government and nongovernment agencies and landowners to evaluate and deliver their conservation programs for Longleaf and other open grown pine systems. We would welcome comments and suggestions regarding our findings and conclusions as well.

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Appendix 1. Management Activity Descriptions and Associated Costs for Low and High Intensity Management Regimes, 2015

Activity	Low Intensity Activity Description	High Intensity Activity Description
Converting Land from Agriculture		
Scalping	Initial one time cost at $40/acre	Initial one time cost, from $40 to $60/acre
Herbicide Site Preparation	Initial one time cost at $80/acre	Initial one time cost, from $80 to $120/acre
Pre-plant Prescribed Fire	Initial one time cost at $20/acre	Initial one time cost, from $20 to $30/acre
Longleaf Seedlings	Initial one time cost at $80/acre	Initial one time cost, from $80 to $200/acre
Planting Labor	Initial one time cost at $40/acre	Initial one time cost, from $40 to $60/acre
Herbicide Treatments	None	Initial one time cost, from $50 to $70/acre
Early Stand Treatments	Burns in years 3 and 5 at $20/acre	Herbicide treatment in year 2 (from $70 to $100/acre), burns in years 3 and 5 (from $20 to $30/acre)
Prescribed burns	Every 5 years, starting in year 5 and ending in year 75, at $20/acre	Every 3 years, starting in year 5 and ending in year 74, from $20 to $30/acre
Understory Restoration[1]	None	Initial one time cost (from $2,000 to $2,500/acre)
Timber Marking	Once in year 40 and 60 at $40/acre	Once in year 40 (from $50 to $75/acre) and again in year 60 (from $40 to $50/acre)
Timber Inventory	None	Once every 13 years, starting in year 13 at $70/acre
Converting Land from Timber		
Site Preparation Burn	Initial one time cost at $40/acre	Initial one time cost, from $40 to $55/acre
Drum Chop	Initial one time cost at $100/acre	Initial one time cost, from $100 to $130/acre
Herbicide Site Preparation	Initial one time cost at $80/acre	Initial one time cost, from $80 to $120/acre
Longleaf Seedlings	Initial one time cost at $80/acre	Initial one time cost, from $80 to $200/acre
Planting Labor	Initial one time cost at $40/acre	Initial one time cost, from $40 to $60/acre
Early Stand Treatments	Burns in years 3 and 5 at $20/acre	Herbicide treatment in year 2 (from $70 to $100/acre), burns in years 3 and 5 (from $20 to $30/acre)
Prescribed burns	Every 5 years, starting in year 5 and ending in year 75, at $20/acre	Every 3 years, starting in year 5 and ending in year 74, from $20 to $30/acre
Herbicide Treatments	Every 10 years up to year 70 at $50	Every 10 years up to year 70, from $50 to $75/acre
Understory Restoration[1]	None	Initial one time cost (from $2,000 to $2,500/acre)
Timber Marking (three times)	Once in year 40 and 60 at $40/acre	Once in year 40 (from $50 to $75/acre) and again in year 60 (from $40 to $50/acre)
Timber Inventory (every 13 years)	None	Once every 13 years, starting in year 13 at $70/acre
Managing Mature Forest		
Prescribed Burns	Every 5 years at $20/acre	Every 3 years, from $20 to $30/acre
Herbicide Treatments	None	Every 10 years, from $50 to $75/acre
Timber Marking	Every 22 years at $40/acre	Every 22 years, from $40 to $50/acre
Timber Inventory	None	Every 13 years, from $50 to $80/acre
Annual Costs		
Forester Fee	Annual fee at $4/acre	Annual fee, from $4 to $7/acre
Land Maintenance Fee	Annual fee at $5/acre	Annual fee, from $5 to $7/acre
RCW Monitoring	Annual fee at $4/acre	Annual fee starting in year 50, from $4 to $6/acre

1 - This practice may not be necessary in all fields.

Activity and cost data provided by the North Carolina Forest Service. Costs are estimates based on certain land characteristics and are likely to vary from site to site

Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina

Model Ecosystem Credit Program Final Report
Component Report 5 of 6

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Model Ecosystem Credit Program

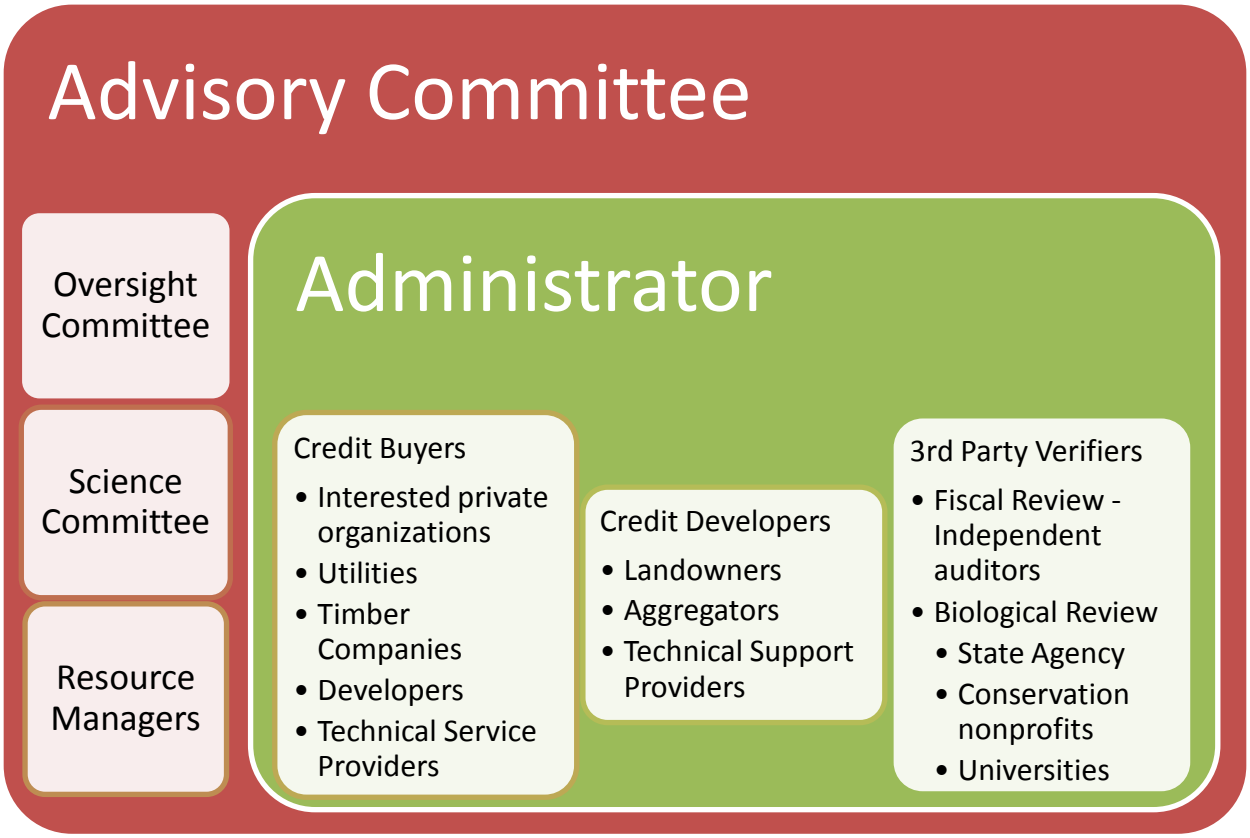
Several conservation programs exist to offset impacts to natural resources, such as wetland mitigation banks, water quality certainty programs, and habitat exchanges. In landscapes that are dominated by smaller acreage private landholdings, like what is found in eastern North Carolina, a strong aggregator network can be critical. Aggregating credits greatly increases the successful involvement of the credit demand entities with large purchasing power. An aggregator system can help combine the contributions of many small owners who do not have direct market knowledge or access, while also focusing efforts in a particular geographic area.

Several different types of conservation benefits programs across the nation were evaluated related to species recovery, water quality improvements, and agricultural sustainability. Evaluations included online research and interviews with selected programs. Attached is a set of case studies (Attachment 1) and a summary chart of programs (Attachment 2) evaluated and for the programs where the greater amount of information was available. The most holistic approach taken today is the State of Nevada as defined in their Conservation Credit System Manual Version 1 dated 12.12.14. The rest of this article is a description of a model program's organizational structure based on lessons learned during the evaluation and input gathered from stakeholders.

Model Ecosystem Credit Program – Organizational Structure

An ecosystem credit program will need a complex, integrated organizational structure to establish, deliver, maintain, monitor, and report progress on providing an ecosystem service. The types of detailed administrative requirements needed are described here. An organizational chart is provided in Figure 1.

Figure 1. Model Ecosystem Credit Program Organizational Structure



Advisory Committee: Oversees programmatic integrity and reports back annually to the public. The Advisory Committee consists of a variety of stakeholders that serve on the Oversight Committee and the Science Committee. The Oversight Committee makes recommendations to the Advisory Committee on process, policy and fiscal issues. The Science Committee makes recommendations to the Advisory Committee on biological and natural resource issues.

Resource Manager: Agencies with a regulatory responsibility to manage the program's specific ecosystem and all species of concern within the scope of the program. Resource Managers, through frequent stakeholder engagement, ensures programmatic functions are in accordance with all current laws, regulations and policies.

Administrator: Facilitates day to day program management including overseeing all credit generation and transactional activities. The Administrator ensures consistent processes in operational management, issues certified credits, and reports results on a regular basis to the Advisory Committee.

Credit Developer / Aggregator: Landowners or managers, or organizations acting as credit aggregators to produce or register credits in the Ecosystem Credit Program. Aggregators are entities that work with multiple landowners to leverage credit activities across a larger landscape than the individual landowner leading to a net gain in credit value.

Credit Buyers: Entities that purchase credits to satisfy regulatory obligations or to the ensure conservation value and longevity of the ecosystem by being good environmental stewards.

Technical Support Providers: Entities with the technical expertise in conservation planning, project design and understanding the Ecosystem Credit Program participation processes are eligible to assist Credit Buyers or Credit Sellers.

Verifier (Third Party Reviewer): Third party entities that assess the accuracy of the credit and debit calculations as well as the habitat gains realized.

Model Ecosystem Credit Program – Partners and their roles

Advisory Committee

The Advisory Committee functions as the oversight organization or Board of Directors for the Ecosystem Credit Program. The Advisory Committee provides instructions for programmatic changes to the Administrators based on best available science and stakeholder input. The committee consists of various stakeholders divided into an Oversight Committee for policy and programmatic delivery decisions and a Science Committee for science based process decisions related to habitat improvements. Below is a table of member categories as well as North Carolina example agencies (Table 1).

Oversight Committee

The Oversight Committee is responsible for overseeing the operations of the Ecosystem Credit Program, making overarching management decisions and conducting other critical ongoing duties related to performance and adaptive management.

Program Performance Functions

- Establishes and updates Memorandums of Understanding with participating organizations
- Oversees the Administrator's implementation of the Credit System's policy and technical aspects
- Evaluates Annual Reports as prepared by the Administrator including an assessment of credit projects' effectiveness and overall programmatic performance goals
- Executes annual audits of the Administrator's finances and operations regarding crediting and debiting processes
- Implements corrective actions based on findings of the annual audits
- Serves as dispute resolution as needed between participants

Adaptive Management Functions

- Evaluates Credit System improvements including habitat metric models, implementation processes and participant engagement
- Evaluates input from the Administrator and Science Committee on new scientific information, incorporating aspects annually
- Approves all adaptive management actions

Science Committee

The Science Committee consists of species and ecology experts that determine best practices and project baseline protocols based on sound science. The Science Committee prioritizes and defines monitoring processes, measures conservation recovery objectives, and makes recommendations on adaptive management.

Key Committee Functions:

- Compile and analyze the best available science regarding habitat functions as it relates to species of concern through adaptive management processes
- Assists the Oversight Committee regarding recommendations for revisions to habitat metric models and implementation processes

Table 1. Model Ecosystem Credit Program Advisory Committee Recommendations

Organizational Type	North Carolina Recommendations
Federal	US Department of Interior Fish and Wildlife US Department of Agriculture Natural Resources Conservation Service
State	NC Department of Agriculture and Consumer Services NC Department of Natural and Cultural Resources NC Department of Transportation NC Forest Service NC Wildlife Resources Commission
Local	NC Association of County Commissioners NC Association of Soil and Water Conservation Districts Voluntary Agriculture District Boards
Academia	NC Cooperative Extension NC State University Duke University Nicholas Institute
Environmental Nonprofits	Environmental Defense Fund The Nature Conservancy NC Longleaf Coalition The Conservation Fund
Commodity Advocacy Groups	NC Farm Bureau Federation NC Forestry Association
Private Sector	Farm Credit Associations of North Carolina NC Electric Cooperatives Duke Energy
Partnerships	South Atlantic Landscapes Conservation Cooperative

Administrator

The Administrator implements the Ecosystem Credit Program, making day-to-day management decisions based on the programmatic guidelines of the Advisory Committee. A variety of organizations can serve in this role but for optimum program flexibility and to maintain neutrality, project partners recommend an independent third party nonprofit.

Program Administration & Credit Accounting:

- Manages day-to-day Ecosystem Credit Program operations
- Manages all Ecosystem Credit Program resource tools, website, guidance documents, and application forms
- Manages credit accounts and the complete ledger of all credits and debits
- Manages accounting of reserve account credits
- Protects participant confidentiality

Credit Developer and Credit Buyer Engagement:

- Maintains programmatic transparency of processes and stakeholder engagement

- Responds to inquires of interest from Credit Buyers, Credit Developers, and Aggregators
- Ensures all necessary outreach to Credit Buyers, Credit Developers, and Aggregators occurs on a frequent basis

Adaptive Management and Reporting:

- Develops an annual performance report that documents achievements versus goals and a reporting of all finances; all individual credit project data is reported at an aggregated level
- Compiles Improvement Recommendations regularly, including updates to resource tools, and reports results to the Advisory Committee for consideration
- Implements programmatic revisions as adopted by the Advisory Committee, including updates to resource tools and credit metric methods

Compliance and Enforcement:

- Performs quality control reviews on information submitted by Ecosystem Credit Program participants and Verifiers
- Ensures programmatic compliance of the Ecosystem Credit Program as defined in Memorandums of Understanding with participating agencies and all applicable federal, state, and local laws
- Works with Credit Developers to implement corrective actions through remedial action plans in cases of intentional and unintentional credit reversals
- Enforces contract compliance and any associated penalties in cases of intentional credit reversals

Financial and Contracting Support:

- Manages funds, contracts, and monitoring partnerships
- Confirms financial assurances are in place for all credit projects
- Facilitates credit auctions or Request for Proposals for Credit Buyers
- Administers contract payments between Credit Buyers and Credit Developers
- Maintains a credit reserve account for use during unintentional credit reversals and to ensure an overall ecosystem net gain is maintained

Science and Technical Support:

- Gains input from the Science Committee on new scientific information to be incorporated into the Ecosystem Credit Program's tools and processes
- Defines questions and makes recommendations to the Advisory Committee to guide monitoring and research investments
- Trains and certifies Verifiers
- Evaluates results of any effectiveness monitoring established for credit and debit projects

Resource Managers

Each federal and state agency with regulatory responsibility for the management of the specific ecosystem and its species of concern determines if program participants will gain regulatory certainty for each credit project. It is advisable that participation guidelines be developed through the use of Memorandums of Understandings so that Credit Buyers and Credit Developers are given a framework to operate within, with the end goal of being provided some level of regulatory certainty.

Specific to the Endangered Species Act (ESA) the following actions are considered:

- For habitat work related to a threatened species listing, a 4(d) rule may be drafted to exempt credit development activities from ESA requirements. The 4(d) rule could include exemption from take requirements or exempt some agricultural and forestry activities.
- If a 4(d) rule is not forthcoming, Credit Buyers may receive protection by the use of Incidental Take Permits or Certificates of Participation in individual or regional Habitat Conservation Plans. Take protection consideration for Credit Developers when a 4(d) rule is not issued is a necessary component but additional agency discussions are needed for this to be a viable option.

Credit Developer / Aggregator

Credit Developers either own eligible land or act as a representative organization for a cluster of private lands. Credit Developers self assess the value of the credits on a given property by the following actions, with all work certified by the Administrator:

- Conduct a site eligibility assessment using an Advisory Committee approved habitat metric model based on sound science.
- Determine the percent of acreage that exhibits specific habitat function thresholds (functional acres); results are supported by field data.
- Establish baseline data as well as credit type and duration being offered; credit type and duration is supported by a defined level of protection for the credit acreage (conservation easement, term easement, declaration of restrictions, conservation agreement, land use contract, best management practice maintenance agreement, or other similar documents).
- Develop a land management plan following applicable state or federal best practices; Candidate Conservation Agreements and Candidate Conservation Agreements with Assurances are recommended if the credit is used for any regulatory requirements.
- When the acreage under consideration is enrolled in existing state or federal conservation programs, determine that applicable credits are beyond actions taken for participating in other conservation programs.
- Determine contributions to the credit reserve account and establish financial assurances for long-term management costs.

Credit Buyers

Credit Buyers participate to satisfy a regulatory requirement or to act as good environmental stewards by ensuring the conservation values and longevity of the ecosystem. By utilizing the Ecosystem Credit Program, Credit Buyers are assured a level of accountability and transparency allowing Credit Buyers to accurately report to their audiences regarding return on investment. Depending on the investment goals of the Buyer, the following characteristics are considered; type of credit to purchase, purchasing thresholds related to desired conservation gains, and life of purchases credits. The Credit Buyer can also use a variety of vehicles to buy credits such as a direct purchase, a reverse auction process, Request for Proposals, or selection from a master list maintained by the Administrator.

If credits are purchased for regulatory compliance the following steps may need to be taken, all of which are done in conjunction with the Administrator and the appropriate Resource Manager:

- Determine the value (functional acres) of the ecosystem at the area of impact using the habitat metric models and assess the additional amount of credits to be set aside in the credit reserve account.
- Document the current value of the ecosystem prior to project implementation in a Baseline Report.
- Determine if there is a necessary distance proximity being required from the debit credit site and the offsetting credit site.
- Determine the length of time the credits are needed to offset impacts.
- Determine the necessary level or protection of the credit acreage (conservation easement, term easement, declaration of restrictions, conservation agreement, land use contract, best management practice maintenance agreement, etc.).

Technical Service Providers

Several entities can serve as Technical Service Providers from private consulting firms to state and local conservation agencies. Technical Service Providers receive designation from the Advisory Committee through a vetting process. Technical Service Providers perform the following tasks; design credit projects or estimate credit obligations, and utilize all programmatic tools in a streamlined approach to account for all credits and debits. Technical Service Providers submit work to the Administrator allowing for an expedited implementation process.

Verifier

All Ecosystem Credit Program projects require verification of the credit estimates from a third party expert entity. The purpose is to provide confidence to all Ecosystem Credit Program participants and the public that credit calculations represent a faithful, true and fair accounting of environmental impacts and benefits. Ongoing verification over time is necessary to ensure the project supports the expected level of environmental enhancements. Continuous monitoring is required for best management practice functionality, credit accounting, and funds accounting. The Advisory Committee needs to determine acceptable levels of verification prior to opening the program up for enrollment.

A variety of organizations can fulfill this role including local, state and federal conservation agencies, nonprofits, or private consulting firms. If the Verifier is from an organization with a seat on the Advisory Committee, a clear separation of individual staff duties is necessary to avoid potential conflicts of interest. An Aggregator organization cannot serve the role of a Verifier. The Verifiers receive certification from the Advisory Committee through a vetting process.

Project aspects to be assessed by the Verifier include:

- Verify that the Ecosystem Credit Program processes were followed accurately.
- The amount of credit issued is accurate according to on-the-ground conditions and complies with the habitat metric methods.
- All accounting is supported by documentation and a documentation process is in place for the life of the credit project.
- Historic management activities are certified complete and future management activities are scheduled in a realistic timeframe to achieve continued compliance with the desired habitat metrics.
- Notify the Administrator of any out-of-compliance issues and develop a draft corrective action plan.

Model Ecosystem Credit Program Processes

Crediting Process

Credits - Credits are a quantifiable unit of habitat measured as the difference in the baseline functional acres and post-project functional acres. A Credit Developer can offer acreage as is; it is assessed for its habitat functionality. A Credit Developer can agree to habitat enhancements which can be done at the onset of the project or at the onset and into the future. A credit with agreed to future habitat enhancements will have a greater financial value. Credits can be purchased for offsetting future year projects with habitat impacts or to “bank” for anticipated impacts, but there is no regulatory assurance given that future impacts can be offset by the past purchased credits.

Debits – Debits are a quantifiable unit of habitat loss measures as the difference in the debit baseline functional acres and the post-project functional acres times a mitigation ratio. To ensure net habitat gains for the ecosystem, debits and credits should be traded at a ratio higher than a 1:1 ratio. Since this report is designed to define a model program and is not meant to be ecosystem specific, no actual trading ratio is provided. Project partners recommend that the trading ratio be established per each program through a consensus building stakeholder driven process. Project partners do recommend consideration of a dynamic offset approach in that a series of time-limited credits are purchased and the location changes over time. The process can provide for a certain number of credits to "come online" each year, the Credit Buyer is not allowed to over purchase credits on the front end to opt out in later years.

Credit Type – Two types of credits exist, a Stewardship Credit where existing conditions are preserved or a Restoration Credit where credits have a management component to enhance the existing habitat. Credits are calculated using the habitat metrics model to determine functional acreage. An assumed mitigation ratio enables each project to achieve net environmental benefits. The type of protection document put in place will determine the credit's durability and duration. Protection documents in order of enforcement strengths include fee simple purchases, perpetual conservation easements, term conservation easements, declaration of restrictions, conservation agreements, and best management practice maintenance agreements. At the end of the credit's lifespan it can be renewed at a new negotiated rate and an updated land management plan.

Process Steps – Credit Developer

1. The Credit Developer will select and validate the site for crediting by using a validation checklist. The proposed project is submitted to the Administrator for concurrence.
2. The Administrator will quantify the expected number of credits using the habitat metrics model and define any habitat improvement best management practices.
3. The Verifier will confirm the Credit Developer's project followings program protocols and the credits are calculated correctly.
4. The Credit Developer will submit registry information to the Administrator. The Administrator reviews the documentation and issues credits to the Credit Developer's account on a credit system registry.
5. The Administrator tracks credits and approves transfers to Credit Buyers accounts.
6. For the life of the project, the Credit Developer conducts regular monitoring, reporting all results to the Administrator.

Process Steps – Credit Buyer

1. The Credit Buyer defines their investment goals based on internal processes or through a negotiated mitigation offset project with a regulatory agency.
2. The Credit Buyer registers their debits with the Administrator's credit system registry.
3. The Credit Buyer identifies eligible projects with assistance from the Administrator. The project's selling value is a negotiated rate between the Credit Developer and the Credit Buyer.
4. Transaction fees and credit costs are transferred to the Administrator at the time of crediting. The total project cost includes the value of implementing the project, executing annual adaptive management practices, a transfer component and a per credit component.

Additional Accountability and Assurances Processes

Both Credit Buyers and Credit Developers need a certain level of certainty that the credit will function into the future for the set number of years it is needed for. The following steps are recommended:

Reserve Credit Account – Some credits are set aside in every project into a pool of credits ensuring an overall net benefit. Reserve credits can be used to temporarily offset unintentional project failures. The credits are temporarily removed from the account to cover nonperforming credits, the nonperforming credits are brought up to performance standards, and the reserve credits are added back into the reserve account. A minimum credit reserve recommendation is 10% of the total project credits.

Credit Verification – Developers perform annual monitoring and submit an annual self-certification to the Administrator. Credits are verified multiple times by a Verifier; before it is registered on the credit registry, every 5^{th} year required with annual spot checks, at the time the credit is released.

Financial Assurances – Fiscal mechanisms are put in place to insure the long-term viability of the credit, referred to as stewardship funds. The allowable investment vehicles and use of the funds are recorded in a contract, with management activities defined in a habitat management plan.

Intrastate Programs – As the program grows larger, it is important to be able to accurately share information through all levels of participation. It is recommended that project developers consider an on-line registry. For example, five models of registries and their web sites that address ecosystem markets follow:

- ✓ The Markit Environmental Registry: www.markit.com/Product/Registry
  Maintained by Forest Trends www.ecosystemmarketplace.com

- ✓ California Department of Fish and Wildlife Ecosystem Services:
  www.wildlife.ca.gov/Conservation/Planning/Banking/Approved-Banks

- ✓ California Air Resources Board (CARB) Compliance Offset Program:
  www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm

- ✓ California Air Resources Board (CARB) Early Action Projects:
  www.arb.ca.gov/cc/capandtrade/offsets/earlyaction/projects.htm

- ✓ Michigan Wetland Bank Registry:
  www.michigan.gov/documents/deq/lwm-wetlands-regOct08_255104_7.pdf

Overarching Programmatic Costs

Program costs for a ecosystem credit program are crucial. For example, carbon project ecosystem services providers in the California Air Resource Board market may charge about 15% to 20% of the total landowner payment price to broker a carbon project. An agency also will have significant costs, as estimated below. Potential program costs are provided here based on our previous experience so that agencies and policy makers can consider the costs of program management. These values are only estimates based on firsthand knowledge of project partners and cannot be relied on as a definitive cost to establish and Ecosystem Credit Program. Costs will vary geographically and increase over time.

Table 2. Estimated Annual Budget - *Assume 10 county geographic service area*

Category	Subcategory	Costs Year 1 = $430,000	Costs Year 5 = $145,000
Administration	Oversight Part Time Executive Director (part time to quarter time)	$53,000	$27,000
	Oversight Part Time Finance Officer (part time to quarter time)	$32,000	$16,000
	Program Delivery – Biologist (full time to part time)	$84,000	$42,000
	Travel	$10,000	$5,000
	Equipment & Supplies (upfront to annual cost)	$50,000	$10,000
Landowner Engagement	Local Agents – Soil and Water Conservation Districts	$100,000	$10,000
Training	Provided to aggregators and technical service providers; habitat management training provided to credit suppliers	$20,000	$5,000
Marketing	Cooperative Extension Service - general outreach and technical manual development	$50,000	
Verifiers Credit Accounting	Credit / Debit auditing by independent CPA	$20,000	$20,000
Verifiers Credit Biological Integrity	State Agencies or Nonprofits contract work	$11,000	$10,000

It was noted by stakeholders with experience running habitat exchange programs that operational costs generally run $500,000 in the early years and drop by 20% in future years. Another unexplored cost saving measure is to bundle the program with existing certification programs for credit verification.

Other cost items not included in the budget are project specific and would be part of the crediting cost;

- Habitat management assurance fund (stewardship)
- Credit insurance pool
- Legal expenses and contingency

A Discussion on the Role of Conservation Districts in an Ecosystem Credit Program

Soil and Water Conservation Districts (Districts) play a critical role in conservation activities on private lands in North Carolina. The first district in the nation was formed in 1937 Anson County, North Carolina. For the past 75 plus years, Districts have been at the forefront of locally led conservation initiatives. NC Districts do not take on a regulatory role although statutory authority exists. A few exceptions are noted for urban Districts that work with erosion and sediment control programs. NC Districts have not traditionally managed programs that are wildlife focused. Much of the their programs focus on water quality, water quantity, and soil improvements. Some conservation programs include best management practices with a wildlife component as a secondary consideration, with the exception of USDA Farm Bill programs such as the historic Wildlife Habitat Improvement Program. For wildlife focused programs, USDA has partnered with the NC Wildlife Resource Commission to provide field biologists. The concept of an Ecosystem Credit Program was something that Districts did not possess a working knowledge of as far as management issues related to threatened and endangered species.

NC Districts were exposed to being a local delivery point for ecosystem services on private lands through a pilot project with the military. The Market Based Conservation Initiative tested alternative tools for working with private landowners to maintain lands in compatible uses under a military flight-training path. A nontraditional partnership formed at the nexus of promoting profitable and sustainable family farms and forests, promoting natural resource conservation, and supporting the military mission. Districts in eastern North Carolina engaged over 4,000 landowners across over 600,000 acres underlying a specific military training flight path. Districts offered orientation workshops, collected applications, and verified information provided. The pilot project operated as a reverse auction process with staggered bid rounds in multi-county clusters. Landowners determined their level of commitment by selecting 10, 20, or 30-year options to place land use restrictions on their property for a requested set price per acre per year. Over 75,000 acres were offered for enrollment. The pilot program's outreach was successful in that NC Districts are a trusted information source for private landowners.

The project area used for sampling Districts includes 33 eastern North Carolina counties that are located within the traditional range of the longleaf pine. In each of these counties, the boundary of the local soil and water conservation district coincides with the county political boundary. Therefore, all districts in the study are single county districts. Eight soil and water conservation districts were visited, resulting in a 24.2% sample rate. The following goals were applied when selecting the local districts to visit:

- Achieve geographical distribution throughout the project area
- Select districts with varying staff sizes and size of on-going programs
- Select districts that did not participate in MBCI to eliminate bias associated with other experiences with ecosystem service type projects

After applying the above-mentioned goals, the following local soil and water conservation districts were selected: Moore, Cumberland, Wayne, Wilson, Pitt, Bladen, Richmond, and Craven.

Face to face visits were made to each district during a regularly scheduled district board meeting. In each district visited, a full complement of 5 supervisors was in attendance and on average two district/NRCS staff were present. Time was set aside on the agenda at each meeting for focused discussions, allowing time for discussion and questions.

In each visit, basic project information covered the following: project background, need and purpose of the project, what will be learned, partnering agencies and organizations in the project, brief explanation of element leads (i.e. supply side, demand side, economics, landowner survey, etc.) and general time line. In addition, the project brief was provided. District supervisors and staff were asked to study the project brief on their own and further discuss the project as an agenda item at an upcoming board meeting. As closure, each district was asked to complete the brief survey that was left with the district and return it to the Association office.

District Survey Responses

Of the Districts that responded, they represent 15% of the Districts in the project area. Because of the commonality of districts concerning their experience with and knowledge of ecosystem services and ecosystem crediting, it is believed that the composite information gathered is representative of the majority of the districts in the project area. The following general observations and conclusions are made from reviewing the composite data:

- There is a general lack of understanding among soil and water conservation districts regarding conservation credit trading and opportunities for expanded ecosystem services that could be offered through districts. If local districts are selected as the point of delivery for a program similar to that studied through the CIG grant, considerable time and effort

will be needed in training and information share before local districts are fully comfortable with their roles and responsibilities.

- Even with their general lack of understanding of the concepts of the project, districts are willing to sponsor landowner workshops and focus groups. Landowner interaction and the sharing of information about new programs is a customary role that districts have played over the years and one that they continue to be comfortable with. Districts are comfortable being the point of contact and a meeting place for buyers and sellers.

- Districts are comfortable serving as the Verifier by confirming that conservation actions taken by a landowner produce the ecological benefits necessary for credit creation. This comfort level stems from the technical expertise of the district staff and their experience verifying that conservation practices installed through landowner contracts through state and federal programs are properly installed and maintained.

- District predict only a “moderate” interest by landowners in their county to learn more about a possible Ecosystem Credit Program. It is assumed that this is due to the fact that the districts themselves have only a moderate or lower understanding of the credit system. In addition, the majority of district board members are agricultural land owners and see their personal interest in such a program as only “moderate”.

- It appears that Districts are only minimally interested in taking a more active role in habitat planning and management related to threatened and endangered plants and animals at this time. It is assumed that this is due to the following: (a) most district board members are engaged in production agriculture and forestry and income from their working lands is critical; (b) most are uncomfortable with the potential of greater regulation for landowners whose land is inhabited by threatened and/or endangered plant and animal species; and (c) most landowners don’t want to be restricted on how they use and manage their land and their potential to maximize economic return.

Additional Information Sources

Conservation Credit System Manual. State of Nevada. December 12, 2014. V1

Todd Fartner, James Mulligan, Rowan Schmidt, and John Gunn. Natural Infrastructure; Investing in Forested Landscapes for Source Water Protection in the United States. Work Resources Institute.

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Ecosystem Services Markets Under Construction: Conservation Districts are on the Crew. National Association of Conservation Districts. 2013

Tamara Dickinson, Timothy Male, Ali Zaidi. Memorandum. Incorporating Natural Infrastructure and Ecosystem Services in Federal Decision – Making. The White House. 10.7.15

Shelly Robertson, H. Bruce Rinker. 3rd Party Evaluation of the Recovery Credit System Proof of Concept. Robertson Consulting Group, Inc. March 2010

Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina

Model Ecosystem Credit Program
Attachment 1. Existing Program Case Studies
Component Report 5 of 6

Alison Lund, Texas A&M University's Institute for Renewable Natural Resources

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TEXAS CONSERVATION PLAN FOR THE DUNES SAGE BRUSH LIZARD OVERVIEW

In December 2010, the U.S. Fish and Wildlife Service (FWS) proposed to list the Dunes Sagebrush Lizard (DSL) as endangered under the Endangered Species Act. The DSL is a small, light brown lizard, found only in the active and semi-stable shinnery oak dunes of southeastern New Mexico and west Texas. In Texas, the geographical range of suitable DSL habitat (dune and dunal complex) only spans approximately 197,606 acres in a unique, spatially dynamic system of Shinnery Oak (*Quercus havardi*) dune complexes (i.e., interconnected areas of sand with large deep blowouts). The DSL habitat lies in the middle of one of the nations' most productive oil and gas regions, the Permian Basin.

Due to the significant collaboration between land and royalty owners, energy and agricultural industry representatives, state universities, state and federal agencies, and biologists, the Texas Conservation Plan (TCP) for the DSL was created, which included both a pre-listing Candidate Conservation Agreement with Assurances and a post-listing Habitat Conservation Plan. On February 17, 2012, the FWS approved the TCP and issued the federal enhancement of survival permit (TE55322A-0) to the Texas Comptroller of Public Accounts (Permit Holder). The voluntary conservation programs in Texas and New Mexico, as well as continued DSL research, prompted the FWS decision on June 13, 2012, to not list the DSL as endangered under the ESA. More information regarding the creation and implementation of the TCP can be found at the Texas Comptroller of Public Accounts' Keeping Texas First website (www.KeepingTexasFirst.org).

PARTIES THAT ARE INVOLVED IN THE ADMINISTRATION AND OPERATIONS OF THE TEXAS CONSERVATION PLAN FOR THE DUNES SAGEBRUSH LIZARD

The following entities have direct oversight and involvement over the management of the TCP:

U.S. FISH AND WILDLIFE SERVICE (FWS)

FWS is the federal agency responsible for implementing the Endangered Species Act of 1973. FWS has overall authority over the TCP and is the issuer of any associated permits to the Permit Holder under Section 10 of the ESA. Under the TCP, FWS is responsible for managing the permits, which includes both an enhancement of survival permit covering Participants enrolled under the Candidate Conservation Agreement with Assurances portion of the TCP (through a Certificate of Inclusion (CI)) and an incidental take permit covering Participants enrolled under the Habitat Conservation Plan portion of the TCP (through a Certificate of Participation (CP)).

TEXAS COMPTROLLER OF PUBLIC ACCOUNTS (PERMIT HOLDER)

Subject to Texas Government Code, Chapter 403, Subchapter Q, the Comptroller of Public Accounts (CPA) is the Texas state agency that serves as the Permit Holder and is directly responsible and accountable for carrying out the provisions of the TCP and ensuring compliance. Safeguards and controls have been developed to meet requirements of the TCP while facilitating continued and uninterrupted economic activity in the Permian Basin and promoting conservation of the DSL for the Covered Activities in the TCP. The CPA serves as the point of contact with FWS and is involved in overseeing the administration of the TCP through the Qualified Third Party Contractors referenced below.

TEXAS A&M AGRILIFE EXTENSION SERVICE (TAMU)

As Permit Holder, CPA has entered into an Interagency Cooperation Contract with TAMU to provide administration of the TCP. TAMU is a member of the Texas A&M University System and focuses on community-based education throughout the State. TAMU takes an active role in managing the operations of the TCP through its contract with the Texas Habitat Conservation Foundation.

TEXAS HABITAT CONSERVATION FOUNDATION (FOUNDATION)

TAMU's contract with the Foundation directs the Foundation to administer the day-to-day operations of the TCP. The Foundation was established for the direct purpose of administering the TCP at the local level. Its headquarters are located in Midland, Texas, near the areas of DSL Habitat and it serves as an authorized agent of TAMU and the Permit Holder. The Foundation is governed by a board of directors, who oversees activities in accordance with the Foundation's bylaws.

The Foundation enters into agreements with enrolled Participants and non-Participant landowners and is the regular point of contact with them. The Foundation is responsible for performing outreach efforts to encourage participation within the TCP, managing the activities of the Participants and contracted non-Participant landowners, addressing disturbance issues, facilitating the generation of mitigation credits and recovery awards, and monitoring for Participant and non-Participant landowner compliance.

The overall focus of the TCP is to provide for the uninterrupted and continued economic activity in the Permian Basin and to conserve the DSL and its habitat by ensuring activities conducted by Participants and non-Participant landowners provide such benefit.

THIRD PARTY REVIEWER

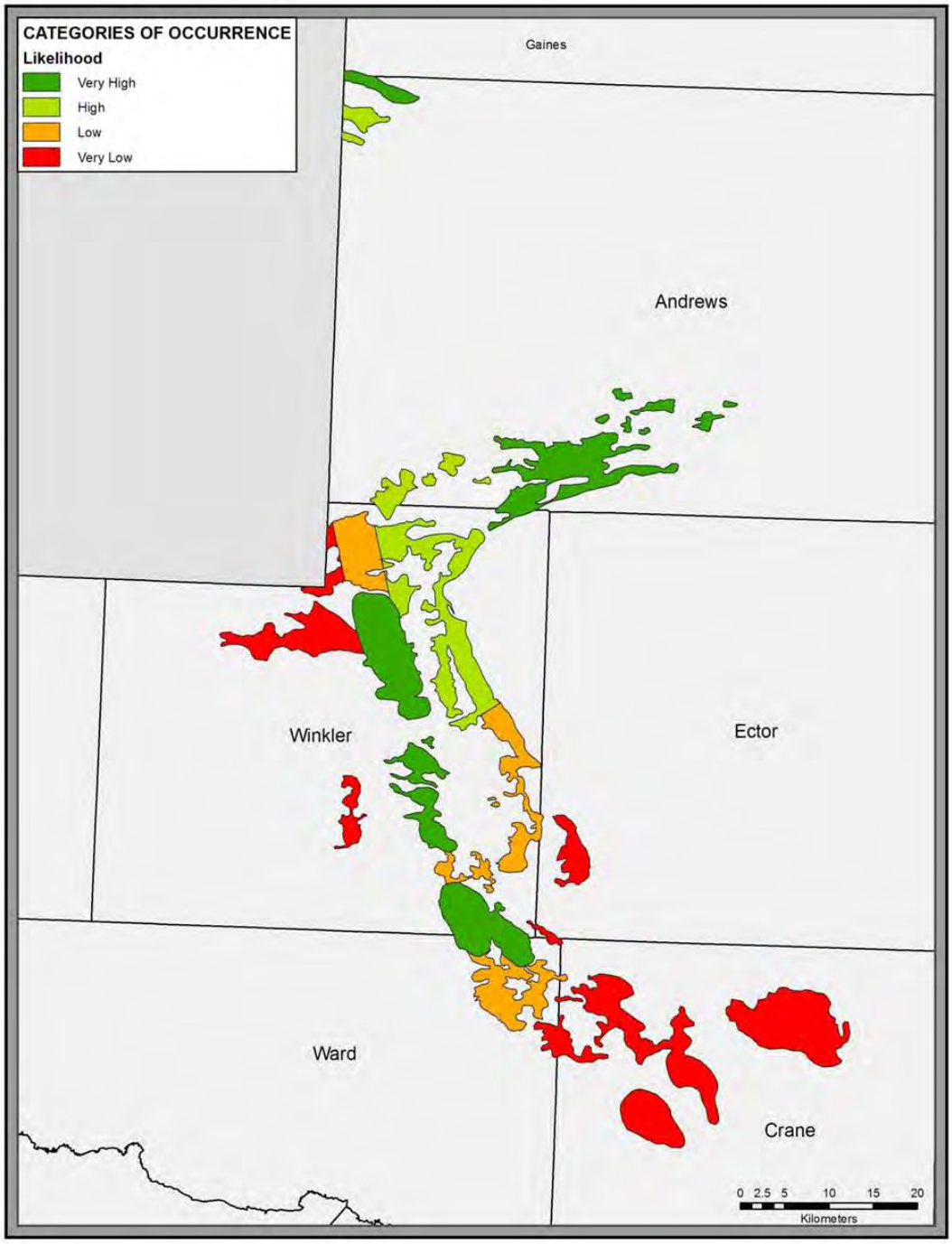
As Permit Holder, CPA has entered into a contract with a Third Party Reviewer (Texas Tech University) to perform ongoing verification of Recovery and Mitigation projects and the mitigation credits and recovery awards generated. They review award/credit calculations, project selection and appropriateness, and if TCP procedures are applied and followed correctly.

PARTICIPANT

Participants are property owners that enroll property in the TCP. The FWS regulations define "property owner" with respect to agreements outlined under 50 CFR §§ 17.22(c), 17.22(d), 17.32(c), and 17.32(d) to mean "a person with a fee simple, leasehold, or other property interest (including owners of water or other natural resources), or any other entity that may have a property interest, sufficient to carry out the proposed management activities, subject to applicable State law, on non-Federal land." Property owners may include agriculture producers and oil and gas companies. Participants are required to adhere to the provisions of their CI or CP.

NON-PARTICIPANT LANDOWNER

Landowners who are not enrolled in the TCP are referred to as non-Participant landowners. Although they are not formal Participants, these landowners may still be involved in conducting conservation measures benefiting the DSL that result in the generation of mitigation credits and recovery awards. Similar to Participants, the non-Participant landowners interact primarily with the Foundation to ensure that their measures are conducted in accordance with the TCP's provisions but may also interact with TAMU, Research, and the Permit Holder as needed. The Foundation may also engage non-Participant landowners about potential participation in the TCP.



Texas Conservation Plan Permit Area/Likelihood of Occurrence Map. The colors in the legend and corresponding map represent Likelihood of Occurrence Class; red is Very Low (0-25% probability of DSL occurrence), orange is Low (25-50% probability of DSL occurrence), light green is High (50-75% probability of DSL occurrence), and dark green is Very High (75-100% probability of DSL occurrence).

CALCULATION OF REQUIRED MITIGATION

Under the Texas Conservation Plan for the Dunes Sagebrush Lizard, surface disturbing activities are allowable within habitat, habitat polygons, and buffer areas, but may be subject to mitigation requirements. Participants are encouraged to avoid impacts or minimize disturbances to the habitat. However, in those unavoidable circumstances, the Foundation provides assistance in determining the extent of habitat loss and mitigation required. The amount of mitigation required is tiered based on the likelihood of occurrence and the distance to the habitat or polygon.

FOR AREAS INSIDE THE HABITAT POLYGON

Mitigation is calculated using the following formula and mitigation ratios referenced below:

Acres Impacted *multiplied by* Mitigation Ratio *equals* Acres of Required Mitigation

Gradient of Likelihood in Habitat	Map Color	Mitigation Ratio
Very High Likelihood of Occurrence	Dark Green	2.5
High Likelihood of Occurrence	Light Green	2.0
Low Likelihood of Occurrence	Orange	1.5
Very Low Likelihood of Occurrence	Red	1.0

Example: A Participant desiring to construct a new well site within the habitat impacting 5 acres in an area identified as having a high likelihood of DSL occurrence (light green = mitigation ratio of 2.0) will be required to earn or obtain 10 acres of Mitigation Credits or equivalent Recovery Awards. In addition, the mitigation activities should occur as close as possible to the impacts that may result from the incidental take.

FOR AREAS INSIDE THE BUFFER AREA

Mitigation requirements are further adjusted based on the buffer distance of the disturbance to the edge of all possible habitat or polygon.

Acres Impacted *multiplied by* Mitigation Ratio *multiplied by* Buffer Distance Multiplier *equals* Acres of Required Mitigation

Distance from Habitat	Multiplier
Within shinnery oak dune complex	1.00
0 to 30 meters	1.00
31 to 50 meters	0.75
51 to 100 meters	0.50
101 to 200 meters	0.25

Example: Under the previous example, if the new well site was constructed 150 meters from the edge of the habitat area (as opposed to directly within the habitat), then the required mitigation would be adjusted to 2.5 acres.

Appendix I of the TCP provides additional examples of mitigation credit calculations.

CALCULATION OF MITIGATION CREDITS GENERATED

Under the CRA, a property owner (Participant or non-Participant) can earn Mitigation Credits by conducting approved mitigation activities (shown below) based on Section 8.7.2 of the TCP. The mitigation credits generated may be used to offset incidental take or be banked for future use or sale to other Participants. The formulas to calculate mitigation credits generated are the same as the formulas to determine mitigation needed (listed above).

Mitigation Activities
Remove abandoned service roads and restore to pre-disturbance conditions, to the extent possible
Remove equipment from abandoned locations
Remove abandoned or unused fencing, windmills, or water storage devices
Establish preservation lands, when possible, for perpetual preservation
Conduct research and monitoring programs to assess the impacts of mitigation efforts

TRACKING AND VALUATION OF MITIGATION CREDITS

The Foundation is responsible for keeping records of the mitigation activity. The Foundation uses a mitigation tracking spreadsheet to assist in this effort. The Foundation tracks this data in its spreadsheet and works with the Participant to ensure that its efforts align with the TCP's requirements.

As Mitigation Credits are generated, they are tracked by project and valued based on a modified weighted average approach. The weighted average balance is calculated using the following formula:

Running Dollar Balance *divided by* Credits Balance *equals* Weighed Average Balance

The Running Dollar Balance represents the running total cost of credits earned from all projects for which there is an inventory of credits available. The Credits Balance represents the total number of credits currently in inventory. The modified approach involves tracking the Credits Balance by specific project and reducing the balance (and corresponding costs) of the oldest or earliest projects as credits are used or sold. Consequently, the weighted average balance is revalued after every reduction in the Credits Balance to account for the remaining credits and costs pertaining to the most recent projects. This modified approach represents a "first-in, first-out" methodology that allows the Foundation to "remove" the oldest projects from inventory as credits are used, while still accounting for the weighted average costs of the remaining projects on the books.

CALCULATION OF RECOVERY AWARDS GENRATED

Under the CRA, a property owner (Participant or non-Participant) can earn Recovery Awards for conducting approved recovery activities. The awards may be used to offset incidental take (if earned by a Participant) or be banked for future use or sale to other Participants. Recovery activities are proactive measures performed by interested parties (Participants in the TCP, as well as non-Participant landowners) that contribute to the recovery of the DSL species. A Recovery Award represents a quantity of credit acre units that can be used to mitigate or offset a surface disturbance by Participants and maintains a portion for net recovery of the species.

Section 12 of the TCP describes the CRA, which is the approach by which Mitigation Credits and Recovery Awards are used to offset the surface disturbance authorized under the TCP and to promote recovery of the DSL.

Recovery Awards are calculated using the following formula:

Acres Targeted for Conservation Measures *multiplied by* Recovery Ratio *multiplied by* Recovery Activity Value *equals* Available Recovery Awards in Acre Units

The Recovery Ratio is a factor used to adjust the amount of acreage positively impacted for the betterment of the DSL. The DSL Likelihood of Occurrence Map referenced at the end of this section and Figure 1-2 of the TCP is used to determine the recovery ratio. The ratio is based on the schedule below from Section 12.4 of the TCP (note the differences from the Mitigation Ratios).

Acres Targeted for Conservation Measures *multiplied by* Recovery Ratio *multiplied by* Recovery Activity-Value m*ultiplied by* Buffer Distance Multiplier equals Recovery Awards

Gradient of Likelihood in Habitat	Map Color	Recovery Ratio
Very High Likelihood of Occurrence	Dark Green	1.0
High Likelihood of Occurrence	Light Green	2.0
Low Likelihood of Occurrence	Orange	2.5
Very Low Likelihood of Occurrence	Red	1.5

The Recovery Activity Value is a factor used to adjust the acreage impacted based on the nature of the activity and its impact on reducing the threat to the DSL. The factor is based on the schedule (shown on the next page) from Section 8.8 of the TCP.

Measure	Potential Benefit	Recovery Activity Value	Potential Threat Reduction
Approved mesquite and invasive species management program	Prevents habitat degradation.	2.0	Very High
Oil & Gas (O&G) surface location removal and restoration	Reduces fragmentation, enhances habitat, and restores larger contiguous blocks of mosaic habitat.	1.5	High
Road/caliche removal and restoration	Reduces fragmentation, enhances habitat, and restores larger contiguous blocks of mosaic habitat.	1.5	High
Reclamation of plugged and abandoned Well Sites	Reduces fragmentation, enhances habitat, and restores larger contiguous blocks of mosaic habitat.	1.5	High
Monitoring effectiveness of establishing restoration of habitat	Contributes to understanding of recovery of habitat and the species and informs Adaptive Management decisions.	1.5	High
Removal of overhead infrastructure	Reduces perching habitat for predatory birds.	0.6	Medium
Purging pipelines (threat removal)	Reduces threat from chemical seepage.	0.6	Medium
Approved feral hog control program	Reduces disturbance to DSLs.	0.6	Medium
Relocation of infrastructure as development creates opportunity for centralization and/or enhancement of habitat	Enhances habitat, and restores larger contiguous blocks of mosaic habitat. Reduces or minimizes impacts that can cause fragmentation and degradation of DSL Habitat.	0.4	Low
Fence removal	Reduces perching habitat for predatory birds.	0.4	Low

Example: A landowner desiring to conduct road removal and restoration activities(recovery activity value of 1.5) impacting 6 acres inside the habitat area identified as having a low likelihood of DSL occurrence (orange = recovery ratio of 2.5) will earn 22.5 acres of recovery awards. Unlike the mitigation process, the recovery process can address a large menu of action across the range of the DSL and not be limited by association with take.

Recovery awards are further adjusted based on the buffer distance of the disturbance to the area of the habitat. Note that the distances for recovery extend beyond the distances for mitigation section above.

Distance from Habitat	Multiplier
Within shinnery oak dune complex	1.00
0 to 30 meters	1.00
31 to 50 meters	0.75
51 to 100 meters	0.50
101 to 200 meters	0.25
201 to 300 meters	0.20
301 to 600 meters	0.15
Beyond 600 meters	0.10 (see below)

For recovery activities conducted beyond 600 meters from the edge of the habitat, any credit awarded will depend on dispersal corridors identified by the Foundation as part of the particular habitat assessment on a case-by-case basis.

Example: Under the previous example, if the road removal activities were conducted 250 meters from the edge of the habitat area, then the recovery awards would be adjusted to 4.5 acres. Additional examples can be found in Appendix I of the TCP.

ALLOCATION, TRACKING AND VALUATION OF RECOVERY AWARDS

ALLOCATION OF RECOVERY AWARDS

For purposes of award distribution, the total amount of Recovery Awards generated is allocated to three separate pools, as described in Section 13.3.2 of the TCP.

- 50 percent of the total Recovery Award will be made available for mitigation upon completion of the recovery activities.
- 10 percent of the total Recovery Award will be allocated to a recovery reserve and will not be made available for mitigation.
- 40 percent of the total Recovery Award will be held in trust until such time as research indicates that the recovery activities have provided a clear net benefit to the recovery of the DSL or its habitat.

Example: Based on the earlier example, the 4.5 acres of Recovery Awards generated would be distributed so that 2.25 acres would be immediately available, 0.225 acres would be held in reserve, and the remaining 2.025 acres would be held in trust for potential subsequent distribution.

TRACKING AND VALUATION OF RECOVERY AWARDS

The Foundation is responsible for keeping records of the recovery activity. The Foundation uses a recovery tracking spreadsheet to assist in this effort. The Foundation tracks this data in its spreadsheet and works with the Participant to ensure that its efforts align with the TCP's requirements.

As Recovery Awards are generated, they are tracked by project and valued based on a modified weighted average approach. The weighted average balance is calculated using the following formula:

Running Dollar Balance *divided by* Awards Balance *equals* Weighed Average Balance

The Running Dollar Balance represents the running total cost of awards earned from all projects for which there is an inventory of awards available. The Awards Balance represents the total number of awards currently in inventory. The modified approach involves tracking the Awards Balance by specific project and reducing the balance (and corresponding costs) of the oldest or earliest projects as awards are used or sold. Consequently, the weighted average balance is revalued after every reduction in the Awards Balance to account for the remaining awards and costs pertaining to the most recent projects. This modified approach represents a "first-in, first-out" methodology that allows the Foundation to "remove" the oldest projects from inventory as awards are used, while still accounting for the weighted average costs of the remaining projects on the books.

PROCESS FOR SOLICITING AND COORDINATING CONSERVATION ACTIVITIES AS A MEANS OF GENERATING MITIGATION CREDITS AND RECOVERY AWARDS

Under the direction of the TCP, the Foundation consistently seeks opportunities to encourage property owners (Participants and non-Participants) to perform conservation activities (mitigation activities and recovery activities) as proactive measures that contribute to the recovery of the DSL species. The Foundation is responsible for generating monetary incentives to Participants and non-Participant property owners to conduct conservation activities that result in the generation of Mitigation Credits and/or Recovery Awards.

Participants and non-Participant landowners earning Mitigation Credits or Recovery Awards who choose not to keep them for their own use may sell the credits and awards to other Participants via the Foundation. In these situations, the Foundation will serve as a broker and money will be transferred through the Habitat Protection Fund. All mitigation or recovery projects must be coordinated with the Foundation.

In those situations where the Foundation determines a specific need for credits or awards, it will issue a Request for Proposals (RFP) to obtain responses for conducting conservation activities. It may also issue an RFP if there is a surplus of TCP funds for which an opportunity arises to generate Recovery Awards. The Foundation will work with TAMU and the Permit Holder to develop the components of the RFP and will utilize guidelines of those organizations for issuing the RFP. Parameters described in the RFP may include all or a selection of the following items:

- Category of activity (mitigation or recovery)
- Type of conservation measures requested (see *Policy 4-05*)
- Location/vicinity where measures are to be performed
- Amount/size of land covered
- Timeframe and duration of activities
- Respondent type (Participant or non-Participant landowner)

Respondents will be asked to submit proposals addressing the requested services. The proposal will include a work plan describing the conservation measures to be performed and a calculation of the credits or awards to be generated, along with the cost per credit or award. Respondents are required to provide detail at a sufficient level to allow the Foundation to calculate a per credit/award scale.

The Foundation will rank the proposals utilizing three equally-weighted factors:

- Benefit to the DSL: Expected ecological benefit to the DSL. Location of the project will be factored into the benefit analysis and includes proximity to the disturbance as well as proximity to inhabited or potential inhabited areas.
- Cost: Unit cost of credit awarded on a per acre basis.
- Timing: Actual time of implementation of the project, based on need at the time of the ranking.

Proposals will also be ranked in comparison to each other. The proposal with the highest ranking will be selected first. The number of projects to be performed will be based on the availability of funds.

The Foundation will then prepare a Management Plan that incorporates the project(s) being proposed, with any references to the proposer's name excluded. The Management Plan will include the following components:

- Description of activity
- Timing of activity
- Duration of project
- Credits or awards to be generated
- Timing and nature of compliance monitoring
- Spatial data files for relevant projects

In order to ensure consistency, spatial data will be field collected by the Foundation. These raw data will be supplied to TAMU where formal shapefiles will be generated. These shapefiles will then be added to the geodatabase in the common projected coordinate system (NAD 83 UTM zone 13N) with previous, existing feature classes to ensure correct topology. This will eliminate any potential errors or discrepancies like overlaps, slivers, etc. that can occur with collecting and generating spatial layers at different times and from different sources.

The Foundation will submit the Management Plan to the U.S. Fish and Wildlife Service (FWS) for formal approval. Upon approval, the Foundation enters into a formal contract with the selected proposer for services.

Participants and non-Participant landowners can generate mitigation credits or recovery awards without entering into a contract with the Foundation. In those cases, the party would contact the Foundation to arrange for a site visit. The Foundation would work with the interested party to create a project that would generate the desired credits or awards. A Management Plan would then be created and the coordination with FWS would occur as described above.

THIRD PARTY VERIFICATION OF MITIGATION AND RECOVERY PROJECTS AND MITIGATION CREDITS AND RECOVERY AWARDS

In order to verify Mitigation and Recovery projects and credit/award calculations are accurate and represent a fair account of impacts and benefits as prescribed in the TCP, an independent third party reviewer will audit all contracted Mitigation and Recovery projects.

PRIOR TO MITIGATION AND RECOVERY PROJECT CONTRACT EXECUTION/START:

1. The Third Party Reviewer receives a Project Description and/or Management Plan from QTPCs (Director with the THCF and/or Project Coordinator with TAMU) with all necessary documentation, including:
    - Proposal outline including type of project to be conducted and Mitigation Credits/Recovery Awards generated, etc.;
    - Qualifications of the proposed implementation persons;
    - Photographs of site or sites; and,
    - Geospatially explicit information for the site(s) to be developed and the Mitigation/Recovery sites, as they relate to Figure 1-1 and 1-2 in the TCP.
2. The Third Party Reviewer provides written confirmation of receipt within two days to QTPCs (Director with the Foundation and/or Project Coordinator with Texas A&M AgriLife Extension Service, TAMU).
3. The Third Party Reviewer to check and verify:
    - Mitigation/Recovery calculations, using the attached Excel spreadsheet (based partially on Appendix I in the TCP and partially on e-mail discussion with the Permit Holder);
    - Geographical information and site attributes.
4. Projects and Mitigation/Recovery calculations will be verified via a desk audit (Site visits may be required – see Steps 7 and 8):
    - Projects should be evaluated early in the proposal stage, within 2 weeks of proposal submission.
    - All necessary documentation needed should be clearly defined and incorporated into each proposal as described in Step 2.
5. Verification through a desk audit will be completed within one week of receiving the Project Description and/or Management Plan from QTPCs.
6. Site visits will be essential to larger projects or those that have high Mitigation/Recovery values. They should be reserved for instances where project uncertainties or unexpected events occur that alter the project outcome or Mitigation/Recovery value. Site visits should be conducted at random (not to exceed one per project activity type) to help refine the preliminary evaluation process and/or determine the most efficient method of documentation to serve the verification process.
7. If necessary, site visits will be coordinated and conducted within three weeks of initial receipt of the Project Description and/or Management Plan from QTPCs.
    - Typically, site visits will be concluded within one day on-site; efforts will be made to include multiple projects within same timeframe to ensure efficient use of funds.

- With prior approval by and notification of landowner/QTPCs/Permit Holder (only after verification procedures have been standardized) students may accompany PIs as a training exercise (student expenses will not be billed to the Permit Holder office). Students will sign confidentiality agreements prior to visits.

8. The Third Party Reviewer will provide written confirmation of appropriateness of project, correctness of Mitigation/Recovery calculations or request corrections utilizing a standardized initial project verification report form that will be sent to QTPCs within one week of desk audit or two weeks of site visit. This form will include the Third Party Reviewer's assessment and Mitigation/Recovery calculations according to the Excel spreadsheet (mentioned in Step 4), qualitative and quantitative (where applicable) assessment of the activity to be performed, and our as well as a written report including our recommendations of Adequate, Unacceptable, or Adequate with Monitoring.

    - The standardized report form will be considered a "living document," and any modifications to the form after initial approval by the Permit Holder will be approved by the Permit Holder office prior to implementation.

DURING PROJECT:

1. Copies of the monthly reports (Section 8.10 of TCP) provided in Appendix F will be provided to the PIs via the KTF website at http://www.keepingtexasfirst.org/tx_response/reports.php.

POST PROJECT COMPLETION:

1. The Third Party Reviewer will receive a project completion notice from QTPCs.
2. The Third Party Reviewer will provide a written confirmation of receipt of completion notice within two days to QTPCs.
3. A project assessment will be conducted via a desk audit within one week, or if needed, coordinate and conduct site visit within two weeks of receipt of project completion notice following process described in the previous section.
4. Project assessments will include review of all associated materials (contracts, invoices, etc.), verification of whether the proposed activities have been performed to the proposed extent (i.e. do the activities cover the proposed acreage, or only a portion of the proposed area? Have the proposed activities been performed completely, without abandonment?), in addition to confirmation of the number of Mitigation Credits/Recovery Awards generated.
5. Utilizing a standardized final project verification report form provide verification of project and Mitigation Credits/Recovery Awards generated or identification of additional work needed to QTPCs within the one week timeframe for the desk audit or two week timeframe for the site visit.
6. Provide Quarterly Reports to include activity to the Permit Holder no later than ten (10) working days after the end of each fiscal quarter.

DISPUTE RESOLUTION:

1. Receive notice of disagreement from QPTCs.
2. All PIs to meet (via teleconference or if agreed to in advance in person) with Permit Holder and all QTPCs and FWS within one month of receipt to evaluate the nature of the dispute and try to resolve it.

3. If said meeting and resulting activities do not resolve the issue within two weeks, follow TCP section 8.6.4.1.e (p. 44).

GOLDEN-CHEEKED WARBLER RECOVERY CREDIT SYSTEM

GOLDEN-CHEEKED WARBLER RECOVERY CREDIT SYSTEM OVERVIEW

The Golden-cheeked warbler Recovery Credit System (RCS) was developed in late fall 2005 and early spring 2006 by a working group convened by the Texas Department of Agriculture in response to a U.S. Fish & Wildlife Service (FWS) Biological Opinion, which recommended Fort Hood's participation in an off-site conservation program. Fort Hood Military Reservation (Fort Hood, TX) has the largest known population of Golden-cheeked warblers (*Dendroica chrysoparia,* GCWA), and maintains biological programs to protect their habitat on site. However, the potential for habitat loss is a constant possibility and, at times, limits on site training at Fort Hood. Therefore, to offset possible habitat losses from live fire training activities, a RCS for the GCWA was developed.

The primary objective of the RCS is to contribute to the Fort Hood Military Reservation environmental management and conservation objectives by providing support for off-site conservation efforts for endangered species, specifically GCWA. By conserving and enhancing habitat on private lands, the program generates recovery credits. This makes possible a market-based system for private landowners to conserve and improve endangered species habitats in return for financial assistance for land management and annual rent payments. As credits accumulate, Fort Hood gains greater training flexibility and protection against future loss of training time should they experience habitat loss on their training grounds. In addition, this tool simplifies administrative actions by creating a consistent process for implementing the Army's obligations under the ESA. More information regarding the creation and implementation of the RCS can be found at the Institute of Renewable Natural Resources' website (http://rcs.tamu.edu/).

PARTIES THAT ARE INVOLVED IN THE ADMINISTRATION AND OPERATIONS OF THE GOLDEN-CHEEKED WARBLER RECOVERY CREDIT SYSTEM

The following entities have direct oversight and/or involvement over the implementation and/or management of the RCS:

U.S. FISH AND WILDLIFE SERVICE (FWS)

FWS is the federal agency responsible for implementing the Endangered Species Act of 1973. FWS has overall authority over the RCS.

DEPARTMENT OF DEFENSE (DOD), U.S. ARMY

Funding partner for 3-year proof-of concept phase. Sole credit buyer for the RCS.

U.S. DEPARTMENT OF AGRICULTURE-NATURAL RESOURCE CONSERVATION SERVICE

Funding partner for 3-year proof-of concept phase.

NATIONAL FISH & WILDLIFE FOUNDATION

Funding partner for 3-year proof-of concept phase.

ENVIRONMENTAL DEFENSE FUND (EDF)

The EDF staff assessed habitat on private ranches, determined associated credit score, and developed warbler-specific management plans for each ranch. EDF developed reports for each property with descriptions and delineations of qualifying and supporting habitat, associated maps, credit calculations, and a management plan for enhancing, expanding, and conserving warbler habitat. This information was provided to each landowner and formed an essential part of their bid package.

TEXAS A&M INSTITUTE OF RENEWABLE NATURAL RESOURCES (TAMU)

The Department of Defense contracted with TAMU to implement a 3-year trial period (proof-of-concept) phase of the RCS and monitor the results.

TEXAS PARKS AND WILDLIFE DEPARTMENT (TPWD)

The TPWD staff developed or approved overall wildlife management plans of which the warbler-specific management plan was a priority component

TEXAS WATERSHED MANAGEMENT FOUNDATION (FOUNDATION)

TAMU sub-contracted with the Foundation to administer the day-to-day operations and general management of the RCS. The Foundation conducted landowner outreach, met with landowners to describe the system, coordinated site visits for the purposes of determining credit score and conducting management-plan development, conducted reverse auctions to purchase credits, executed contracts with landowners, conducted prescribed management activities, and performed yearly compliance monitoring.

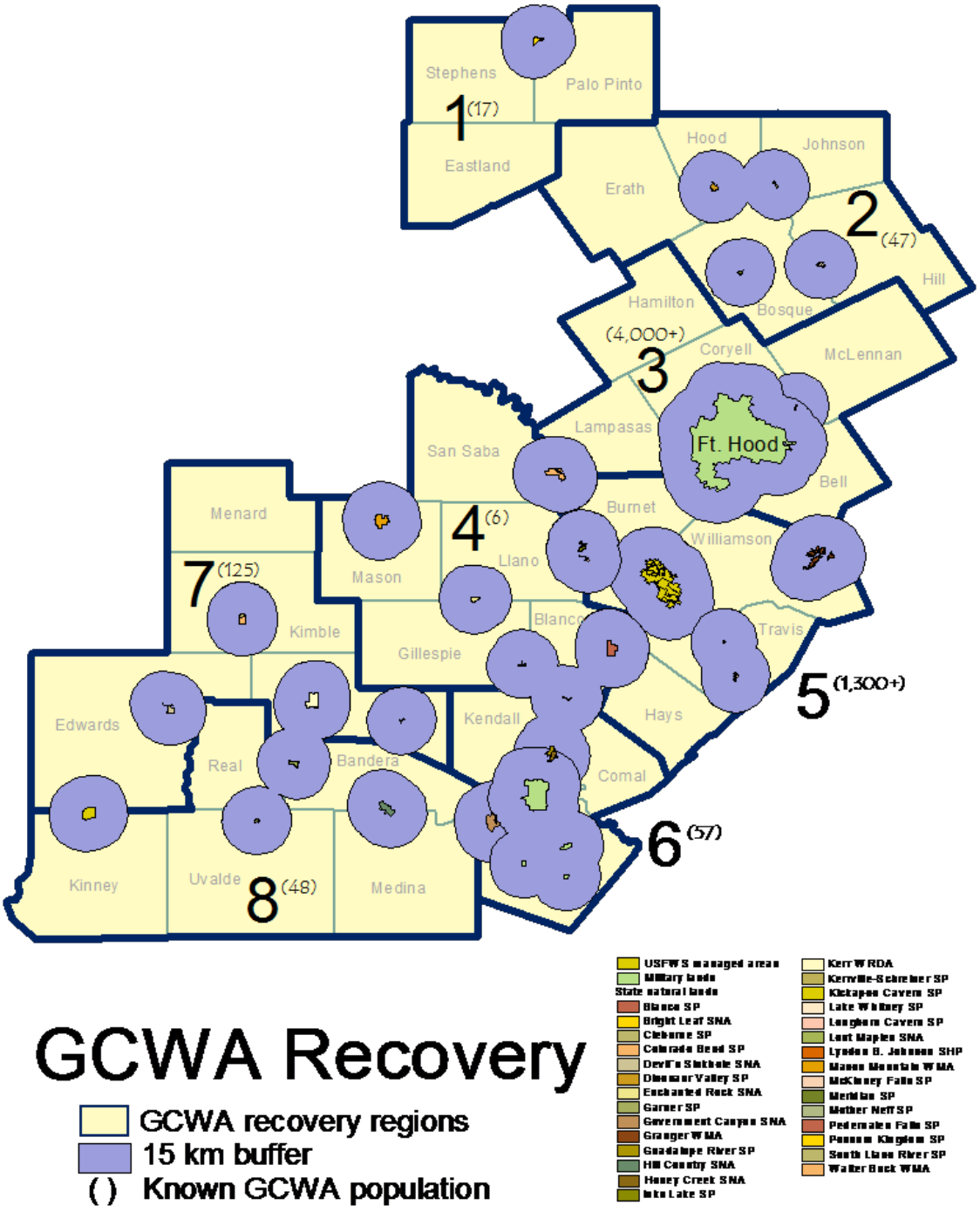
THIRD PARTY REVIEWER

The DoD entered into a contract with a Third Party Reviewer (Robertson Consulting Group, Inc.) to perform an evaluation of the initial 3-year proof-of-concept for both the process and the intended impact and overall utility of the RCS.

The Foundation commissioned an audit from a third party reviewer to examine both the funds and the credits generated and debited.

PRIVATE LANDOWNER

Private landowners are property owners with qualifying habitat that contract property (10 years to 25 years in 5 year increments) in the RCS.



Golden-cheeked Warbler Recovery Map. The map delineates the eight recovery regions used to calculate recovery credits. The legend further identifies known GCWA populations (with a 15 meter buffer) within the regions.

CALCULATION OF REQUIRED MITIGATION

The Recovery Crediting Guidance (USFWS 31 July 2008) outlines the general steps while the biological opinion for debiting (USFWS 3 March 2009) clearly describes the process for the proof of concept. As of 21 January 2010, the debiting action had been reviewed, approved, and assigned debits, but the action had not yet been implemented.

As described in the Recovery Crediting Guidance, the recovery debiting process includes the debit development phase and programmatic debiting consultation phase. The debit development phase establishes the standards according to which credits will be used. This phase may be conducted separately or concurrently with the credit accrual planning and development. The debiting process as part of a RCS is subject to consultation under section 7(a)(2) of the Endangered Species Act (programmatic debiting consultation). The project-specific application includes project-specific consultation under programmatic consultation and actual debits of the credits. As individual projects are proposed, the Federal Action Agency provides project- specific information as described in the programmatic biological opinion.

As described in the biological opinion for debiting (USFWS 3 March 2009), a tiered decision approach for site selection will be used in order to prioritize training areas based on minimizing impacts on GCWA habitat. Tiers were defined by the size of gaps in habitat and relation to habitat edge as follows:

- Tier 1. Non-endangered species habitat
- Tier 2. Isolated < 101-hectare marginal habitat
- Tier 3. > 101-hectare marginal habitat
- Tier 4. Isolated < 101-hectare moderate to high quality habitat
- Tier 5. > 101-hectare moderate to high quality habitat

A sub-committee of species and habitat experts developed treatment standards for modifying GCWA habitat on Fort Hood and estimated appropriate habitat recovery periods. The sub-committee specified standard one as light thinning and standard two as moderate thinning.

Recovery periods, and therefore debits, will then be assigned based on the tier and the standard. As described in the biological opinion (USFWS 3 March 2009 p. 10):

Debit values will be traded for credits based on the duration of use plus the habitat recovery period. Habitat recovery period is the time necessary for the affected habitat within the training area to return to acceptable pre-disturbance condition as a result of the treatment standard, scheduled maintenance, and training disturbance. Habitat recovery period begins when scheduled training area maintenance and training use have ceased.

The actual habitat recovery period is unknown at this time; however, the subcommittee developed standards to estimate the habitat recovery period that will be added to the training duration. The document notes the estimates are based on professional judgment as there are no data that support these estimates.

For the proof of concept, Fort Hood Military Reservation will debit their account 755 recovery credit years to thin small juniper trees using treatment standard two on 237 acres in Land Group Two in order to allow dismounted squads, platoons, and companies to conduct force on force maneuver training. Of the 237 acres, 35.14 are designated as tier 3, 5.05 acres as tier 4, and 196.98 acres as tier 5. Fort Hood

plans to implement minimization periods so that the recovery period for Tier 5 habitat will be five years, allowing for a five-year training period. As of 21 January 2010, the FWS approved the proposed action, finding it consistent with the terms and conditions of the RCS opinion, although actual thinning has not yet occurred. As this single action will utilize the accumulated credits, the RCS opinion is therefore terminated from further actions.

DEVELOPING A BID PACKAGE

Once the landowner contacted the program operators, the first step was to assess the habitat and assign credit. After a landowner contacted program operators about participation, the EDF assessed the habitat to ensure it met stated guidelines from the TPWD, assigned the ranking criteria for credit valuation (below) using the science committee recommendations, and wrote a management plan for the warbler in particular. That document was then attached to a larger wildlife management plan.

CONSERVATION UNIT AND SCIENCE-BASED CRITERIA FOR VALUATION OF RECOVERY CREDIT

CONSERVATION UNIT

A conservation unit is defined as a 20 acre area that is verified as meeting the TPWD criteria for areas that are likely to be inhabited by GCWAs.

SCREENING CRITERIA

Proposed conservation units must be within a priority landscape for GCWA recovery. Priority landscapes will be defined using the best available information. Pending review of this information, a conservation unit or units must be an integral part of a block of continuous GCWA habitat that is at least 250 acres (100 ha) in extent, and a minimum of 50 acres must be under contract.

RANKING CRITERIA

The following criteria are designed to place increased value on those projects that have the greatest potential to support viable populations and that are likely to provide the greatest recovery benefits. Greater value is placed on aggregations of conservation units, units that are within Recovery Regions with relatively low known populations, units that are close to existing populations and units that are within relatively large blocks of existing habitat.

1. Assess potential number of contiguous conservation units. One unit = 20 acres, two units = 40 acres, etc. (no partial units e.g., one unit = 20 – 39 acres, two units = 40 – 59 acres, etc.)
2. Apply number of units weighting

Units	Weighting	Total Credit
1	0.0	1.0
2	0.1	2.1
3	0.2	3.3
4	0.3	4.6
5	0.4	6.0

Units	Weighting	Total Credit
6	0.5	7.5
7	0.6	9.1
8	0.7	10.8
9	0.8	12.6
10	0.9	14.5
Etc…		

3. Apply recovery region priority multiplier

Recovery Region	Multiplier
1, 2, 4, 6, 7, 8	2.00
5	1.50
3	1.00

4. Apply habitat characteristic/landscape context multiplier

Proximity to existing GCW population	Multiplier
Within 15km of a known population of GCWs of at least 10 pairs	1.10
Within 15km of a known population of GCWs of at least 100 pairs	1.20
Extent of surrounding GCW habitat	**Multiplier**
Unit(s) are part of 250 – 620 acres (100 - 250 ha) of contiguous habitat	1.00
Unit(s) are part of >620 acres (250 ha) of contiguous habitat	1.50

Number of Units *multiplied by* Recovery Region Multiplier

multiplied by Proximity Multiplier *multiplied by* Landscape Multiplier *equals* Recovery Credits

Example: A landowner wants to assess their land of 110 continuous acres. It equates to 5 conservation units within 15km of Fort Hood (Recovery Region 3) that are situated within a block of 740 acres (300 ha) of contiguous habitat with over 100 known Golden Cheeked Warbler pairs.

Line Item	Calculation
Number of units weighting	6.0 credits
Recovery region multiplier	6.00 credits
Proximity multiplier	7.20 credits
Landscape multiplier	**10.80 credits**

FINALIZING THE BID PACKAGE

Once the recovery credits had been calculated, the landowner worked with program operators to prepare a bid. The bidding calculations were determined using the following formulas:

Recovery Credits *multiplied by* Length of Contract *equals* Recovery Credit Years

Costs per Recovery Credit *multiplied by* Recovery Credit Years *equals* Total Sponsor Cost

Percentage of Cost Share *multiplied by* Total Sponsor Cost *equals* Landowner Cost Share

Landowner Cost Share *plus* Total Sponsor Cost *equals* Total Value

Example: An interest landowner contacts the program and is assigned 2.52 recovery credits for their property after a habitat assessment was performed. The property owner decides to commit to a 20 year contract at $700 per recovery credit year, totaling $35,280 in sponsor cost. The landowner bids 33.3 percent as cost share for the $35,280, meaning the landowner must pay $11,748.24 into their account which will be distributed through completed management practices or annual payments. The total value of the landowners bid is $47,028.24.

Line Item	Calculation
Recovery credits assigned to the property based on size, location, and other weighting factors	2.52
Length of contract	20
Recovery credit years (credits X length of contract)	50.4
Bid per recovery credit year (RCY)	$700.00
Total sponsor (program) cost put into account for annual payments and management practices	$35,280.00
Landowner cost share (33.3%) put into their own account for annual payments and management practices	$11,748.24
Total in account for management practices and annual payments	**$47,028.24**

REVERSE AUCTION PROCESS FOR GENERATING RECOVERY CREDITS

A reverse auction process was utilized to select the winning (funded) bids. Bids were ranked based on number of credits, contract length, recovery credit years, recovery credit year cost, and percent of landowner cost share. Finally, bid packages and a ranking sheet were taken to Fort Hood for review and approval*.

Over the course of 8 bidding rounds, the competitive nature of the bidding resulted in increased cost-efficiency for Fort Hood: the cost per RCY for all bids decreased from approximately US$ 1,600 to just over US$ 600, which equated to an average cost per acre of US$ 888. Landowners quickly discovered they could increase the competitiveness of their bid by increasing the length of their contract term. In the first bid round, the majority of landowners chose a 10-year term; by the final bid round, all landowners chose the 25-year term.

* Although the ranking system was designed to identify the properties with both the best habitat value (through the credit valuation) and the best fiduciary value, Fort Hood staff occasionally chose properties based on proximity to the base and not on the ranking system developed by the science and economic committees during the planning process.

ALLOCATION, TRACKING AND VALUATION OF RECOVERY CREDITS

The Foundation contracted an accounting firm to account for both the money and the credits generated/debited.

As the debiting action has not yet occurred, the monitoring requirement has not yet been activated. The biological opinion (USFWS 3 March 2009 p.16), however, clearly describes the expectations:

On an annual basis, Fort Hood will evaluate and report on Management Plan compliance for each property. The report will include, but not be limited to: property bid contract number system used by the Cooperator<, county location of property, contract length (10-year, 20-year, etc.), credit vintage, results of bird monitoring surveys, results of vegetation monitoring surveys, results of scientific studies other than bird and vegetation monitoring, any change in status of the credit property (e.g., habitat damage from fire or land management), any change in status of credit property owner, any change in status of the surrounding properties, and copy of aerial imagery and any other imagery/maps used to determine credit land status.

Fort Hood is required to monitor the account balance and the habitat developed on Fort Hood (i.e., debit projects) and to report the results of monitoring to the FWS on an annual basis.

THIRD PARTY VERIFICATION OF THE GOLDEN-CHEEKED WARBLER RECOVERY CREDIT SYSTEM ACCOUNTING

The Foundation commissioned an audit of both the funds and the credits separately. The management letter states that financial statements ,present fairly, in all material respects, the financial position of the foundation as of August 31, 2009, 2008 and 2007 and the changes in its net assets and its cash flows for the years then ended in conformity with accounting principles generally accepted‘ and that the supplemental recovery credit suppliers’ schedule and values are also fairly stated.

THIRD PARTY VERIFICATION OF THE GOLDEN-CHEEKED WARBLER RECOVERY CREDIT SYSTEM, 3-YEAR PROOF-OF-CONCEPT

In 2009, the Department of Defense contracted with Robertson Consulting Group, Inc. to provide an objective and thorough evaluation of the 3-year proof-of-concept for both the process and the intended impact and to assess the utility of RCS. The peer review panel was composed of three independent scientists charged with the evaluation of all successful and unsuccessful landowner bids, review of program documents, and assessment of habitat on 8 contracted sites. In addition, they conducted 17 interviews with participating landowners and 24 interviews with program operators, military personnel, and other stakeholders. The review can be found at the Institute of Renewable Natural Resources' website (http://rcs.tamu.edu/media/277200/rcs_evaluation_executive_summary.pdf).

THE REVIEW CONCLUDED THE RCS:

1. Model was viable and feasible in a real-world environment,
2. participants perceived the process to be efficient,
3. promoted effective federal/non-federal landowner partnerships,
4. program met its goals for habitat conservation, and 5) provided additional flexibility for federal agencies to accomplish their mission.

Utah Prairie Dog Habitat Credits Exchange Program

UTAH PRAIRIE DOG HABITAT CREDITS EXCHANGE PROGRAM OVERVIEW

The Utah prairie dog (UPD) was down listed as threatened by U.S. Fish and Wildlife Service (FWS) in 1984. As a consequence of its threatened status, FWS requires that a Conservation Banking Agreement govern market-based mitigation for the prairie dog. The Utah Prairie Dog Habitat Credits Exchange Program (HCEP), a UPDs habitat credit bank, was established in 2007 to provide options to developers and private landowners to purchase habitat credits, permitting clearance from the Endangered Species Act "ESA" in perpetuity for development or sale of lands encumbered by the UPD. The HCEP is one facet of a multi-pronged effort working towards habitat and species conservation and future delisting of the UPD.

Through the HCEP, a program administrator purchases conservation actions (e.g., conservation easements) from private landowners and in doing so accrues conservation credits. Once accrued, the program administrator sells the credits to the entities required to offset their impacts to prairie dogs. Thus, the HCEP trades impacts on UPDs and their habitat for conservation targeted to high-value habitat elsewhere. More information regarding the creation and implementation of the HCEP can be found at the Panoramaland RC&D's website (http://panoramalandrcd.org/?page_id=199).

PARTIES THAT ARE INVOLVED IN THE FUNDING, ADMINISTRATION AND OPERATIONS OF THE UTAH PRAIRIE DOG HABITAT CREDITS EXCHANGE PROGRAM

FUNDING:

NATURAL RESOURCE CONSERVATION SERVICE (NRCS)

ENVIRONMENTAL DEFENSE FUND (EDF)

UTAH FARM BUREAU FEDERATION (UFBF)

UTAH DIVISION OF NATURAL RESOURCES (UDNR)

ENANGERED SPECIES MITIGAITON FUND (ESMF)

Initially the HCEP was funded by the NRCS Conservation Innovation Grant which was awarded to EDF and UFBF to develop the program concept. The NRCS funds were used to acquire the first three conservation easements; additional funding is now provided by mitigation funds.

ADMINISTRATION AND OPERTATIONS:

PANORAMALAND RESOURCE CONSERVATION AND DEVELOPMENT COUNCIL (RC&D)

The RC&D administer the day-to-day operations of the HCEP. The RC&D enters into agreements with private landowners and is the regular point of contact with them. The RC&D is responsible for performing outreach efforts to encourage participation within the HCEP, managing the activities of the contracted landowners, addressing disturbance issues, facilitating the generation, crediting and debiting of mitigation credits, and monitoring of contracted landowner compliance.

U.S. FISH AND WILDLIFE SERVICE (FWS)

FWS is the federal agency responsible for implementing the Endangered Species Act of 1973. FWS has overall authority over the HCEP.

THIRD PARTY REVIEWER

Utah State University has recently been tasked with performing a comprehensive review of the HCEP. No information regarding this review has been released.

PRIVATE LANDOWNER

Private landowners are property owners with qualifying habitat who may sell a perpetual conservation easement on those acres to the RC&D.

UTAH DIVISION OF WILDLIFE RESOURCES (UDWR)

UDWR has species management authority in the state of Utah, thus regulatory authority over the program. UDWR administer the Iron County HCEP and provide mitigation approval, perform surveys to determine how many credits are required for development, perform annual species site population surveys and approve all property enrollments into the program.

UTAH STATE UNIVERSITY COOPERATIVE EXTENSION (EXTENSION)

Extension acts as an oversight committee which provides advice (through professional, industry and technical support) for direct program objectives and general administration. Extension assists in marketing the program to credit buyers and private land owners in occupied UPD habitat.

CALCULATION OF REQUIRED MITIGATION

Incidental take of UPD may be mitigated by several mechanisms. The HCEP provides mitigation credits (i.e., Conservation Credits, credits) to prospective economic developers by offsetting losses through the protection of UPD habitats in other locations. Therefore, prospective economic developers can purchase credits from the HCEP in order to comply with the ESA, the process detailed by the Iron County HCP and ESA section 7 consultations.

The land in question will be evaluated (at no cost) by the RC&D (must receive final approval from FWS or UDWR), FWS or UDWR to determine its importance to UPDs. This habitat assessment will determine how many credits will be needed to offset loss of UPD habitat because of development. The assessment will determine if the land is Low, Medium or High quality UPD habitat. Once the degree of incidental take is calculated based on the factors (of the habitat assessment) provided below, credits can be purchased and the incidental take can be authorized.

The following criteria are employed to determine the appropriate calculation:

Factor	Criteria	Value	Priority
HABITAT QUALITY			
Species Richness	species richness = 10, 3 grass, 3 forb	0	Low
	species richness >10, 3 grass, 3 forb	1	Medium
	species richness >20, 6 grass, 6 forb	2	High
Average shrub canopy cover	average shrub canopy cover >20%	0	Low
	average shrub canopy cover 11-20%	1	Medium
	average shrub canopy cover 0-10%	2	High
% Ground Cover	% Ground cover 0-20	0	Low
	% Ground cover 20-60	1	Medium
	% Ground cover 60-100	2	High
Moisture rich vegetation	None	0	Low
	300-1000m	1	Medium
	<300m	2	High

LANDSCAPE CONTEXT			
Landscape Location	>2 km dispersal distances to other colony	0	Low
	1 -2 km dispersal distances to other colony	1.5	Medium
	≤ 1 km dispersal distance to other colony	4	High
Barriers to dispersal	4 sides barred to dispersal (w/in 2 km)	0	Low
	3 sides barred to dispersal (w/in 2 km)	1.5	Medium
	0-2 sides barred to dispersal (w/in 2 km)	4	High
POPULATION			
Persistence	unknown or occupied <6 of 10 years	0	Low
	occupied 6-10 years	1	Medium
	occupied consistently for 10 years (or more)	2	High
Number of Prairie Dogs - Population size	1 - 10 UPD	0	Low
	11 - 40 UPD	1	Medium
	> 40 UPD	2	High
	Total Value(TV; Sum, 1 from each above)		
	Max Value (MV)	20	
RESULTING VALUE: LOW/MED/HIGH ***Calculate TV/MV = Resulting Value***	Low Value = <0.5		
	Medium Value = 0.5 - 0.74		
	High Value = >0.75		
MITIGATION MULTIPLIER:	Permanent: Low (6), Medium (8), High (10)		
	Temporary: Low (1.2), Medium (1.6), High (2)		

Total Value *divided by* Max Value *equals* Resulting Value

Acres *multiplied by* Mitigation Multiplier *equals* Credits

Credits *multiplied by* Current Credit Cost *equals* Total Mitigation Cost

Example: A landowner wants to permanently develop 5 acres of UPD habitat. After the initial habitat assessment was performed by FWS, the property was determined to be High value. Since this development is permanent a mitigation multiplier of 10 is used to determine the number of credits needed. Currently credits are sold at $800/credit so $40,000 total is owed for mitigation.

TV= 15.5; 15.5/20=0.0775[high value]

5 acres * 10 [high mitigation multiplier]=50 credits

50 credits * $800 =**$40,000 [mitigation cost]**

Ratio Calculation:

Impacting high quality habitat and mitigating with medium quality habitat = ***3.33 ratio***
3.33 ratio x 5 acres =16.65 acres of conservation
$40,000/16.65= ***$2,402 per acre***

Impacting high quality habitat and mitigating with high quality habitat = ***2.5 ratio***

2.5 ratio x 5 acres =12.5 acres of conservation
$40,000/12.5= ***$3,200 per acre***

Because all credits are consolidated – acquired a combination of medium and high quality habitat credits – the current ratio is 2.86. It is a floating number, determined by the amount of each type of credit acquired.

Impacting high quality habitat = ***2.86 ratio***
2.86 ratio x 5 acres = 14.30 acres of conservation
$40,000/14.30= ***$2,797.20 per acre***

DETERMINING CREDIT COST

Credit costs are calculated based on a combination of variables which are determined by: direct and indirect costs associated with the purchase of the off-site mitigation easement property; endowment fund costs established for future monitoring of easement property; and program administration. Those variable costs are then factored by the mitigation ratio established by the FWS, UDWR and members of the HCEP Advisory Panel as sufficient offset for development impact. Credit costs are subject to variation resulting from variable land acquisition prices & associated program costs. Credits prices are also subject to the theory of economics, supply and demand, for example if demand increases beyond the available credit supply credits will then be sold through auction.

CALCULATION OF MITIGATION CREDITS GENERATED

Willing landowners with at least 20 UPDs on 40 acres may sell a perpetual conservation easement on those acres to the RC&D. This transaction preserves UPD habitat, thereby earning UPD credits. The landowner gets paid by the RC&D for keeping UPDs on his/her ground while retaining title and agricultural rights. The RC&D will hold the conservation easement on the preserved land and coordinate stewardship of the land with the primary landowner. Each landowner, in conjunction with the RC&D, will be able to develop a customized management plan that protects habitat values for UPD and allows continued agricultural activities.

Participating properties will be evaluated and ranked by the RC&D, FWS and UDWR. Upon evaluation, properties receive a rating and a value. Upon approval for easement purchase credits can then be calculated from the value given. The amount of credits earned will be determined by the environmental evaluation, ranking, and quality of the UPD habitat and an inventory of the existing population.

The following criteria are employed to determine the appropriate calculation:

Factor	Criteria	Value	Priority
HABITAT QUALITY			
Species Richness	species richness = 10, 3 grass, 3 forb	0	Low
	species richness >10, 3 grass, 3 forb	1	Medium
	species richness >20, 6 grass, 6 forb	2	High
Average shrub canopy cover	average shrub canopy cover >20%	0	Low
	average shrub canopy cover 11-20%	1	Medium
	average shrub canopy cover 0-10%	2	High
% Ground Cover	% Ground cover 0-20	0	Low
	% Ground cover 20-60	1	Medium
	% Ground cover 60-100	2	High
Moisture rich vegetation	None	0	Low
	300-1000m	1	Medium
	<300m	2	High
LANDSCAPE CONTEXT			
Landscape Location	>2 km dispersal distances to other colony	0	Low
	1 -2 km dispersal distances to other colony	1.5	Medium
	≤ 1 km dispersal distance to other colony	4	High
Barriers to dispersal	4 sides barred to dispersal (w/in 2 km)	0	Low
	3 sides barred to dispersal (w/in 2 km)	1.5	Medium
	0-2 sides barred to dispersal (w/in 2 km)	4	High
POPULATION			
Persistence	unknown or occupied <6 of 10 years	0	Low
	occupied 6-10 years	1	Medium
	occupied consistently for 10 years (or more)	2	High
Number of Prairie Dogs - Population size	21-30 UPD	0	Low
	31-60 UPD	1	Medium
	> 60 UPD	2	High
	Total Value(TV; Sum, 1 from each above)		
	Max Value (MV)	20	
RESULTING VALUE: LOW/MED/HIGH ***Calculate TV/MV = Resulting Value***	Low Value = <0.5; ***Not eligible to enroll***		
	Medium Value = 0.5 - 0.74		
	High Value = >0.75		
	Permanent commitment: Medium (3X), High (4X)		

CREDIT VALUATION MULTIPLIER:	Temporary, 10-15 year commitment: Medium (1X), High (2X)	
	Temporary, 16+ year commitment: Medium (2X), High (3X)	

Total Value *divided by* Max Value *equals* Resulting Value

Acres *multiplied by* Credit Valuation Multiplier *equals* Credits Generated

Example: A landowner wants to permanently enroll their land of 80 contiguous acres. After the initial habitat assessment was performed by FWS, the property was determined to be High value. Since this development is of High value and permanent credit valuation multiplier of 4 is used to determine the number of credits generated.

TV= 15.5; 15.5/20=0.0775 [high value]

80 acres * 4 [high credit valuation multiplier]=**320 Credits**

ALLOCATION, TRACKING AND VALUATION OF MITIGATION CREDITS

THE HCEP uses the Regulatory In lieu fee and Bank Information Tracking System (RIBITS) to manage all credits generated and sold. Further information on this system can be found at the U.S. Army Corps of Engineers' website (https://ribits.usace.army.mil/ribits_apex/f?p=107:27:8977090853153::NO:RP:P27_BUTTON_KEY:22).

	Program	Website	Status	Description	Level	Managing Agency	Compliance Monitoring
Threathened and Endangered Species Programs	Texas Conservation Plan for the Dunes Sagebrush Lizard (TCP)	www.KeepingTexasFirst.org	Active, currently acting as a CCAA	The TCP is a voluntary program for property owners to participant in, acting as both a CCAA and HCP for the Dunes Sagebrush Lizard. Under this program, Participants and non-Participant landowners may enter into contracts to perform Recovery and/or Mitigation Activies which generate Recovery Awards and Mitigation Credits for the TCP. Conservation Measures are also applied to the enrolled acreage by Participants (no credits awarded for implementing these measures).	Federal- U.S. Fish and Wildlife Service	Texas Comptroller of Public Accounts; sub -contractors Texas A&M AgriLife Extension Service and Texas Habitat Conservation Foundation	Subcontractors perform monthly monitoring of TCP Participants and pre, during and post monitoring of contracted Recovery and Mitigation Activities.
	Golden-Cheeked Warlber Recovery Credit System (RCS)	http://rcs.tamu.edu/	Active, Proof-of Concept Program	The RCS allowed the Department of Defense to receive credit for recovery measures implemented by private landowners to offset adverse effects from training activities pertaining to the conservation of the golden-cheeked warbler (GCW). BY conserving/managing GCW habitat for a specified number of years, landowners generated credits for the DoD to use to offset habitat damage on DoD lands.	Federal- U.S. Fish and Wildlife Service, U.S. Department of Defense (DoD), U.S. Department of Agriculture (NRCS); NGO- National Fish and Wildlife Foundation	Texas Parks and Wildlife Department, Environmental Defense Fund, Texas A&M Institute of Renewable Natural Resources ; sub -contractors Texas Watershed Management Foundation	
	Range-wide Conservation Strategy for the Gopher Tortoise	http://www.fws.gov/southeast/candidateconservation/examples.html	Active	The Range-Wide Conservation Strategy for the Gopher Tortoise is meant to serve as a guide to help the U.S. Fish and Wildlife Service, the six states in the gopher tortoise range, and many other public and private partners work together to proactively conserve the gopher tortoise.	Federal- U.S. Fish and Wildlife Service		
	Candidate Conservation Agreement for the Gopher Tortoise (CCA)	http://www.fws.gov/southeast/candidateconservation/pdf/CCA_GopherTortoise_revisedDec2012_final.pdf	Active	The CCA for the Gopher Tortoise was developed as a cooperative effort among state, federal, non-governmental, and private organizations. It establishes a common conservation approach and framework and supports efforts by the signatories to leverage knowledge and funding. The CCA is flexible and voluntary, so that different conservation and management actions can be adopted and implemented at varying levels by each partner.	Federal- U.S. Fish and Wildlife Service		

	Program	Third Party Review	Permits	State and Local Laws	Landowner Assurances	Landowner Incentives	Landowner Hinderances
Threathened and Endangered Species Programs	Texas Conservation Plan for the Dunes Sagebrush Lizard (TCP)	Multiple reviews included in TCP. Ongoing review of all Mitigtion and Recovery projects are performed by Texas Tech Univesity.	Federal enhancement of survival permit (TE55322A-0) issued once species is listed. TCP then converts from a Candidate Conservation Agreement with Assurances into a Habitat Conservation Plan	Endangered Species Act	Contracted landowners will only have to perform activites describes in their Mangement Plan.	100% payment for Recovery or Mitigation Activities performed as specified in contract.	Must comply with contract/Management Plan regulations. Vary by contract.
	Golden-Cheeked Warlber Recovery Credit System (RCS)	The DoD contracted Robertson Consulting Group, Inc. to perform an evaluation of the initial 3-year proof-of-concept for both the process and the intended impact and overall utility of the RCS. The Texas Watershed Management Foundation commissioned an audit from a third party reviewer to examine both the funds and the credits generated and debited.		Endangered Species Act	Contracted landowners will only have to perform activites describes in their contract/Mangement Plan.	Financial assistance for land management and annual rent payments.	Must comply with contract/Management Plan regulations. Vary by contract.
	Range-wide Conservation Strategy for the Gopher Tortoise			Endangered Species Act			
	Candidate Conservation Agreement for the Gopher Tortoise (CCA)			Endangered Species Act			

	Program	Website	Status	Description	Level	Managing Agency	Compliance Monitoring
	Utah Prairie Dog Habitat Credits Exchange Program (HCEP)	http://panoramalandrcd.org/?page_id=199	Active	Through the HCEP, a program administrator purchases conservation actions (e.g., conservation easements) from private landowners and in doing so accrues conservation credits. Once accrued, the program administrator sells the credits to the entities required to offset their impacts to prairie dogs. Thus, the HCEP trades impacts on upland prairie dogs and their habitat for conservation targeted to high-value habitat elsewhere.	Federal- U.S. Fish and Wildlife Service(FWS), Environmental Defense Fund; State- Utah Farm Bureau Federation, Utah Division of Natural Resources, Endangered Species Mitigation Fund	Panoramaland Resource Conservation and Development Council (RC& D), Utah Division of Wildlife Resources (UDWR), State University Cooperative Extension	Land seeking enrollment or needing credits is evaluated by RC&D (must receive final approval from FWS or UDWR), FWS or UDWR before contracting into the program or purchasing credits.
Water Quality Programs	Texas Water Quality Management Plan Program (WQMP)	https://www.tsswcb.texas.gov/en/wqmp	Active	The WQMP is a voluntary program tied to the State's water quality assessments that identify priority water quality problems. The WQMPs are used to direct planning for implementation measures that control and/or prevent water quality problems. Several elements may be contained in the WQMP, such as effluent limitations of wastewater facilities, total maximum daily loads (TMDLs), nonpoint source management controls, identification of designated management agencies, and ground water and source water protection planning. Some of these elements may be contained in separate documents which are prepared independently of the current WQMP update process, but may be referenced as needed to address planning for water quality control measures	State- Texas State Soil and Water Conservation Board	Texas State Soil and Water Conservation Board	State- Texas State Soil and Water Conservation Board
	Louisiana Master Farmer Program	http://www.lsuagcenter.com/en/environment/conservation/master_farmer/	Active	The Louisiana Master Farmer Program focuses on helping agricultural producers voluntarily address environmental concerns as well as helping them enhance the production and resource management skills they need for the continued sustainability of Louisiana agriculture. The program helps producers across a wide range of agricultural and natural resource enterprises by teaching them more about environmental stewardship, conservation-based production techniques and resource management. The program uses a comprehensive approach that includes classroom instruction, observation of LSU AgCenter research-based best management practices and implementation of a comprehensive conservation plan. It also involves a voluntary producer certification process.	Federal- U.S. Department of Agriculture (NRCS)	Louisiana State University Ag Center, Louisiana Farm Bureau,Louisiana Cattlemen's Association andLouisiana Department of Agriculture and Forestry	Commissioner of Agriculture and Forestry

	Program	Third Party Review	Permits	State and Local Laws	Landowner Assurances	Landowner Incentives	Landowner Hinderances
	Utah Prairie Dog Habitat Credits Exchange Program (HCEP)	Utah State University has recently been tasked with performing a comprehensive review of the HCEP. No information regarding this review has been released.		Endangered Species Act	Contracted landowners will only have to perform activites describes in their contract/Mangement Plan.	Payment for conservation easement as determine by contract.	Must comply with contract/Management Plan regulations. Vary by contract
Water Quality Programs	Texas Water Quality Management Plan Program (WQMP)	NA	NA	Texas Water Code, Clean Water Act, Texas Senate Bill 503	NA	Cost-share funding up to $15,000.	Must comply with criteria outlined in the Field Office Technical Guide (written by the NRCS).
	Louisiana Master Farmer Program	NA	NA	Environmental Protection Agency's Impaired Waters List (Total Maximum Daily Load monitoring).	Participants who complete the certification are "presumed" to be in compliance with Louisiana's state soil and water conservation requirements.	Classroom instruction on environmental stewardship and Best Management Practices, field day workshops, help developing a conservaiton plan, and a certificate (good for 5 years).	Must attend 6 hours of continuing education every year.

	Program	Website	Status	Description	Level	Managing Agency	Compliance Monitoring
Other	Michigan Agriculture Environmental Assurance Program (MAEAP)	http://www.maeap.org/	Active	The MAEAP is an innovative, proactive, and voluntary program, designed to reduce farmers' legal and environmental risks through a three-phase process: 1) education; 2) farm-specific risk assessment and practice implementation; and 3) on-farm verification that ensure the farmer has implemented environmentally sound practices.	State- Michigan Department of Agriculture and Rural Development	Michigan Department of Agriculture and Rural Development	Michigan Department of Agriculture and Rural Development
	New York Agriculture Environmental Management (AEM)	http://www.nys-soilandwater.org/aem/	Active	AEM is a cooperative, interagency program that provides one-on-one help to farmers to identify environmental risks on their farms. Once these risks are identified, farmers receive planning, design and help obtaining financial assistance to correct existing problems and prevent future ones. The State Committee develops policy for the statewide AEM program and administers programs through staff and various groups associated with the interagency AEM Steering Committee.	State- New York State Department of Agriculture and Markets and New York State Soil and Water Conservation Committee	Local Soil and Water Conservation Districts	NA

	Program	Third Party Review	Permits	State and Local Laws	Landowner Assurances	Landowner Incentives	Landowner Hinderances
Other	Michigan Agriculture Environmental Assurance Program (MAEAP)	NA	NA	Senate Bill 122 and House Bill 4212, now Public Acts 1 and 2 of 2011	NA	Classroom instruction on new and emerging regulations and opportunities affecting agriculture, on-farm risk assessment, third-party verification that the property meets the State's Generally Accepted Agricultural Management Practice, recognition for their accomplishments and access to incentives.	To maintain MAEAP Verification, producers must request a MDARD visit every three years.
	New York Agriculture Environmental Management (AEM)	NA	NA	Clean Water Act, Clean Air Bond Act	NA	Help identifying issues on property, development of a conservaiton plan to address issues , and assistence in finding financial assistance.	NA

Determine Certainty Program Framework of a Market Based Conservation Initiative for Longleaf Pine Habitat Improvements in Eastern North Carolina

Ecosystem Credit Policy Review
Component Report 6 of 6

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This project proposed to advance the concept of a national streamlined model of endangered and threatened species habitat improvement efforts allowing for a landscape scale approach within the Longleaf Pine Ecosystem. The project was designed to develop innovative data, information, methods, and partnerships to increase the Longleaf pine ecosystem in North Carolina. This ecosystem provides unique ecological benefits, and has been a focus of many cooperative efforts in the last decade. Several factors come into play making this the opportune time to engage in landscape scale ecosystem improvement efforts including; (i) potential land usage changes in eastern North Carolina and private landowner preferences, (ii) an existing market-based project approach to open space conservation coined the Market Based Conservation Initiative, (iii) on-going Longleaf Pine Ecosystem restoration efforts, (iv) nationally recognized habitat exchange systems and (v) state level Certainty Program efforts. All of these efforts have their own sets of merits and weaknesses, but the overarching missing piece is a national streamlined model that can work across an entire ecosystem. This component of our report addresses the policy components of our project that can help advance restoration of key ecosystems on private lands. A complete listing of all sources that were used during drafting is provided at the end of the document.

In the United States, approximately 1,586 plant and animal species are currently listed as either threatened or endangered, and numerous candidate species are under review for listing under the Endangered Species Act (ESA). To achieve future conservation success, working on private lands in an innovative way is needed. Proactive management measures can be initiated by private landowners to assist in the species recovery process while also benefiting themselves through incentives (often regulatory assurances) offered by different conservation programs. To do work in ecosystems supporting threatened and endangered species, actions must fit within the confines of existing federal legislation, below is a summary of the key legislation, the Endangered Species Act.

Endangered Species Act (ESA) – Overarching Legislation

The ESA was adopted in 1973 as a means to protect and recover imperiled species and the ecosystems in which the species depend upon, through listing the species as threatened or endangered. Once listed, the 'take' of a species is strictly regulated. The ESA is administered by Interior Department's U.S. Fish and Wildlife Services (FWS) for freshwater and terrestrial species. (Discussions of marine species are excluded from this report.) In addition, the ESA encourages FWS to work with various entities to implement conservation actions for candidate species (i.e., species at risk of being listed as endangered or threatened) so that full protection for the species may become unnecessary. Below is a summary of notable ESA sections;

To review all ESA Sections, please visit: http://www.fws.gov/endangered/laws-policies/esa.html

Section 4 describes the listing process, citizens' petition rights, designation of critical habitat, and recovery of species and delisting. The FWS has one year following the submission of a citizens' petition to make a decision on the listing status of a species. If the FWS misses the timeline designated by the ESA, then citizens' have the right to sue in order to enforce the timelines and make sure the species being considered receives adequate and timely protection.

Section 6 offers a variety of tools available to help States and private landowners implement conservation projects to benefit the species. For example, the Cooperative Endangered Species Conservation Fund provides grants to the States and territories that contribute a variety of voluntary conservation projects for candidate, proposed, and listed species. Some programs also provide funding to States and territories for species and habitat conservation actions within private landowners' property.

Section 7 dictates that all Federal agencies must maintain high standards for their actions, which may adversely affect the critical habitat and overall well-being of an endangered or threatened species, as designated by the ESA.

Section 9 defines prohibited activities that can range from the illegal import and export, take, illegally taken possession of, transport, or sale of endangered or threatened species. Take can also include harming or harassing the species by altering their natural habitat that may indirectly cause a decrease in the population by disrupting crucial behavior patterns such as feeding or breeding.

Section 10 explains the course of action that is necessary to receive a permit that will allow the prohibited actions described in Section 9. However, Section 10(a)(1)(A) allows for the removal of a species for scientific reasons or for the means of development and breeding or survival of the species; while Section 10(a)(1)(B) permits incidental take, or the accidental killing or harming of an endangered or threatened species.

Existing ESA Programs Review

Many threatened and endangered species' habitats reside on private landscapes. This fact highlights the importance of landowner involvement for protecting and promoting a species habitat or population. It is necessary for landowners to understand that certain construction and/or other common activities landowners perform may result in the '*take'* of a listed species. These actions will require a permit from the FSW, as described in Sections 9 and 10 of the ESA. Landowners are responsible for identifying the banned development and/or activities as designated by the ESA. There are several tools for private landowners when it comes to managing and protecting candidate, threatened and endangered species.

Candidate Conservation Agreements with Assurances (CCAAs) and Candidate Conservation Agreements (CCAs) are widely used to conserve candidate species in order to avoid a later listing. The general thought behind CCAAs and CCAs is that species are easier to recover before they reach endangered status. By implementing voluntary plans (CCAAs on private or State land and CCAs on Federal land) to conserve candidate species, private landowners receive incentives in the form of regulatory assurances. If the species does become listed as endangered or threatened, landowners who participate in a CCAAs and CCAs are protected from further regulations beyond what is listed in their agreement and will receive an *Enhancement of Survival Permit*, allowing incidental take in reference to the management activities identified in the agreement. The first CCAA was implemented for the Robust Redhorse in the Ocmulgee River in Georgia in 2001.

For more information on CCAAs and CCAs, please visit:
CCA- http://www.fws.gov/endangered/esa-library/pdf/CCAs.pdf
CCAA - http://www.fws.gov/southwest/es/NewMexico/documents/CCAA_national_factsheet.pdf

Safe Harbor Agreements (SHAs) are similar to the CCAAs and CCAs in that these programs strive to incorporate private landowners' voluntary participation in species conservation in return for regulatory assurances. A big difference between these programs is that CCAAs and CCAs deal specifically with species that are not yet listed, while SHAs work strictly with species that have already been listed with the status of endangered or threatened. SHAs focus on improving (or returning) a species habitat to original and agreed-upon (in the SHA), baseline conditions, even if that means the incidental take of a species will occur. The first SHAs were established to help with the recovery of the red cockaded woodpecker in the Sandhills region of North Carolina in 1995.

For more information on SHAs, please visit: http://www.fws.gov/endangered/esa-library/pdf/harborqa.pdf

Habitat Conservation Plans (HCPs) are available for landowners including private citizens, Corporations, Tribes, States, and counties who want to develop property inhabited by listed species. This conservation option is often used to balance the economic need for land development with the conservation needs of a listed species. The landowner must determine any likely impacts to the species from the proposed actions as well develop a plan to avoid, minimize and mitigate the negative impacts, and the necessary funding available to carry out the steps. Once approved by FWS, the landowner will receive an *Incidental Take Permit*, which allows landowners to partake in otherwise legal activities that may adversely affect or harm a listed species or its habitat. Although FWS provide guarantees that HCPs will be fulfilled, third parties are permitted to sue if they find the HCP to be inadequate, which can extend the implementation for several years. The first HCP was created for the San Bruno Mountain, California, to benefit the Mission blue butterfly in 1983.

For more information on HCPs, please visit: http://www.fws.gov/endangered/esa-library/pdf/hcp.pdf

Conservation Banking has an overarching goal to protect and manage lands that are inhabited by endangered, threatened or candidate species. In return for permanently protecting the land and monitoring it for the safety and survival of these species, the FWS can approve a designated amount of credits that bank owners may sell. These credits are used to offset adverse effects on a particular species from an action that takes place elsewhere. The first wetlands conservation bank was created by The Stream + Wetlands Foundation, formerly the Ohio Wetlands Foundation, in 1992.

For more information on Conservation Banks, please visit:
http://www.fws.gov/southwest/es/Documents/R2ES/conservation_banking.pdf

Recovery Credit Systems are a tool for federal agencies to benefit threatened and endangered species on non-federal lands by creating a 'bank' of credits. The federal agency may develop and store conservation credits on private lands that are used to offset temporary or permanent negative impacts to the species habitat on federal lands. Private landowners provide these credits through maintaining or improving the species habitat on their land. This program offers incentives to the landowner through tax deductions, regulatory assurances and/or possible payments, as determined by the program. The first Recover Credit System was designed for the Golden Cheeked Warbler in Fort Hood, Texas in 2005.

For more information on Recovery Crediting, please visit:
http://www.fws.gov/home/feature/2007/EndangeredspeciesRecoveryQsandAsVF1107.pdf

Grants for States and Territories, offered through the Cooperative Endangered Species Conservation Fund, benefit voluntary conservation projects for candidate, proposed and listed species. These funds can be awarded to private landowners and groups for conservation projects. Funded activities include habitat restoration, species status surveys, public education and outreach, species reintroduction, nesting surveys, genetic studies and development of conservations management plans.

For more information on Grants, please visit: http://www.fws.gov/grants/ and http://training.fws.gov/courses/csp/csp3115/resources/ESA_Folder/grants.pdf

Working Lands for Wildlife – An Ecosystem Success Story

Working Lands for Wildlife (WLW) rolled out in the 2014 Farm Bill and was based on previous work under the Wildlife Habitat Incentive Program (WHIP). WLW's purpose is to restore declining species, provide regulator certainty to participants, and strengthen rural economies by benefiting agriculture and forestry production capacity. Regulatory assurances are provided through a variety of legal mechanisms such as informal agreements, conference opinions, biological opinions, CCAs, SHAs, and HCPs. Multiple federal, state, and local partners target resources to a species in which the declining population trends can be reversed and the overall program benefits additional secondary species (1).

Species that are selected have habitat needs that are critical on private lands and the needs are compatible with traditional agriculture and forestry production practices. The species also has a viable core habitat that can be protected and where partners identify opportunities for additional habitat recovery. Current ESA tools are used to provide the regulatory certainty of some best management practices causing an "incidental take"; participants can be provided with 30 year+ exemptions (2, 3).

WLW currently focuses on seven key species; bog turtles, lesser prairie-chickens, gopher tortoise, New England cottontail, golden-winged warbler, southwestern willow flycatcher, and the greater sage grouse. Through a variety of efforts from multiple partners the following successes are being achieved, as noted below:

- The ***Sage Grouse Initiative***, started in 2010 by the USDA Natural Resources Conservation Service, achieved conservation success in 2015. The partnership brought together ranchers, government agencies (including conservation districts), universities, non-profits and businesses to support wildlife conservation across 11 western states. The partnership deployed proactive voluntary conservation measures and substantial public-private collaboration in protecting and establishing sagebrush habitat at a landscape scale approach. The Greater Sage Grouse was determined by the FWS to not face a risk of extinction now or in the foreseeable future, in 2015.

  To learn more about the initiative visit http://www.sagegrouseinitiative.com/

- A ***Gopher Tortoise Pilot Program*** is allowing landowners to manage for longleaf pine habitat but not necessarily have species identified on site and still be eligible for selling or banking acreage for credits. A CCA was drafted in 2006 by fish and wildlife state agencies, Department of Defense representatives, and related nonprofit organizations across 4 southeastern states. By 2012, the Gopher Tortoise Candidate Conservation Marketplace was established, allowing the US Army to work with partners to manage proactively habitat before ESA federal listing becomes necessary (4).

- The ***Southwestern Willow Flycatcher Restoration Program*** is taking a habitat approach within the species range since the bird is a key species and its habitat needs benefit multiple species. A diverse group of conservation partners came together in 2005 to implement a comprehensive conservation plan for the species. By 2013 the work of the partnership paid off when the FWS ruled that almost 75 miles of Rio Grande riparian habitat was excluded from critical habitat designation.

State Level Certainty Programs

For an ecosystem crediting program to be successful, private landowners will need regulatory assurances, these assurances that can mirror the existing Certainty Program framework. Certainty Programs are created at the state or multi-state level to provide regulatory certainty for current and future state and federal regulations. As defined in a National Association of Conservation Districts whitepaper, Certainty Programs are voluntary programs on private lands that provide confidentiality to participants while also requiring verification to prove implementation actions taken. Four types of Certainty Programs exist; carbon sequestration, water quality trading, habitat improvements, and general ecosystem services, with most of the recent programs focusing on water quality issues. In addition to participants receiving regulatory certainty, in some cases they are given additional ranking consideration in other conservation programs at the state or national level. In other cases, enrollment in the program opens up specific ecosystem marketing opportunities by providing a streamlined verification process that the participant is a good environmental steward (5, 6, 7). Below is a listing of some existing programs:

- Ohio was the first state to create a state to federal water quality agreement, in 2012, involving private entities such as utility companies and water treatment facilities. The ***Ohio Water Quality Trading Program*** is a multi-state program which relies on local soil and water conservation districts to identify local priorities and confirm adopted targets are being met (8).

- The ***Willamette Partnership*** in Oregon created tools to determine the value of ecosystem services. One accomplishment was their ability to leverage Conservation Reserve Enhancement Program resources for river buffer plantings to cool streams allowing utilities to meet water temperature requirements (8).

- The ***Louisiana Master Farmers Program*** established a farmer certification process through a streamlined training approach. Participants install best management practices in accordance with a conservation plan that meet specific environmental enhancements. The overarching goal is to obtain high participation rates so that future water quality and other environmental regulations are not necessary. Rice growers that participate can receive crop premiums from Kellogg (5).

- The ***Michigan Agriculture Environmental Assurance Program*** was established to provide an educational venue for producers. The voluntary process provides training and streamlines documentation of practices that minimize agriculture nonpoint source pollution. The participant can use the label as a marketing tool to demonstrate sound environmental stewardship (5).

- The ***New York Agriculture Environmental Management*** program was established to create a whole watershed planning effort while tailoring the process to the needs of the enrolled farms and their specific natural resource base. The voluntary process provides farmers access to a certified planner that inventories current activities and assets, develops a conservation plan, and assists with plan implementation and post evaluation. Enrolled farmers can document their environmental stewardship actions in a streamlined manner (5).

Ecosystem Credit Program Policy Recommendations

At the time this project was undertaken, the above Working Lands for Wildlife success stories were still unfolding. Project partners encourage the continuation of this new trend to consider species recovery from a habitat approach and not just a single species approach. This new trend coupled with the 10.7.15 Executive Order for federal agencies to consider ecosystem services values in relation to proposed federal actions, leads project partners to understand that existing federal regulations allows for a habitat approach to species protection thereby benefiting multiple species (9). However, additional state level regulations should be considered when establishing an Ecosystem Credit Program.

Present Use Valuation is a reduced property tax program offered in some form in every state in the nation. Its intent is to provide lower taxes for rural properties in order to prevent them from being converted to higher and more expensive land uses. Properties developed in agriculture and forestry production or managed for habitat conservation are assessed at a lower property tax value as opposed to highest and best use property tax values. In return, counties receive production and economic development benefits and/or the ecosystem benefits of working lands and open space acreage. These programs have focused on providing tax relief for working farm and forest lands in the past, and are slowly being extended to provide ecosystem benefits as well (10).

Participants in present use valuation are usually required to demonstrate actual production occurring on the property and in most cases are required to follow a management or conservation plan, and may incur withdrawal penalties if they drop out of a program. Land must stay enrolled in the tax relief program for a specified time range, ranging up to 15 years in some cases such as Georgia, and face back penalties of all tax reductions or savings plus interest if they are converted to other uses.

In North Carolina, landowners who own productive agriculture or forestland when a property is taken out of the program the current owner pays current year and three years back taxes for the difference in value. North Carolina's primary PUV program provides reduced tax assessments based on land productivity, and applies to working farms and forest that exceed varying minimum acreage levels, starting at 10 acres for farms and 20 acres for forests. A new North Carolina wildlife reduced use tax valuation program was passed in 2008, but has limits of a maximum of 100 acres, and has only been used for a few properties to date.

By requiring program participants be enrolled in Present Use Valuation, an extra level of program enforcement is in place. Project partners recommend each state carefully consider not capping enrolled acres per landowner per county to allow for maximizing the ecosystem benefits.

Voluntary Agriculture Districts are voluntary land use designations existing in some states for agriculture and forestry production at the county level. Participants are also likely eligible for additional ranking considerations for state and federal conservation programs. Some programs are established with voluntary opting out clauses whereas other enhanced programs place a 10-year enrollment requirement. By requiring participants be in designated Voluntary Agriculture Districts, an extra level of program enforcement is in place and a secondary benefit of more land base connectivity may occur.

Adaptive Management is a process by which programmatic changes are adopted as better science is developed. A time mechanism should be in place to reassess habitat needs and required management techniques. Habitat needs may change temporally as the impacts of climate change are noted. Better best management practices may come online as more of these programs and specific species habitat needs are studied.

However, adaptive management can go against the grain of regulatory assurances, requiring a delicate balancing act. If program enrollees are being asked to do additional management practices, then they should have the right to re-negotiate their contract terms, specifically the level of incentive payments. Or a process could be developed to allow "older" management plans to be grandfathered in as is and only place adaptive management practices on newer program enrollees' plans. A consensus building process that includes all stakeholders should be adopted to determine adaptations, carefully weighing the needs of the species and the economic impact of any potential changes.

Topics Needing Further Evaluation

Project Partners explored other topics through stakeholder discussions, but additional research is needed before policy recommendations could be offered to address the identified issues.

Prescribed Burn Implementation is one of the most limiting factors to Longleaf Pine restoration in North Carolina. The practice is limited by the number of implementation days, the site's proximity to roads and other development, institutional policies limiting the number of burn permits, the lack of qualified specialists, and liability concerns. Some state and federal partners are able to implement the practice on acreage within the confines of their jurisdiction, but it is very difficult for private landowners to overcome implementation obstacles. Other groups are seeking ways to overcome these obstacles with research being conducted by NC State University and project partners are hopeful that this issue can be resolved in the coming years.

Cost Evaluation of Term Contracts versus Permanent Easements is another unresolved issue that project partners were unable to fully evaluate under this project. For any program working with older growth ecosystems, the value of adding a "first right of refusal" clause to a term contract should be evaluated as an opportunity to continue the investment.

When the eastern North Carolina pilot project Market Based Conservation Initiative was implemented to test alternative tools to keeping lands in compatible uses under existing military training routes, a cost analysis was conducted. That study indicated that term limited conservation performance based contracts outperform conservation easements on a 5:1 basis. For example, if contracts were secured for $20/acre/year, with three years of funding at $2,000,000 per year, ~10,000 acres could be placed under contract for 30 years. During the same time, only 1923 acres could be secured using permanence conservation easements if the average cost per acre tracked with 2010 USDA Grasslands Reserve Program ($3120/acre FY 2010; range $1564 to $4837) for Virginia, South Carolina, Tennessee, and North Carolina.

Evidence further suggests that term limited conservation performance based contracts serve as a gateway to longer term or permanent conservation. For example, the North Carolina Conservation Reserve Enhancement Program, a river buffer program, has witnessed a significant increase in both number of agreements and acres enrolled in permanent easements since its inception in 1999. As landowners have grown more familiar with the program, permanent easement enrollment has increased from less than 20% of the program enrollment to over 70%. The majority of the first 10-year agreement enrollees that decided to re-enroll opted for a permanent conservation easement.

Conservation Benchmarks were not determined during project evaluation. Before implementing a true program, greater analysis would be needed on threshold limits of allowing for destruction of isolated Longleaf Pine stands and the aggregation of restored Longleaf Pine stands. The overall species net benefit of habitat trading across the landscape would need to be determined.

Policy Review Conclusions

Project partners feel that an ecosystem crediting program is possible within the existing regulatory framework. The following guiding principles are recommended:

- All programs should be created through a stakeholder driven consensus building process with representative organizations that support habitat conservation, control existing habitat, or benefit from functioning ecosystems. Locally led conservation actions have a long tradition of effectively bringing together a community, state, or region to establish proactive environmental solutions to natural resource degradation.

- Framework future programs similar to the Working Lands for Wildlife Program where voluntary incentives are utilized, habitat practices benefit multiple species, and regulatory agencies allow habitat improvements to count towards delisting or preclude listing of species of concern.

- Regulatory certainty is key to private landowner participation in an ecosystem crediting program. The Certainty Program framework is a viable model to adopt, leading to certified program participation in a streamlined manner. Standardized practices will ensure that habitat improvements will be obtained. Program enrollment transparency allows for both private landowners and regulators to know that obligations are being met in a uniformed manner.

- Project partners support consideration of Present Use Value taxation and Voluntary Agriculture Districts enrollment for ecosystem credit program supply participants. Both tools provide an added layer of enforcement by providing enrollees additional benefits while also applying penalties for program noncompliance.

- Project partners support adaptive management processes to be incorporated into an ecosystem crediting program. As technologies advance and better science is established, a process allowing for future programmatic changes needs to be in place for the program to succeed.

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