Tennessee Forest Carbon

An Opportunity for Landowners in Tennessee to Engage in the Carbon Market

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ABSTRACT

In 2012, the California Air Resource Board initiated the first Cap-and-Trade (Cap) compliance market in the United States. It is a rigorous and iterative program that was launched under extreme scrutiny, with protocols that command high performance. So far, the Cap appears to be promoting new opportunities for greenhouse gas reductions and improving land conservation. Forest carbon is one of the four approved protocols under the Cap and projects can be developed throughout the United States. There is a projected shortfall in forest carbon offsets available to satisfy the growing demand. This could be a new incentive for land conservation throughout forested areas of the United States. The Southeastern United States contains a large amount of forested land in the hands of non-industrial private landowners (NIPL), and appears to be a prime target for new forest carbon projects under the protocol. The region is also under immense development pressure, even though more agricultural land is turning back into forests than being developed. But ecosystem services are not well-understood throughout the United States, and resource conservation services in general are under-utilized in Tennessee. So the situation begged whether or not the forest carbon market could incentivize land conservation by non-industrial private landowners (NIPL) in Tennessee. A policy analysis was conducted to compare four alternatives that are in practice elsewhere in the United States with six separate criteria developed from the extensive research of existing literature. The Cap came out on top dues to its rigorous protocols, current success, and strict oversight. The compliance regime also assured a new level of assurance for the price of the carbon offsets. Project developers certainly have an opportunity in Tennessee, but the real challenge will be in identifying and developing relationships with willing landowners.

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ABBREVIATIONS AND ACRONYMS

AC	Avoided Conversion
ACR	American Carbon Registry
ARB	Air Resources Board
ATFS	American Tree Farm System
C	Carbon
CAA	Clean Air Act
Cap	Cap-and-Trade
CAR	Climate Action Reserve
CDM	Clean Development Mechanism
CH4	Methane
CO2	Carbon dioxide
Corps	Army Corps of Engineers
CWA	Clean Water Act
DOI	Department of the Interior
DOT	Department of Transportation
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ETS	Emissions Trading Scheme
FIA	Forest Inventory and Analysis Program of the U.S. Forest Service
FSC	Forest Stewardship Council
FWS	U.S. Fish and Wildlife Service
GHG	Greenhouse Gas
GSMNP	Great Smoky Mountains National Park
HCP	Habitat Conservation Plan
IFM	Improved Forest Management
IPCC	Intergovernmental Panel on Climate Change
IRT	Interagency Review Team
LTTN	Land Trust for Tennessee
N2O	Nitrous Oxide
NHIP	Natural Heritage Inventory Program
NIPL	Non-industrial Private Landowner

Abbreviations and Acronyms continued

NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Agency
NRCS	National Resource Conservation Service
ODS	Ozone Depleting Substances
OESM	Office of Ecosystem Services and Markets
PES	Payment for Ecosystem Services
Projects	United States Forest Offset Projects
QCE	Qualified Conservation Easement
RGGI	Regional Greenhouse Gas Initiative
RIBITS	Regional Internet Bank Information Tracking System
SFI	Sustainable Forestry Initiative
SO2	Sulfur Dioxide
TACIR	Tennessee Advisory Commission on Intergovernmental Relations
TDEC	Tennessee Department of Environment and Conservation
TDOT	Tennessee Department of Transportation
TDF	Tennessee Division of Forestry
TNAG	Tennessee Department of Agriculture
TWF	Tennessee Wildlife Federation
TWRA	Tennessee Wildlife Resources Agency
UNEP	United Nations Environmental Programme
U.S.	United States
USDA	United States Department of Agriculture
USFS	United States Forest Service
Extension	University of Tennessee Extension Service
WCI	Western Climate Initiative

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1.0 INTRODUCTION

In 2012, the California Air Resource Board (ARB) established the first mandatory Cap-and-Trade Program (Cap) in the United States (U.S.). The Cap is part of the broader scope of the ARB's Global Warming Solutions Act of 2006, an effort to reduce greenhouse gas (GHG) emissions from covered entities in California (ARB, 2012a). It is also the first regulated climate change program in North America, stemming from success by non-regulatory mechanisms for addressing climate change (RGGI, 2013; WCI-INC, 2013). Forest carbon projects are one of four approved protocols available under the Cap for developing carbon offset credits (ACR, 2010; Clegern, 2012). Yet existing voluntary projects are not eligible under the Cap. This has created a need for additional forest projects in other areas of the U.S. that adhere to the Cap's stringent protocols. The Southeastern United States has a high potential for carbon sequestration because there is a high number of forested acres in the hands of non-industrial private landowners (Butler, 2008). As a result, the region has been identified as a primary target for forest carbon project development (Galik et al, 2013).

In addition to carbon sequestration, forest carbon projects provide a financial incentive for land conservation. New incentives could be effective in areas like the southeast that are experiencing increased land development pressures. Since 2000, the southeast has grown 13.5%, while the state of Tennessee has grown 11.5% (Mackun & Wilson, 2011). There has been an 85% increase in developed land in Tennessee since 1982. Many communities lack local planning departments and there are growing conflicts regarding land use practices (TACIR Staff, 2011). Sprawling development poses higher costs on communities and parcelization disrupts ecosystems (Hatcher et al, 2013). Non-industrial private landowners (NIPL) are mainly concerned with how they will keep their property intact for their heirs, and how will they pay rising property taxes (Oswalt, 2012).

Increased land use change and economic pressures such as these require incentivized conservation beyond traditional policy measures such as tax breaks and resource conservation services. Existing ecosystem markets such as wetlands mitigation and conservation banks are a proven tool for preserving ecosystem services and providing financial benefits to landowners (Costanza, 1997; Layke, 2009; NRC, 2005). Yet the extent of landowner willingness to engage in ecosystem markets is uncertain (Forest Trends, 2013; Hanson et al, 2011). So the question arises of whether or not the forest carbon market could incentivize land conservation by NIPLs in Tennessee.

A policy analysis was performed to explore the opportunity. Literature was reviewed to understand the history of ecosystem markets in general; and then a more granular review was taken on conservation policy and behaviors specifically in Tennessee. Problem statements were crafted to explain the various

issues that impact NIPLs decisions to engage in a forest carbon project. Information from the literature review was synthesized to conduct the analysis. Alternatives were developed, criteria were determined and weighted, and a policy matrix was constructed. The alternatives were ranked against the criteria to determine which alternative would be most preferred and why.

This paper is laid out in eight sections. Section 2.0 lists the problem statements that were developed to help define the problem. Section 3.0 describes existing ecosystem markets in the United States. Section 4.0 discusses forest carbon projects eligible under the Cap. Section 5.0 explores conservation regulations and behaviors in Tennessee. Section 6.0 presents the objective and methodology used in the policy analysis. Section 7.0 delivers the results and observations of the policy analysis. Section 8.0 provides the discussion and conclusion.

2.0 Problem Statement

2.1 California Cap Needs Registered Forest Offset Projects

A 2012 study by the American Carbon Registry highlights California carbon offset supply shortage, projecting 29% shortage by 2015 and a 67% shortage by 2020 (Stevenson et al, 2012). The Southeastern U.S. has a high potential for carbon sequestration due to its large amount of forestlands in the hands of non-industrial private landowners (Butler, 2008). The Cap can accept registered forest carbon offset projects from other areas of the United States. As a result, the southeast has been identified as a primary target for forest carbon project development (Galik et al., 2013).

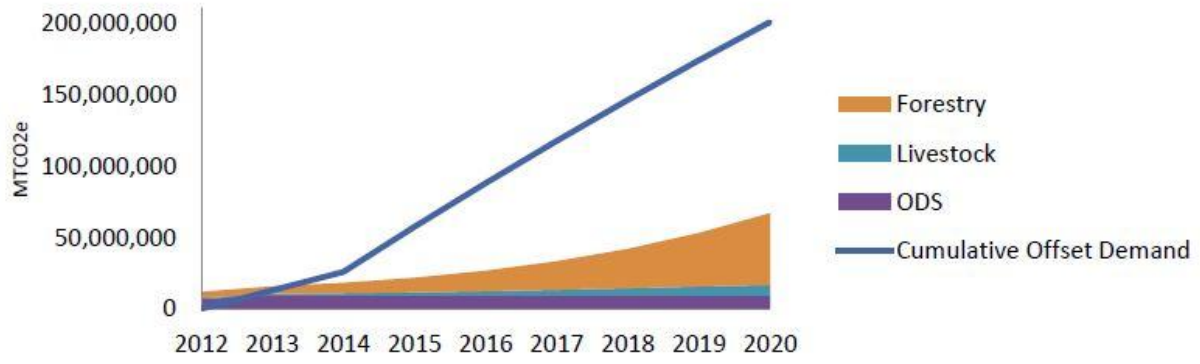


Table 1 - Forecast Cumulative ARB Offset Supply vs. Potential Offset Demand from 2012-2020

2.2 Ecosystem Markets are Successful but Under-utilized Tools

Since the 1970s, ecosystem markets such as water, conservation and carbon have grown. Ecosystem services are benefits that people derive from nature, and include the contributions clean air, water and soil provide to create healthy habitats (Layke, 2009). Ecosystem valuations are performed to determine how these services can be translated into viable markets. These credits are traded in a regulated market and have the potential to become a new economic driver for rural communities, as well as provide an incentive for ecosystem protection (Nicholas Institute, 2013; U.S.DA, 2013). In 2008, the U.S. Department of Agriculture (USDA) established the Office of Ecosystem Services and Markets (OESM) to support development of emerging markets for water quality, carbon sequestration, wetlands, biodiversity, and other ecosystem services (USDA, 2013). The Tennessee Department of Transportation (TDOT) and the Tennessee Department of Conservation (TDEC) manage the wetland mitigation banks in the state. The Tennessee Wildlife and Resource Agency (TWRA) and University of Tennessee Extension Service (Extension) provide information to landowners on available programs. The Tennessee Wildlife Federation (TWF) and land trusts guide landowners through the processes. TWF recently started an in-lieu fee (ILF) program for mitigation banks as well. Despite the standardization of these tools, education and capacity building need to be improved throughout the southeast (Yonavjak et al, 2011).

2.3 Tennessee Does Not Support Climate Change Legislation

Public acknowledgment of climate change has grown since the Kyoto Protocol was adopted in 1997, but Tennessee is unlikely to initiate any legislation to combat climate change. State agencies have considered climate change in reports since 2002, and advocacy groups work to promote varied agendas for sustainability focused on climate change (Associated Press, 2013; Sustainable Tennessee, 2012; TWRA, 2009). Despite research performed on the impact of climate change on Tennessee's biodiversity and forests, no climate action plans have been developed (TDF, 2010; TWRA, 2009). There is an Office of Sustainable Practices that works with people from all parts of the Tennessee Department of Environment and Conservation, but no Office of Ecosystem Markets as in the federal government. In April 2012, a bill was passed that allows creationism to be part of the curriculum in public schools and teachers to question scientific theories without academic rigor, including evolution and climate change (Haynes, 2012). The voluntary carbon market has not been embraced as a management option. There are only two forest carbon projects in Tennessee registered with the Climate Action Reserve. Forest certification and eco-labeling have low penetration as well (TFA, 2013; Yonavjak et al., 2011).

2.4 Land Planning is Not a Priority in Tennessee

Smart Growth brings a greater awareness of the benefits of planning for land conservation and has become widely-accepted throughout the U.S. since the mid-1900s (SGA, 2010). It includes economic development, improved cities, increased tourism, farmland conservation, flood control, and environmental protection. Despite the international acceptance, Tennessee has been slow to embrace Smart Growth. Comprehensive planning is not required for municipalities and counties in Tennessee. There is no entity at the state level that conducts comprehensive, long-range planning (TACIR Staff, 2011). In 2012, the Tennessee government dissolved the 60+person planning department that had been housed at the Economic and Community Development Agency. Local communities are now burdened with long range planning. These efforts have come about with varied success in the four largest cities and rely largely, if not wholly, on funding from the private sector.

2.5 Tennessee Forestland Increasing, but Land Ownership Changing

Forests in Tennessee cover 14 million acres, encompassing 52% of the state's land area, 3% of that is owned by wood-using industry and 16% is owned by the state (Oswalt, 2012). The state ownership is higher than the average southeastern states forestland ownership of 13%. Forest land increased rapidly in the state since 1971, but is now leveling off. This was largely due to forests regenerating on unused agricultural fields The area of farmland reverting back to forest is greater than the area of forest being lost to development pressure (TDF, 2013). But as land is passed on to new generations, fragmentation, parcelization, and associated land use changes occur. These forces together will decrease the amount of forested properties, cause low acreage family forests to increase, and make it more difficult to manage these properties nationwide (Hatcher, Jr. et al., 2013)

2.6 NIPLs in Tennessee Value Their Forestland

The National Woodland Owners Survey from 2006 identified that 65% of non-industrial private landowners in Tennessee owned less than ten acres, and only five percent owned tracts more than 100 acres (Butler, 2008). This same study identifies that about 8% of the area owned by NIPLs is over 1,000 acres. Their top five main concerns are insects or plant diseases, fire, trespassing or poaching, keeping land intact for heirs, and high property taxes. NIPLs own their land primarily because of its beauty and scenery. They have a strong desire to pass the land onto their heirs. They value their privacy. Most private forestland hosts a home or cabin. These same landowners have an ethic to protect nature. Almost 20% of these landowners said they plan to harvest firewood, which indicates a growth in acceptance of forest management plans.

3.0 ECOSYSTEM MARKETS IN THE U.S.

In the past twenty years, increased land use change has promoted a variety of market forces to incentivize conservation beyond traditional policy measures. These forces are called ecosystem markets. They place an economic value on ecosystem services such as clean water, flood buffers, sustainable timber, habitat for fisheries, clean air, and pollination of native and agricultural plants. Land use change disrupts water quality, nutrient cycling, and soil retention. It contributes to climate change, and altered ecosystems have negative impacts on human well-being (Millennium Ecosystem Assessment, c2005). Payments for ecosystem services (PES) reward conservation of these resources and are the primary instrument of ecosystem markets (NRC, 2005).

The instruments that support PES include direct public payments, direct private payments, tax incentives, Cap-and-trade markets, voluntary markets, and certification programs (Forest Trends, 2013). The three prevalent ecosystem markets in the United States are water, biodiversity and carbon. Mitigation banks provide public payments and are regulated on the federal level yet managed on the state level. Carbon is a market-based commodity, publicly traded under a voluntary market for over a decade and more recently under mandatory cap-and-trade programs.

Mitigation banking provides some value to the natural environment, yet it is still in debate to whether or not it is a proven tool for protecting ecosystem services. In some cases, mitigation banking encourages destruction of one habitat while promoting the conservation of another (Morgan & Roberts, 1999; Reiss, Hernandez, & Brown, 2009). Despite these critiques, mitigation banks have laid the groundwork for a new way of valuing ecosystem services. In addition, the private market is growing for establishing mitigation banks. Private firms capitalize on the PES for wetland, stream, and endangered species habitat mitigation throughout the U.S., while contributing to workforce development to create and manage these sites. Land trusts such as the Pacific Forest Trust and The Conservation Fund have promoted the voluntary carbon market as an opportunity to defend against climate change while conserving land (Wayburn et al., 2000).

3.1 WATER: WETLAND MITIGATION BANKING

One of the first efforts in commoditizing ecosystem services was the Clean Water Act of 1972 (CWA), which recognized the need to protect water resources from industrial and agricultural pollution. Wetlands provide numerous beneficial services for people and wildlife, including drinking water quality, flood control, fisheries, wildlife habitat and recreation. Well-managed wetlands are set aside or banked to provide ecosystem services. Mitigation banking is defined as “the restoration, creation, enhancement, or

preservation of a wetland, stream, or other habitat area undertaken expressly for the purpose of compensating for unavoidable resource losses in advance of development actions, when such compensation cannot be achieved at the development site or would not be as environmentally beneficial" (NMBA, 2011). In the late 1990s, wetlands worldwide were valued at nearly $15 trillion (Costanza, 1997).

Mitigation banking was first introduced by the U.S. government in 1983 through guidance by the Fish and Wildlife Service (FWS) to protect wetlands, or find other sites to replace ones destroyed by development (Dahl & Allord, 1997). Most of these banks were sites qualified as compensatory mitigation resulting from impacts to wetlands caused by state agencies such as the Department of Transportation (DOT). Compensatory mitigation is "the restoration, establishment, enhancement, or in certain circumstances, preservation of wetlands, streams or other aquatic resources for the purpose of offsetting unavoidable adverse impacts" (EPA, 2008).

In the early 1990s, the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) began to understand that banking can resolve noncompliance with existing policies, particularly Section 404 of the Clean Water Act. Section 404 requires that negative impacts to waterways and the creatures that inhabit them must be avoided during every authorized discharge. For impacts that cannot be avoided, compensatory mitigation ameliorates negative impacts to ecosystem services provided by the watershed. Part of this requirement was to assure accountability in mitigation banking. The existing compensatory mitigation challenged the effectiveness of banking practices, so third-party firms began getting involved (EPA, 2008).

By 2005, there were more than 450 wetland mitigation banks, reflecting an increase of over 375% since 1990. Prices for wetland credits range from $3,000 to $600,000, which indicates that there is a market demand for well-managed wetlands. This range in price results from challenges in acquiring land that is appropriate for siting a bank, such as the price of the land itself, the cost of developing a wetland mitigation bank, and the variances between different regions (Ecosystem Marketplace, 2010). Initially only ILF prices were public and offered an approximate value of the banks. The costs of wetland credits are now tracked by the Corps in the Regional Internet Bank Information Tracking System (RIBITS), a database established by the CWA revisions of 2008. It is maintained by the Corps to track mitigation banks (Corps, 2013; EPA, 2008). There has been slow uptake in use of this instrument by state agencies. Some state agencies set ILF prices that can be paid if mitigation opportunities are not available (EPA, 2008).

The 2008 revisions also issued a new round of regulations on compensatory mitigation. These new rules covered impacts to all waters of the U.S. and aim to replace "lost aquatic resource functions and area, expand public participation in compensatory mitigation decision making, and increase the efficiency and predictability of the mitigation project review process" (Corps, 2013). New instruments, including online tools, were designed to assure the effective implementation of the new regulations, and states are slowly implementing the new regulations (Corps, 2013; EPA, 2008).

3.2 Biodiversity: Conservation Banking

Conservation banks were established in the U.S. through the Endangered Species Act (ESA) in the early 1990s. The U.S. Fish & Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) are the agencies responsible for the development of conservation banks. These banks mitigate negative impacts to species that have been listed under ESA. The first guidelines were released by the FWS in May 2003 and promote consistency by standardizing bank establishment and operational criteria nationwide (DOI, 2003). No two banks are developed or used in an identical fashion. The guidelines emphasize that, in contrast to mitigation banks, "conservation banks preserve existing habitat with long-term conservation value to mitigate loss of other isolated and fragmented habitat that has no long-term value to the species" (DOI, 2003). In contrast to wetland banking, which maintains function and values present in a particular watershed, the FWS is tasked with judging projects on how the species are impacted, not where they can be moved to.

As of January 2009, almost 90,000 acres of habitat were protected by more than 90 FWS approved conservation banks. In 2011, conservation banks were expanded to cover marine and anadromous species. ESA Section 7 demands federal agencies communicate with FWS to determine impacts to listed species. ESA Section 10 demands incidental take permits and Habitat Conservation Plans (HCP) for such impacts. The FWS administers the ESA for land and freshwater species, while the NMFS administers ESA for all other water species. As of 2013, conservation banks are located in only eleven states (USFWS, 2013).

3.3 Carbon: Voluntary and Regulated Markets

In the late 1950's, the concept of tradable permits developed in the United States. By the 1970s, the EPA was experimenting with regulations that balance social and business needs through the Clean Air Act (CAA). As a result, one of the first flexible regulatory mechanisms was put into play with the first emissions trading program in 1979: a phase out of leaded petroleum that took almost ten years to complete. The Helsinki Protocol demanded uniform sulfur dioxide (SO2) emissions reductions in 1985 (Calel, 2013). Efforts to reduce GHGs formalized in 1987 when the Montreal Protocol eliminated the

production and consumption of ozone depleting substance (ODS). Ten years later, the Kyoto Protocol was adopted, which brought together countries through the United Nations Environment Programme's (UNEP) Intergovernmental Panel on Climate Change (IPCC). The IPCC reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change (UNEP, 1988). The Kyoto Protocol laid the groundwork for carbon trading to mitigate the impacts of carbon dioxide (CO2) into the atmosphere. The U.S. withdrew from the Kyoto Protocol in 2001 and has yet to adopt any legislation to address climate change at the federal level.

Since 2001, U.S. businesses and state governments have promoted adoption of varied emissions trading schemes. From 2003 to 2010, the Chicago Climate Exchange (CCX) encouraged businesses to voluntarily make legally binding commitments to cut their emissions on a trading platform. On the other side of the country, the Regional Greenhouse Gas Initiative (RGGI) launched in 2009. RGGI was a collaborative made up of 10 Northeastern states voluntarily capping electricity sector emissions (Calel, 2013). The Western Climate Initiative (WCI) brought together several western states and two provinces in Canada "to identify, evaluate, and implement emissions trading policies to tackle climate change at a regional level" (WCI-INC, 2013). The American Carbon Reserve (ACR) and the Climate Action Reserve (CAR) accept verified carbon projects and have been trading carbon offsets for more than ten years. Global carbon markets were launched in 2005 with the European Emissions Trading Scheme (ETS) and implementation of the Clean Development Mechanism (CDM). In 2006, the California legislature passed the Global Warming Solutions Act of 2006, an effort to reduce greenhouse gas (GHG) emissions from covered entities in California (ARB, 2012a). This Act created the first mandated Cap-and-Trade Program (Cap) in the United States.

In 2012, the Cap went into effect. It is managed by the California Air Resources Board and is the first regulated climate change program in North America. The ARB is the only entity that can issue compliance offset credits for use under the Cap. Any reduction of GHG emissions used for compliance purposes "must be real, permanent, quantifiable, verifiable, enforceable and additional" (ARB, 2012a). CAR and ACR were approved as the two Project Offset Registries by the ARB in December of 2012 (Clegern, 2012). There are four approved Compliance Offset Protocols under the Cap which projects must adhere to: U.S. Forest, Urban Forests, Livestock Projects and ODS. The first auction under the Cap was in the spring of 2013 and was more successful than anticipated.

4.0 FOREST CARBON PROJECTS UNDER THE CAP

Forest carbon projects under the Cap can incentivize land conservation and promote improved forest management. Carbon can be sequestered through sustainable forestry practices, in which carbon is stored in biomass by well-managed harvesting, reforestation, and other natural processes. Carbon sequestration is a part of tree growth. Trees absorb carbon through photosynthesis, where their leaves, roots and wood fiber absorb carbon, and then release oxygen. Unconsumed dead wood continues to store the carbon for hundreds of years. Once carbon is sequestered, credits with market value can be generated and sold or traded to industries needing to offset carbon emissions (Forest Trends, 2013; Irland et al., 2001). Forests are vital for offset purposes to bridge the gap until new carbon sequestration technologies are created (Leahy, 2011). The projected utility for these offsets are estimated to be 30 years (Forest Trends, 2013).

Land Use, Land Use Change, and Forestry (LULUCF) is a policy of the Kyoto Protocol. It is defined by the IPCC as "a GHG inventory sector that covers emissions and removals of GHGs resulting from direct human-induced land use, land-use change and forestry activities" (UNEP, 1988). Standing carbon stocks and emissions of GHGs in forests have been examined for their impact on carbon sequestration since the late 1990's (IPCC 1998). Forestry has been a component of a majority of the voluntary carbon market schemes throughout the world, yet the complexity of modeling LULUCF has brought a variety of approaches into production to deal with the same problem. Approaches varying from geographic/spatial to economic have complicated the overall picture (Michetti, 2012). The potential benefits of forests in terms of carbon sequestration will not be fully realized if these ecosystems are not carefully managed and robust protocols are standardized (Lorenz, 2010).

The ARB Cap-and-Trade Program demands adherence to stringent protocols based on IPCC guidance. U.S. Forest Offset Projects (Projects) are one of four approved protocols available under the Cap for developing carbon offset credits (ACR, 2010). There are three eligible types of Projects under the ARB: Reforestation, Improved Forest Management, and Avoided Conversion (ARB, 2013). Reforestation is replanting trees on land to improve stocking to optimal levels. Reforestation is a short commercial opportunity of approximately 30 years. Improved Forest Management (IFM) maintains or increases the stocks of carbon through new management activities. The new carbon stocks are set against a baseline of carbon stocks inventoried before onset of a project. Avoided Conversion (AC) prevents changing a forest into a non-forest use. The forested land is dedicated to continuous forest cover through a conservation (or Qualified Conservation Easement (QCE) as described by the ARB) or transferred to public ownership, either state or municipal. Transfer to federal ownership is excluded from the protocol (ARB, 2012b). Of the three project types, IFM provides the best return on investment (ROI) and is least cumbersome to

satisfy. Reforestation is easiest to perform, but it provides the lowest ROI. AC is the most cumbersome, but has the potential to provide the highest ROI.

The predominant requirements of the forest protocol under the Cap are ownership, start date, location, project commitment or permanence, protection of the type of forest use, and forest management (ARB, 2013). The land must be privately owned, and can include most tribal forests, or nonfederal public forests acquired post-2007. The project must commence on or after January 1, 2007, and can be triggered by a change in ownership; placement of a conservation easement; change in management, or most commonly, commitment to a carbon project. The projects can be located anywhere in the continental U.S., Alaska, or Hawaii. A project must maintain carbon stocks credited as offsets for 100 years, and periodic inventories and verifications must be performed to demonstrate that offset stocks and other commitments are being met. The forest use must be protected. AC projects require a qualified conservation easement. IFM projects do not require an easement, but may receive more offsets if an easement is included. The forest owner must maintain a management plan certified under the Sustainable Forestry Initiative (SFI), American Tree Farm System (ATFS), Forest Stewardship Council (FSC), or enrolled under a state or federal forestry program. The land must be managed for native vegetation species (Jenkins & Smith, 2013).

The Cap does not come without criticism, but the process is iterative, with another round of amendments being considered in the summer of 2013. Most concerns have been over legacy contracts with electricity suppliers. California's Legislative Analysis Office determined that the Cap is the most cost-effective way to reduce climate pollution (Taylor, 2012). Project developers who worked under the voluntary market are now engaging in the compliance market. Some of these firms are financed through Venture Capital funds, and typically take their earnings once a project is registered. Others are collaborations of corporate and non-profit entities which at times approach projects with less rigor. The stringent protocols of the Cap provide a uniform and standardized platform which provides a new level of security to participants. NIPLs and state governments have an improved opportunity to reap financial benefits from the carbon market because there is an increasing demand for carbon offsets. Voluntary projects entered into before 2007 are not eligible under the Cap (Stevenson et al., 2012). This has resulted in the need to locate additional Projects in other areas of the U.S. under a specific protocol. The southeastern U.S. has been identified as a key player for this opportunity due to its high number of NIPLs (Butler, 2008). Yet the question remains of whether or not the southeast, specifically Tennessee, is willing to engage in the carbon market under a Cap.

5.0 CONSERVATION IN TENNESSEE

Tennessee has a tremendous amount of biodiversity throughout a multitude of ecotones. The state is bordered by the Great Smoky Mountain National Park (GSMNP) on the east and the Mississippi River on the west. GSMNP covers 520,000 acres and is the most visited park in the U.S. It hosts Discover Life in America, the All Taxa Biodiversity Inventory that has discovered nearly 10,000 new animal species in the past ten years. The Cherokee National Forest also spans the eastern half of the state, and encompasses more than 650,000 acres. The state hosts an enormous number of riverine systems that comprise the Tennessee Valley. The Tennessee Valley Authority (TVA) manages the most iconic hydro-electric projects in the United States, with more than 11,000 miles of open shoreline. All of this beautiful outdoors attracts new residents and recreationalists, with the latest census reports indicating a growth rate of 11.5% since 2010 and another 20% gain expected in the next ten years (TACIR Staff, 2011). Ecosystem services are a large part of this landscape, and are already under an immense amount of pressure (Carter, 2007).

There are a variety of programs supported by federal agencies that Tennessee state agencies have adopted to help landowners better manage their properties (Appendix 5). These are managed through and the Tennessee Department of Agriculture. These services are offered to assist NIPLs find alternatives to best manage their land, yet they are not well promoted to landowners. In Tennessee, wetland mitigation banks are in operation, but conservation banking is not formally regulated. There are only two voluntary market carbon offset projects in Tennessee.

5.1 WATER: WETLANDS MITIGATION BANKING

Wetlands in Tennessee are regulated under the Tennessee Water Quality Control Act (TWQCA). Funding for wetland mitigation banking comes from EPA grants, wetland permits, and the state's general operating budget (TDEC, 2004). Approximately 400-500 wetland permits are issued each year and most are approved. Tennessee measures the success of their programs on the basis of acreage lost and gained. Yet historically, less than 40% of the monitoring reports have been listed on file. Inadequate design of projects resulted in only partial success of earlier projects (Morgan & Roberts, 1999). The Corps approved new instruments for ILF under the CWA from 2008 in June 2013. There were questions early on how quickly states would comply with the requirements (ELI, 2009). Future transactions involving the Tennessee Stream Mitigation Program (TSMP) will be tracked on RIBITS. In June of 2013, the Corps confirmed that going forward credits accepted as mitigation obligations and the number of credits generated by compensatory mitigation projects will be tracked and reported by service area (Corps, 2013).

As of 2008, 22 Nationwide Permits (NWP) had been issued by TDEC. These are conditional §401 water quality certification permits. State certification was issued for only seven NWPs. Seven other NWPs were not certified (ELI, 2009). The Tennessee Water Pollution Control Regulations require applicants try to avoid or at least minimize impact to wetlands (TDOT, 2010). TDOT is the largest applicant and practices compensatory mitigation through credits generated from eight wetland mitigation banks. An interagency review team (IRT) established the banks through a Memorandum of Agreement. The oversight is by the Mitigation Bank Review Team. In addition, four other banks were listed in TDEC documentation, though TDOT does not appear to use them (TDEC, 2004). In April 2012, the Tennessee Wildlife Federation (TWF) created the Tennessee Mitigation Fund as the first state-supported I mitigation fund (TWF, 2012). TWF identifies mitigation sites and works with landowners to restore those sites to permanently functioning wetlands that comply with rules set forth by the Corps. Landowners apply to TWF for permits to build mitigation sites. Once these sites are constructed, TWF monitors the site over time to ensure the successful restoration of lost wetland functions. Net proceeds from projects are held in escrow. The proceeds and interest from the escrow account are used to maintain existing sites, as well as develop projects later on. Both RIBITS and the TMF are new to Tennessee in 2012 and it has yet to be determined how rigorously they comply with the 2008 CWA revisions.

As of December 31, 2012, the Tennessee Stream Mitigation Program (TSMP) had accepted the liability for 203,824 credits and had produced 144,819 credits through IRT approved projects. The TSMP accepted mitigation responsibility for 26,169 credits during 2012. Total assets equaled $9,842,365 while accrued liabilities totaled $479,733 giving the mitigation fund an end of year equity balance of $9,362,632 as of December 31, 2012. The mitigation fund received deposits totaling $5,233,800 while reflecting an accounts receivable balance of $352,400. The program account also earned a total of $48,538 from interest bearing accounts. Total expenditures for 2012 equaled $5,991,183 of which $5,910,990 was program/project related expenditures and the remaining $80,193 were general and administrative expenditures (Corps, 2013).

5.2 BIODIVERSITY: CONSERVATION BANKING

Tennessee is not one of the eleven states with FWS approved conservation banks. Compliance with the ESA in Tennessee is performed by the Natural Heritage Inventory Program (NHIP). The Rare Plant Protection and Conservation Act of 1985 established the Division of Natural Areas which manages the NHIP. The Division of Natural Areas can enter into agreements with TWRA and TDOT to develop conservation plans and is the lead state agency in the process of listing and recovery efforts for federally

endangered or threatened species of plants. This process was established through a formal cooperative agreement between the FWS and the state (TDEC, 2013).

The FWS also funds projects through TDOT, TWRA and TDEC outside of this agreement to protect species. These projects typically involve fieldwork, research and management activities to prevent endangered species from becoming further impacted, aid in their recovery so they can get off the ESA listings, and to prevent the extermination of the most seriously threatened species. In the planning and design phase of transportation projects, TDOT biologists identify possible negative impacts to listed species (TDOT, 2010). TWRA and TDEC both have oversight specifically of animal species, and TDEC administers some of the FWS funded projects. NHIP maintains a database of state and federally listed species which biologists working on TDOT projects review periodically. Species found within project areas are listed in ecology reports, and then added to the database (TDEC, 2013).

5.3 Carbon: Voluntary and Regulatory

There is a high potential for forest carbon projects in Tennessee, but as of 2013, there were only two registered voluntary forest carbon projects and there are no forest carbon programs through the state. Forests cover 14 million acres in Tennessee, encompassing 52% of the state's land area. Of the remaining forestland, 3% is owned by wood-using industry and 16% is owned by the state (Oswalt, 2012). The state ownership is higher than the average southeastern states forestland ownership of 13%. This leaves nearly five million acres in private ownership. These NIPLs value their land but are concerned about how they will afford to keep it.

In 2008, the Farm Bill directed all states to develop a statewide assessment and strategy of forest resources. The TDF led this effort in collaboration with multiple government agencies and nongovernmental organizations. The assessment was developed to complement other state agency plans such as the TWRA Wildlife Action Plan and TDEC's Recreation Plan. The focus of the assessment and strategy was on maintaining water quality and quantity through forest conservation (TDF, 2010). Hardwood forest types continue to dominate the Tennessee landscape, with the oak-hickory forest type comprising 73% (10.3 million acres) of the 14 million acres of Tennessee forest land in 2009. (TWRA, 2010). The 1999 to 2002 southern pine beetle epidemic was the worst in Tennessee since the 1970s. Yet the survey found that many of the impacted pine forests have been replanted or naturally regenerated to mostly hardwood-type forests. Early successional acres declined between 1961 to 2009 as Tennessee's forests aged. Recently, the area of forests in the zero to 10-year age class began to increase. These young forests provide unique habitat and as older forests decline it becomes more important to manage the

growing resource more sustainably. There has been a 190 percent increase of exotic hardwoods and invasive plants since 1999 (Oswalt, 2012).

There has been a decline in forest industry ownership of land, from an estimated 1.3 million acres in 1999 to only 374,000 acres in 2009. This is largely due to the increasing trend of forest industry divesting their holdings. Forest land increased rapidly in the state since 1971, but is now leveling off. This was largely due to forests regenerating on unused agricultural fields. But as land is passed on to new generations, fragmentation, parcelization, and associated land use changes occur. These forces together will decrease the amount of forested properties, cause low acreage family forests to increase, and make it more difficult to manage these properties throughout the U.S. nationwide (Hatcher, Jr. et al., 2013) Yet currently in Tennessee, the area of farmland reverting back to forest is greater than the area of forest being lost to development pressure (TDF, 2013)

Land trusts educate NIPLs through their efforts to promote land conservation. They add capacity to and facilitate decision making on public policy efforts. The Tennessee Land Trust Network is run by the Foothills Land Conservancy and provides a clearinghouse for conservation practitioners. Throughout the southeast, land trusts have protected more than a million acres with conservation easements and direct purchases over the past ten years, and many have been in operation longer than that. There are nine accredited land trusts in Tennessee, which have conserved 152,000 acres as of 2010 (LTA, 2010). Unlike the northwestern U.S., none of the land trusts in Tennessee currently engage in forest carbon projects, but rather rely on traditional methods of conservation, such as conservation easements and state programs. Larger conservation organizations such as Ducks Unlimited, The Conservation Fund, and The Nature Conservancy also work throughout Tennessee and have experience with forest carbon projects in other regions of the U.S..

6.0 OBJECTIVE & METHODOLOGY

The objective of the project was to determine if a carbon offset project can incentivize conservation by non-industrial private landowners in Tennessee. A policy analysis was performed following guidance from the fourth edition of Eugene Bardach's *A Practical Guide to Policy Analysis: The EightFold Path to Problem Solving* (Bardach, 2012). Problem statements were crafted to explain the various issues that impact NIPLs decisions to engage in a forest carbon project. To conduct the analysis, alternatives were developed, criteria were determined and weighted, and a policy matrix was constructed.

Alternatives are the various options used to achieve the objective desired. Each criterion was considered in the range of these different alternatives and how much that difference matters, including the measured performance and the value of that performance. They were then weighted on a scale from one to five for how important non-industrial private landowners' might react to the criteria and input into a value tree. A policy matrix was constructed to provide a visual comparison of how the alternatives and criteria score. From this comparison, values were assigned to project a variety of outcomes. These were then ranked from most to least favorable to develop scenarios for new land conservation opportunities for NIPLs in Tennessee.

6.1 ALTERNATIVES

Alternatives are the various options used to achieve the objective desired. They can be considered the courses of action or strategies of intervention to solve or mitigate the problem at hand (Bardach, 2012). They start out as a broad yet comprehensive list of ideas. From the larger question of whether or not the forest carbon market can incentivizes land conservation in Tennessee came four targeted scenarios. These scenarios emulate existing forest carbon offset projects from other regions of the U.S.

1. Develop a Project under the Cap (Cap)
2. Develop a Voluntary Project (Voluntary)
3. Add Project Development Program to Land Trust (Land Trust)
4. Design Legislation for a Tennessee Carbon Offset Program (TN Program)

6.2 CRITERIA

Each criterion was considered in the range of different alternatives and how much that difference matters, including the measured performance and the value of that performance, and then weighted. The six criteria selected were based on economic efficiency, uncertainty, ecological impacts, equity, practicality and political acceptability. They were weighted on how important NIPLs viewed them.

Criteria include:

1. Costs: Minimize Costs to Landowners (25%);
2. Uncertainty: Ability to Promote Ecosystem Markets in Tennessee (5%);
3. Equity: Educate Landowners About Benefits of Planning (15%);
4. Ecological Impacts: Increase Land Conservation (25%);
5. Practicality: Research-based Protocols (15%); and,
6. Acceptability: Political Acceptance (15%).

6.2.1 Cost: Minimize Costs to Landowners (25%)

The National Woodlands Owner Survey 2006 and the Tennessee Forest Survey Assessment indicated that NIPLs are concerned about their future ability to manage their land due to the potential of financial hardship and risk of low or no return. At the same time, there is great concern over whether or not there is an opportunity to keep land intact for their heirs and afford increases in property taxes. Costs are integral to their ability to maintain the land. So it was determined that the economic aspects were of the highest concern to NIPLs. Minimizing costs is weighted the highest at 25%.

6.2.2 Uncertainty: Ability to Promote Ecosystem Markets in Tennessee (5%)

Wetland mitigation is well-established in Tennessee, but other forms of ecosystem markets are not operating very effectively. This is a disadvantage to landowners and conservation. The opportunities afforded by conservation banking and the carbon market should be leveraged to promote land conservation and provide landowners a new suite of financial opportunities. But as the literature revealed, ecosystem markets are not highly understood throughout the country, let alone in Tennessee, so uncertainty was weighted only at 5%.

6.2.3 Equity: Educate Landowners About Benefits of Planning (15%)

There are many resources about management alternatives available to NIPLs in Tennessee, from loans to incentive programs and even burgeoning ecosystem markets. Yet despite efforts by existing programs, including state agencies, universities and non-profits, many landowners lack the capacity to engage in, with many not even aware of, the opportunities provided through conservation services. Education is a pre-cursor to promoting ecosystem markets, and was deemed important and weighted at 15%.

6.2.4 Ecological Impact: Increase Land Conservation (25%)

Our natural systems are intrinsically tied together, and increased land conservation provides better habitat and species protection, and improves waterways, combats climate change, and improves overall ecosystem services. There are increasing development pressures in Tennessee. Successful land conservation using existing tools such as easements would benefit from additional resources. The impact

of the Cap on land conservation may last for 100 years, but the window of opportunity for engaging is a bridge of about 30 years. In the short term, the ecological impact could be great, so it is weighted at 25%.

6.2.5 Practicality: Research-based Protocols (15%)

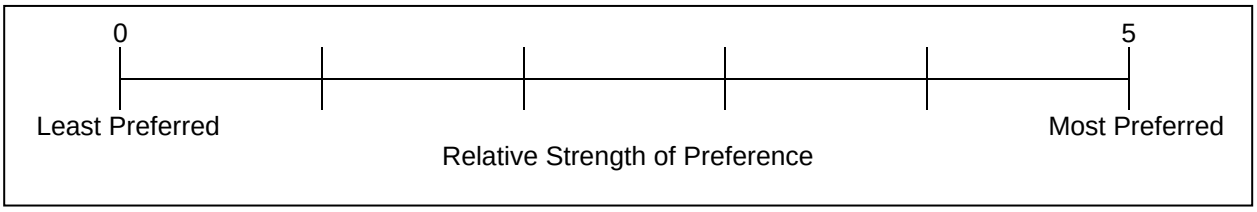
Carbon offset projects should include the standards set forth in established protocols developed over the past twenty years. Reduction of GHG emissions used for compliance purposes must be real, permanent, quantifiable, verifiable, enforceable and additional for the landowner to benefit with the least risk. The only way to assure compliance is for the program to be rooted in standardized, research based protocols. But adhering to protocols can be costly, so often less robust paths are taken and less rigorous projects are developed. Standardization is weighted at 25%.

6.2.6 Acceptability: Political Acceptance (15%)

New rules and regulation that directly or indirectly impact a region will garner political consideration. The path to implementation can make or break the opportunity. The legislature in Tennessee will only embrace climate change and comprehensive planning if it is mandated and regulated. The carbon market is a sophisticated regime not popularly understood, but it does garner attention from the public officials. Hence a 15% weight was assigned to acceptability.

6.3 ALTERNATIVES MATRIX

An Alternatives (or Outcomes) Matrix was constructed to display scores for each of the alternatives as compared to the criteria. The scores represent relative strength of preference or, alternately, points on a continuum (Bardach, 2012). A matrix provides a helpful visual display of the comparison between the alternatives and criteria. A matrix also helps analysts determine what they have in hand and what they need to look into further. The relative strength of preferences is represented on a scale that is weighted for performance. The scores range from zero to five on a five point gradient.



Results from the scores and weights were developed in a matrix to determine the best choice scenario.

7.0 RESULTS AND OBSERVATIONS

The analysis concluded that developing a Forest Carbon Offset Project through the California Cap-and-Trade Program was the most practicable option. Second was adding a Project Development Program to a Land Trust. Though this would be costly, it removes uncertainty in promoting ecosystem markets in Tennessee due to it equitably providing NIPLs education about financial opportunities from ecosystem services. Third was developing a Forest Carbon Offset Project under a Voluntary Program. It lacks the rigor offered under a compliance market that is growing in acceptance and reliability. The least favorable alternative was designing legislation for a Tennessee program as it is politically unfeasible.

Rank	Program
1	Develop a Project under the Cap (Cap)
2	Add a Project Development Program to an Land Trust (Land Trust)
3	Develop a Voluntary Project (Voluntary)
4	Design Legislation for a Tennessee Carbon Offset Program (TN Program)

Table 2 - Ranked Preference

The following discussion presents the results and observations for each alternative, ranked from most preferred to least preferred and observations on how they scored against each criterion.

Criteria	Weight	Cap	Land Trust	Voluntary	TN Program
Costs **Minimize Costs to Landowners**	**25**	5	3	3	1
Uncertainty **Ability to Promote Ecosystem Markets in TN**	**5**	4	4	3	3
Equity **Educate landowners About Benefits of Planning**	**15**	3	4	3	3
Ecological Impacts **Increase Land Conservation**	**25**	5	3	3	3
Practicality **Research-based Protocols**	**15**	5	3	2	3
Acceptability **Political Acceptance**	**15**	3	2	3	1
Quantitative Analysis Totals	**100**	**25**	**19**	**17**	**14**

Table 3 - Matrix of Alternatives with Weights and Ranking

Ranges: (0=ineffective/poor performance - 5=optimal/strong performance)

7.1 Develop a Project Under the Cap

Criteria	Weight	Policy Alternative 1 Develop a Project Under the Cap
Costs Minimize Costs to Landowners	**25**	There has been an increase in project development firms in response to the growth of the voluntary carbon market over the past decade. Most project developers internalize the upfront costs, taking their fee as a percentage of the offsets once a project is registered. Landowners incur very little upfront costs. So the cost to landowners is minimized. In addition, limited harvesting is allowed under the protocol providing additional income. **(5)**
Uncertainty Ability to Promote Ecosystem Markets in TN	**5**	Carbon projects under the Cap can promote ecosystem markets in Tennessee, as well resource conservation services. As there are only two carbon projects in existence at this time, rasing awareness could come about through increasing participation and word-of-mouth. The rigor of the protocol and success to-date provides a security not found in the voluntary market. **(4)**
Equity Educate landowners About Benefits of Planning	**15**	Because the project developers typically run the project and the protocols are cumbersome, equity is limited as the landowners aren't required to learn much. But again, rasing awareness could come about through increased participation and word-of-mouth without actually needing to understand the science. A poitive externality is that ecosystem markets may provide the landowner with information about other opportunities. **(3)**
Ecological Impacts Increase Land Conservation	**25**	A forest carbon project is a win-win for conservation purposes, as the land would not be put under conservation otherwise. **(5)**
Practicality Research-based Protocols	**15**	Adoption of the well-established and robust ACR and CAR Protocols by the ARB for development of forest carbon projects provides transparency and confidence in the market. These research-based protocols required by the Cap provide a legitimacy and security that is not available in the voluntary carbon market. **(5)**
Acceptability Political Acceptance	**15**	Political acceptance is not a big concern as the project drivers exist outside of the state, and the impact is on lanodowners and not legislation. As such, the projects would not impact climate change legislation either, but the more forest carbon projects developed, the more the legislature and public can learn. **(3)**
Quantitative Analysis Totals	**100**	**25**

Table 4 - Develop a Project Under a Cap

7.2 Add a Project Development Program to an Land Trust

Criteria	Weight	Policy Alternative 2 Add Project Development Program to Land Trust
Costs Minimize Costs to Landowners	**25**	A land trust would have difficulty absorbing the upfront costs associated with the Cap. The program would need to be accepted by the land trusts board of directors, which could take time and money. The burden to finance a project might then fall on the landowner. **(3)**
Uncertainty Ability to Promote Ecosystem Markets in TN	**5**	The land trust is a good vehicle through which to promote ecosystem markets in Tennessee. They already have connections to landowners and provide support and guidance on land conservation opportunities. There is concern about adding a fee-based service to an organization that provides guidance and services to landowners at low or no cost. **(4)**
Equity Educate landowners About Benefits of Planning	**15**	The culture of most land trusts surrounds educating landowners about the varied schemes available to help them leverage their assets. Landowners interested in these would benefit in learning about the opportunities for financial gain that can be leveraged through the forest carbon market. Land trusts already have connections to landowners and provide support and guidance on land conservation opportunities. **(4)**
Ecological Impacts Increase Land Conservation	**25**	Adding forest carbon projects to the land trust programs of conservation tools can incentivize conservation. But it is limited to landowners with acceptable stocking levels, typically > 3,500 acres. **(3)**
Practicality Research-based Protocols	**15**	Land trusts in the NW US already provide forest carbon offset programs and have relied on conservation easements through the voluntary market. Staff would need to be trained in the Cap's protocols, which would require time and resources. Additionally, land trust can partner with project developers. **(3)**
Acceptability Political Acceptance	**15**	Land trusts rely on government support and private donations. A strategy for entry into project development would need to be well thought out to assure that donors and supporters are not confused or put-off. The program would need to be accepted by the land trusts board of directors, which could take time **(2)**
Quantitative Analysis Totals		**19**

Table 5 - Add Project Development Program to Land Trust

7.3 Develop a Voluntary Carbon Offset Forest Project

Criteria	Weight	Policy Alternative 3 Develop a Voluntary Carbon Offset Forest Project
Costs Minimize Costs to Landowners	**25**	The landowner may be responsible for up-front costs or even the entire project. But the voluntary market protocols are not as expensive as developing a compliance project and there are a larger number of markets to engage in. Some Project Developers still engage in voluntary offset projects, but the trend is towards the Cap. Voluntary programs may be less costly to perform, but the ROI is lower because offsets are in demand due to the Cap. **(3)**
Uncertainty Ability to Promote Ecosystem Markets in TN	**5**	Ecosystem markets have not had very good penetration under a voluntary regime. They do offer alternatives to a strict compliance regime with more flexible schedules and phased engagement. But they are not as secure as the ARB protocols and more vulnerable to market fluctuations. There is a threat that they could negatively promote the carbon market once the Cap becomes more established. **(3)**
Equity Educate landowners About Benefits of Planning	**15**	A voluntary project may provide better education about planning because landowners would likely need to be more involved. On the other hand it could discourage the landowner because it may be too cumbersome. **(3)**
Ecological Impacts Increase Land Conservation	**25**	Voluntary markets provide an alternative to traditional conservation tools, but the incentive may not be as certain as a project under the Cap. **(3)**
Practicality Research-based Protocols	**15**	The Voluntary market is not as practical as the compliance market because the protocols may not be held to the same robust standards. There is also less oversight of the process and the threat of unethical trading schemes. Research-based protocols do exist in the voluntary market. **(2)**
Acceptability Political Acceptance	**15**	Political acceptance is not a big concern as the project drivers exist outside of the state, and the impact is on landowners and not legislators. As such, the projects would not impact climate change legislation either, but the more forest carbon projects developed, the more the legislature and public can learn. **(3)**
Quantitative Analysis Totals	**100**	**17**

Table 6 - Develop a Voluntary Carbon Offset Forest Project

7.4 Design Legislation for a Tennessee Compliance Regime

Criteria	Weight	Policy Alternative 4 Design Legislation for a TN Carbon Offset Program
Costs Minimize Costs to Landowners	**25**	A compliance program initiated at the state level would be costly. A campaign would need to be developed, a champion identified and it would eventually demand citizen approval. A full cost-benefit analysis is beyond the scope of this analysis. But there is potential for the state to engage in the California market. **(1)**
Uncertainty Ability to Promote Ecosystem Markets in TN	**5**	There is uncertainty regarding the benefits of ecosystem services nationwide, and existing markets have not be well accepted in Tennessee. **(3)**
Equity Educate landowners About Benefits of Planning	**15**	A state-level program for forest carbon could raise awareness of ecosystem markets and educate landowners on the full suite of resource conservation opportunities. **(3)**
Ecological Impacts Increase Land Conservation	**25**	A forest carbon program at a state level would add an assurance to the level of protection to state lands in the hands of the state. But the likelihood of engaging in a plan that lasts 100 years through many administrations is unlikely. **(3)**
Practicality Research-based Protocols	**15**	Applying research-based protocols would be necessary, as the state would be under great scrutiny. Adopting a program that has been tried and tested in another state could be helpful. **(3)**
Acceptability Political Acceptance	**15**	In the current climate, a state-wide compliance program would not be politically acceptable, as the state is turning power back to the hands of local governments. Legislation would be viewed as a burden to all the citizens of Tennessee. Getting buy-in to restrict the use of state land for 100 years is politically unfeasible. **(1)**
Quantitative Analysis Totals		**14**

Table 7 - Design Legislation for a TN Carbon Offset Program

8.0 DISCUSSION AND CONCLUSION

The southeastern United States has been identified as one of the regionsto satisfy the demand for forest carbon offset projects resulting from the new compliance market administered by the California Air Resource Board. The ARB does not require NIPLs to invest time or energy in learning their stringent protocols for registering a project. Existing project developers are well-trained in the protocols with venture capitalists fronting the costs. Existing voluntary projects are not eligible for the ARB Program. This has created a need for additional forest projects in other areas of the U.S. that adhere to the Program's stringent protocols. The Southeastern United States has a high potential for carbon sequestration due to its large amount of forestlands in the hands of NIPLS.

This need addresses another problem present in the southeast: a need for financial incentive to encourage land conservation. The tremendous population growth in the region over the past 30 years accompanied with an 85% increase in developed land demands new opportunities for land protection be explored. NIPLs are mainly concerned with how they will keep their property intact for their heirs, and how will they pay rising property taxes. The carbon market can answer both of these concerns, but the question remains of whether or not NIPLs are open to the ideas of ecosystem markets. Adoption of forest carbon project development has been slow in Tennessee, with only two projects developed to-date. The Cap comes in strong as the preferred alternative. Some of the other drawbacks include the lack of a planning culture from the state to the individual level and the changing face of forest ownership. But Tennessee NIPLs do value their land and want to leave a lasting legacy.

Equity and acceptability ranked lowest for project development under the Cap. Landowners would benefit if they better understood what natural resource services are available to them. Better promotion of all natural resource services would incentivize land conservation and promote forest carbon project development. Project developers have a difficult time breaking into the forest carbon market in Tennessee. An allegiance with local conservation groups and identification of a champion to help promote the opportunity would help engage landowners. The next criteria that could be improved include uncertainty and ecological impacts. There is a lack of knowledge in Tennessee of conservation services that are available, let alone the financial opportunities from ecosystem markets. Along with that comes the need for increased land conservation for support of ecosystem services. Developing forest carbon projects in Tennessee is a distinct alternative to doing nothing.

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APPENDIX 1 – GLOSSARY

Adapted from http://www.na.fs.fed.us/ecosystemservices/carbon/glossary.shtm and http://www.arb.ca.gov/cc/inventory/faq/ghg_inventory_glossary.htm

A number of technical terms and phrases are associated with carbon markets and with climate change policy. Some of the more frequently used terms are defined below.

Adaptation. Actions to adjust to and minimize the negative impacts of climate change on natural and social systems.

Additionality. Term used to designate that an emissions reduction represents an action that would not have occurred (under a business as usual "BAU" scenario), typically because of some financial or biological barrier, or both.

Allowances. Permits to emit GHGs, commonly measured in CO2 equivalents (CO2e); allowances can be allocated to companies and polluters based upon historical emission or production levels or auctioned in the market.

Baseline. The sequestration of carbon (in the case of forestry and agriculture) or emission of greenhouse gases (in the case of industry) that would occur without the contemplated policy intervention or project activity.

Base-year approach. A baseline measurement approach whereby the amount of carbon sequestered is measured as a net increase in carbon relative to the base year measurement.

Base-year. A historic datum (a specific year or an average over multiple years) against which a forest's carbon gains (or a company's emissions) are tracked over time. A base year is usually established by a regulatory body.

Carbon dioxide-equivalent (CO2e). The universal unit of measurement to indicate the global warming potential (GWP) of greenhouse gases, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases against a common basis.

Carbon footprint. A term used to refer to the carbon dioxide emissions associated with a certain activity or suite of activities. The term has become rather common in recent years, and various "carbon footprint calculators" are available on the Web to help individuals determine the carbon-intensity of their lifestyle.

Carbon inventory. A list of carbon emission sources and their quantities.

Credit (carbon credit). Formally accredited offsets that can be traded in a regulatory or voluntary climate change program.

Ecosystem services. Ecological goods and services (functions and processes) that provide benefits and critical, life-sustaining support to natural and social systems. They are typically difficult to measure and quantify, and therefore are undervalued or not valued (monetarily) in traditional economic systems.

Emissions. The release of GHGs into the atmosphere.

Forest Owner: A Forest Owner is the owner of any interest in the real (as opposed to person) property involved in a forest Project, excluding government agency third party beneficiaries of conservation easements. Generally, a forest Owner is the owner in fee of the real property involved in a Forest Project. In some cases, one entity may own the land while another entity may have an interest in the trees or the timber on the property, in which case all entities or individuals with interest in the real property are collectively considered Forest Owners, however, a single Forest Owner must be identified as the Offset Project Operator.

GHG. Greenhouse gas.

GHG inventory. A list of greenhouse gas emission sources and their quantities.

Leakage. The shift in greenhouse gas (GHG) emissions from an area subject to regulation (e.g., Cap-and-trade program) to an unregulated area, so reduction benefits are not obtained. This would happen, for example, if a GHG-emitting industry moved from a country with an emissions Cap to a country without a Cap.

Mitigation. Actions to reduce emissions and enhance sinks of GHGs, so as to reduce the impacts and effects of climate change.

Offset. A specific activity or set of activities that reduce, remove, or sequester GHG emissions from the atmosphere.

Offset (carbon offset). A greenhouse gas (GHG) offset is generated by the reduction, avoidance, or sequestration of GHG emissions from a specific project. Offsets are so named because they counteract or offset greenhouse gases that are emitted into the atmosphere; they are a compensating equivalent for reductions made at a specific source of emissions. Examples of offsets would include forestry and agricultural activities that absorb carbon dioxide, and reductions achieved by entities that are not regulated by a greenhouse gas control program.

Offset Project Operator. The Offset Project Operator is responsible for undertaking, listing, and verifying a forest project, however, all Forest Owner(s) are ultimately responsible for all Forest Project Commitments. The Offset Project Operator may identify an Authorized Project Designee pursuant to 95974 of the Regulation, to assist or consult with implementation of the Forest Project. All information submitted to ARB or an Offset Project Registry shall reference the Offset Project Operator and all Forest Owner(s) who are ultimately responsible for the accuracy and completeness of the information submitted.

Permanence. Carbon offsets should be permanent, meaning that the carbon that a project avoids emitting or sequesters should remain out of the atmosphere forever. With respect to forestry, the concern is frequently about lack of permenance—or reversibility—of the benefits of storage as the result of land conversion, forest degradation, or catastrophic events (such as insect outbreaks and wildfires). There are various mechanisms to account for the reversibility risks inherent to terrestrial sequestration projects; choice of mechanisms is often related to carbon accounting methodologies, their associated timeframes, and policy requirements.

"Real, Measurable, Verifiable, Additional." Terms commonly used to confirm the validity and legitimacy of offsets (link to Offset in glossary). "Real" indicates that a reduction in GHG emission has taken place; "measurable" indicates that it can be quantified. "Verifiable" indicates that it can be registered and tracked. "Additional" indicates that it represents a scenario or action that is above and beyond what would have typically happened in a "business as usual" scenario.

APPENDIX 2 – APPROVED GROWTH AND YIELD MODELS

Compliance Offset Protocol U.S. Forest Offset Projects

http://www.arb.ca.gov/cc/Capandtrade/protocols/usforest/usforest-models.htm

California Conifer Timber Output Simulator (CACTOS). CACTOS is a legacy model and is no longer available for downloading. User guide may be found at: http://www.fire.ca.gov/resource_mgt/downloads/forestry/cactos/CACTOSUsersGuide.pdf or contact Greg Biging at UC-Berkeley (510) 642-1249.

Cooperative Redwood Yield Project Timber Output Simulator (CRYPTOS) & CRYPTOS EMULATOR. CRYPTOS is a legacy model and is no longer available for downloading. User guide may be found at: http://www.fire.ca.gov/resource_mgt/downloads/forestry/cryptos/CRYPTOSUsersGuide.pdf or contact Greg Biging at UC-Berkeley (510) 642-1249.

http://www.demoforests.net/http://www.demoforests.net/

FORest and Stand Evaluation Environment (FORESEE*). *please note correct spelling is FORSEE. FORSEE may be obtained for a fee by joining the California Growth and Yield Modeling Cooperative www.cagym.com or contact Christopher Hipkin, Vice Chair at: hipkin@pacbell.net or (510) 654-6310.

Forest Vegetation Simulator (FVS). FVS is available free of charge through the U.S.DA Forest Service http://www.fs.fed.us/fmsc/fvs/software/complete.shtml or contact FVS Technical Support (970) 295-5770.

Stand Projection System (SPS). SPS is a proprietary forest growth and yield model that may be obtained for a fee at http://www.dendrometrics.com/MBG-Tools.htmlhttp://www.dendrometrics.com/MBG-Tools.htmlor contact Steve Fareweather at (503) 224-3445.

Forest Projection and Planning System (FPS). FPS is a proprietary forest growth and yield model that may be obtained for a fee at http://www.forestbiometrics.com/software/fps/ or contact Richard Zabel at (503) 226-4562.

Forest REsource Inventory, Growth, and Harvest Tracking System (FREIGHTS). FREIGHTS is a legacy model and is no longer available for downloading. http://www.arb.ca.gov/cc/Capandtrade/protocols/usforest/usforest-models.htm

APPENDIX 3 – CALIFORNIA'S AIR RESOURCE BOARD (ARB)

The following information is provided to provide detail on the ARB's protocols and requirements. It was consolidated from the ARB website http://www.arb.ca.gov/.

Mission

ARB's mission is "to promote and protect public health, welfare, and ecological resources through effective reduction of air pollutants while recognizing and considering effects on the economy. The ARB oversees all air pollution control efforts in California to attain and maintain health based air quality standards" (ARB, 2012c).

The ARB considers one offset credit equal to one metric ton of carbon dioxide (MTCCO2). Offset credits issued by the ARB can be used by businesses complying with the regulations under the Cap for a maximum of eight percent of the business' compliance obligation. Carbon offsets are the equivalent of a California carbon allowance and can also be freely sold or traded (ARB, 2011).

The Cap has regulations that follow rigorous protocols that every carbon offset credit must be "real, verifiable, quantifiable, enforceable and permanent" (ARB, 2012b). Each carbon offset credit must also go over and above any reductions already required by law or regulation, making each credit "additional" to what would happen in a do-nothing or business-as-usual scenario (Clegern, 2012). ARB has approved four protocols to apply for measuring the reductions achieved: (1) Forestry, (2) Urban forestry; (3) Dairy manure digesters; and, (4) Destruction of Ozone Depleting Substances (ARB, 2012b).

Standards

U.S. Forest Project Protocols require use of protocols established by the the U.S. Forest Service Forest Inventory and Analysis (FIA. The FIA is a national program that estimates biomass in U.S. forests by regions. The ARB specifically details use of FIA "regional cubic foot volume equations and incorporate the U.S. Forest Service's Component Ratio Method (CRM) to estimate the volume in the non-bole (everything except trunk or main stem) portions of the tree. The bole portion of the tree is estimated directly from inventory field measurements (DBH, height, and species). The CRM involves calculating the dry weight of individual components before estimating the total above-ground or below-ground biomass." (ARB, 2011)

Registries

Approved offset project registries are the American Carbon Registry (ACR), based in Sacramento; and the Climate Action Reserve (CAR), based in Los Angeles. The services they provide are under the ARB compliance protocols. Registries list and review projects. They issue registry offset credits to be submitted to the ARB for final evaluation. And they can then issue of ARB compliance offset credits (Clegern, 2012).

Verification

More than 60 independent, third-party verifiers partner with the ARB to evaluate the offset projects submitted under the Cap. These 60 verifiers work for eleven verification bodies that have also been certified by ARB. These third-party verifiers have extensive backgrounds in related field-work and auditing, and also know the science and engineering associated with forest carbon accounting. They are required to take specific ARB training and pass the ARB test. The ARB reviews the findings from these verified carbon offsets before they issue compliance offset credits. Once approved, those offsets may be used to comply with California's Cap-and-trade regulation(ARB, 2012b).

APPENDIX 4 – ARB FOREST TYPES

The following information is an excerpt from the California Air Resource Board's Compliance Offset Protocol U.S. Forest Projects Chapter 2: Forest Project Definitions and Requirements on pages 9-11 (ARB, 2011).

2.1 Project Types

The following types of Forest Project activities are eligible:

2.1.1 Reforestation

A Reforestation Project involves restoring tree cover on land that is not at optimal stocking levels and has minimal short-term (30-years) commercial opportunities. A Reforestation Project is only eligible if it can fully satisfy the eligibility rules in the Regulation and:

The project involves tree planting or removal of impediments to natural reforestation, on land that:

- Has had less than 10 percent tree canopy cover for a minimum of 10 years; or
- Has been subject to a Significant Disturbance that has removed at least 20 percent of the land's above-ground live biomass in trees.

No rotational harvesting of reforested trees or any harvesting of pre-existing carbon in live trees occurs during the first 30 years after offset project commencement unless such harvesting is needed to prevent or reduce an imminent threat of disease. Such harvesting may only occur if the Offset Project Operator or Authorized Project Designee provides a written statement from the government agency in charge of forestry regulation in the state where the project is located stipulating that the harvesting is necessary to prevent or mitigate disease.

The tree planting, or removal of impediments to natural reforestation, does not follow a commercial harvest of healthy live trees that has occurred in the Project Area within the past 10 years, or since the occurrence of a Significant Disturbance, whichever period is shorter.

The offset project does not employ broadcast fertilization.

The offset project does not take place on land that was part of a previously listed and verified Forest Project, unless the previous Forest Project was terminated due to an Unintentional Reversal (see Section 7) or is an early action offset project transitioning to this protocol according to the provisions of the Regulation and this protocol.

If the offset project was an offset project in a voluntary offset program, the offset project can demonstrate it has met all legal and contractual requirements to allow it to terminate its project relationship with the voluntary offset program and be listed using this compliance offset protocol.

Reforestation Projects on both private and public lands, excluding federal lands that are not included in the categories of land listed in section 3.6 of this protocol, are eligible.

2.1.2 Improved Forest Management

An Improved Forest Management (IFM) Project involves management activities that maintain or increase carbon stocks on forested land relative to baseline levels of carbon stocks, as defined in Section 6.2 of this protocol. An Improved Forest Management Project is only eligible if it can fully satisfy the eligibility rules in the Regulation and:

- The offset project takes place on land that has greater than 10 percent tree canopy cover.
- The offset project employs natural forest management practices, as defined in Section 3.8.2 of this protocol.
- The offset project does not employ broadcast fertilization.

The offset project does not take place on land that was part of a previously listed and verified Forest Project, unless the previous Forest Project was terminated due to an Unintentional Reversal (see Section 7) or is an early action offset project transitioning to this protocol according to the provisions of the Regulation and this protocol.

If the offset project was an offset project in a voluntary offset program, the offset project can demonstrate it has met all legal and contractual requirements to allow it to terminate its project relationship with the voluntary offset program and be listed using this compliance offset protocol.

Eligible management activities may include, but are not limited to:

- Increasing the overall age of the forest by increasing rotation ages.
- Increasing the forest productivity by thinning, diseased, and suppressed trees.
- Managing competing brush and short-lived forest species.
- Increasing the stocking of trees on understocked areas.
- Maintaining stocks at a high level.

Improved Forest Management Projects on both private and public lands, excluding federal lands that are not included in the categories of land listed in section 3.6 of this protocol, are eligible.

2.1.3 Avoided Conversion

An Avoided Conversion (AC) Project involves preventing the conversion of forestland to a non-forest land use by dedicating the land to continuous forest cover through a Qualified Conservation Easement or transfer to public ownership, excluding transfer to federal ownership. An Avoided Conversion Project is only eligible if it can fully satisfy the eligibility rules in the Regulation and:

It can be demonstrated that there is a significant threat of conversion of project land to a non-forest land use by following the requirements for establishing the project's baseline in Section 6.3 of this protocol.

The offset project does not employ broadcast fertilization.

The offset project does not take place on land that was part of a previously listed and verified Forest Project, unless the previous Forest Project was terminated due to an Unintentional Reversal (see Section 7) or is an early action offset project transitioning to this protocol according to the provisions of the Regulation and this protocol.

If the offset project was an offset project in a voluntary offset program, the offset project can demonstrate it has met all legal and contractual requirements to allow it to terminate its project relationship with the voluntary offset program and be listed using this compliance offset protocol.

An Avoided Conversion Project may involve tree planting and harvesting as part of the project activity.

Avoided Conversion Projects are eligible only on lands that are privately owned prior to offset project commencement.

APPENDIX 5 – FOREST INCENTIVE PROGRAMS IN TENNESSEE

This table was adapted from the USDA's list of Financial Incentive Programs for Non-Industrial Private Forest Owners (USDA, 2012).

Level	Program Name	Organization
Federal	Biomass Crop Assistance Program (BCAP)	Farm Service Agency
Federal	Conservation Reserve Program (CRP)	Farm Service Agency
Federal	Conservation Stewardship Program (CSP)	Natural Resources Conservation Service
Federal	CRP Continuous Sign-Up	Farm Service Agency
Federal	Emergency Watershed Protection Program (EWP)	Natural Resources Conservation Service
Federal	Environmental Quality Incentives Program (EQIP)	Natural Resources Conservation Service
Federal	Forest Legacy Program (FLP)	Tennessee Division of Forestry
Federal	Forest Stewardship Program (FSP)	Tennessee Division of Forestry
Federal	Healthy Forest Reserve Program (HFRP)	Natural Resources Conservation Service
Federal	Landowner Incentive Program (LIP)	Tennessee Wildlife Resources Agency
Federal	Partners for Fish and Wildlife	U.S. Fish and Wildlife Service
Federal	Private Individual Grants	U.S. Fish and Wildlife Service
Federal	Southern Pine Beetle Prevention Program (SPBP)	Tennessee Division of Forestry
Federal	Wetlands Reserve Program (WRP)	Natural Resources Conservation Service
Federal	Wildlife Habitat Incentives Program (WHIP)	Natural Resources Conservation Service
State	Farm Wildlife Habitat Program (FWHP)	Tennessee Wildlife Resources Agency
State	Property Tax: Forest Land	Tennessee Division of Forestry
State	Tennessee Agricultural Enhancement Program	Tennessee Division of Forestry
Private	Tennessee Tree Farm Program	Tennessee Forestry Association

Table 8 - Financial Incentive Programs for Non-Industrial Private Forest Owners in Tennessee