An Introduction to Forest Carbon Offset Markets

NC STATE EXTENSION

Eastern Forestry Notes

Introduction

Forest carbon is considered as a forest product that can be a viable alternative source of income for forest landowners. This note describes the forest carbon market today and explains the possible opportunity it represents for certain forest.

Managing forests for carbon sequestration offers the opportunity to reverse or stabilize human and societal emissions from fossil fuels and land use. The total amount of global greenhouse gas (GHG) is increasing rapidly; about the half of GHG emissions have occurred in the last 40 years (Boden et al. 2017). Current climate models predict rises in global temperatures, sea-levels, and climatic shifts. Climatic shifts result in intensive droughts and flood events, and sea level rises intrude on fresh water aquifers - putting drinking water reserves at risk. Evidence suggests that a warming global climate will disproportionally affect local communities that depend on agriculture or coastal livelihoods (Hsiang et al. 2017).

Research suggests that carbon capture in forests can play a large role in mitigating the impacts of climate change. Currently, the US Forest Service estimates that forests in the US capture about 16% of US emissions from burning fossil fuels (Vose et al. 2012). Moreover, forests offer multiple ecosystem services to the public ranging from water quality and quantity regulation to providing wildlife habitat that protects biodiversity.

Understanding Carbon Offset Credits

To understand forest carbon markets, one needs to know how CO_2 is measured and traded. The standardized carbon unit is “metric tons of carbon-dioxide equivalent” often written as MtCO2e, or an “offset”. CO_2 is one of the most common GHGs in the atmosphere contributing to global warming. All other gases are compared to CO_2 for simplicity. Therefore, the CO_2 equivalent has become the standard unit for describing different greenhouse gases. The US Environmental Protection Agency (EPA) defines it as the number of metric tons of CO_2 emissions with the same global warming potential as one metric ton of another greenhouse gas. As an example, methane has a warming potential 25 times greater than CO_2, which implies that 1 ton of methane is equivalent to 25 tons of CO_2. A key component of carbon markets is the ability of regulators, buyers, brokers, and sellers to have a commodity that is measurable, quantifiable, verifiable, and trackable. Currently, sellers of forest carbon are large forestland owners looking to diversify their forest-based revenue streams.

Forest Carbon Project Types

Currently, there are three different project types that are eligible to produce carbon offsets; afforestation or reforestation, avoided conversion, and improved forest management (IFM) (*Table 1*). IFM projects are the most common compliance offsets traded in California’s cap and trade program. Project developers must be able to show that their forests are sequestering more carbon than a ‘business-as-usual’ scenario across the three forest project types (Yankel 2014). Each forest project has different costs and benefits, and approaches of carbon accounting; understanding which one is right for your property is the first step in the exploratory process.

Table 1. Types of forest carbon offset projects.

Project Types	Description
Afforestation/Reforestation (R)	• Projects involve restoring tree cover to previously non-forested land. • Afforestation projects have high costs because

	they generally require significant planting and maintaining trees.
Avoided Conversion (AC)	• Preventing the conversion of forested land to non-forested land. • AC project developers must demonstrate that the forested land is under significant threat of conversion for an AC project to be viable.
Improved Forest Management (IFM)	• Projects involve land management activities that increase or at a minimum maintain the current level of carbon stocking.

Every carbon offset project must meet certain requirements, which are presented in Table 2. Eligible projects must sequester additional carbon than in a “business as usual” scenario. Similarly, the project must have a long-term commitment, up to 100 years, and must demonstrate that it doesn’t facilitate any GHG emissions outside of the project area.

Table 2. Key eligibility requirements for each carbon offset project.

Key Attributes of Forest Carbon Projects	Descriptions
Additionality	• Additionality requires the forest project sequester more carbon than in a ‘business as usual’ scenario. • Project must demonstrate that the carbon sequestration would not have happened without the development of the specific offset project.

Permanence	• Permanence requires that GHG removal enhancements be maintained for up to 100 years. • To demonstrate permanence each project must undergo a third-party verification of inventory reports and a site visit every six years during the life of the project (~25 years).
Non-leakage	• Leakage from carbon projects happens when GHG reductions in one area results in an unintended increase in GHG emissions in another location. • Project operators must demonstrate their project does not cause excessive leakage, essentially wiping out the increases in GHG removal from their project. • Leakage is of biggest concern on afforestation projects where cropland is being converted back to forests.

Carbon Marketplaces

There are two distinct types of carbon markets; voluntary and regulatory markets.

Voluntary markets exist where companies or individuals buy carbon credits for purely a voluntary reason. Many companies voluntarily purchase carbon credits to demonstrate their commitment to protecting the environment and to demonstrate corporate social responsibility. Voluntary carbon markets, which emerged in the late 2000s, traded roughly 63.4 MtCO2e worth $191.3 million in 2016 (Hamrick and Grant 2017). Carbon offset prices in the voluntary market,

globally, span a wide range: in the first quarter of 2018, prices ranged from $0.1/MtCO2e to $70/MtCO2e with an average price of $3/MtCO2e. Forestry and land use projects are one of the larger voluntary carbon project categories (Hamrick and Grant 2018). Unlike compliance markets, there is a wide range of factors that influence the price of carbon credits, including type and location of project, additional project benefits, marketing, and others.

Several factors could drive the future growth of voluntary markets. The rise of new global agreements like the Carbon Offset and Reduction Scheme for International Aviation may increase the demand for carbon credits in voluntary markets (Lampert and Bryan 2017). Also, if the number of compliance markets decreases, this may drive demand toward voluntary markets. However, the resulting uncertainty and volatility in voluntary markets, globally, could lead many project developers to focus on compliance markets for their more stable market conditions.

Voluntary markets are dominated by buyers who aim to meet some internal sustainability claim or carbon goal, rather than a regulatory requirement. Carbon offset credits sold on the voluntary market, generally, follow more flexible accounting and measurement guidelines than those on the regulatory or compliance market.

Compliance markets exist globally including in the United States. Carbon credit prices determine the viability of carbon offset projects, among other things. Generally, prices in compliance markets remain more stable. The recent carbon offset settle prices from the California Cap-and-Trade Program averaged about $14/offset (californiacarbon.info). Compliance markets arise when laws or regulations are enacted that limit or cap the quantity of GHG emissions people and firms can emit. Cap-and-trade programs are a good example of compliance carbon markets. The emitters can either reduce GHGs emissions to the atmosphere or buy carbon credits from sellers who are sequestering GHGs from the atmosphere.

California's Cap-and-Trade Program

In 2013, California launched its cap-and-trade program creating the market infrastructure needed to bring buyers and sellers of compliance carbon offset credits together. California's cap-and-trade program is the first multi-sector program created in North America. California, as the first mover in creating a marketplace for carbon offsets and the large size of its economy, provides the best opportunity for forestland owners to connect with a compliance market.

Under California's cap-and-trade program, there are strict project development protocols and standards for each project type. Some of the project eligibility requirements administered by the California Air and Resource Board (ARB) include:

- ARB offset projects are generally only allowed on private forestland.
- ARB requires that owners have a long-term management plan that demonstrates harvest levels can be sustained over time and that is certified by the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or the American Tree Farm System (ATFS).
- ARB also requires that forests be managed for native vegetation, with projects consisting of at least 95% native species based on carbon stocking levels.
- Three key attributes that every project must demonstrate are additionally, permanence, and non-leakage (Germany, 2010)

Landowners from all across the country have participated in the Californian's carbon compliance market. Several carbon projects from Eastern states like Virginia, West Virginia, Maine, North Carolina have been awarded forest offsets in the California market (Jenkins, 2018). A number of small-scale Blue Source AC projects from North Carolina have been registered in ARB.

Carbon Credit Registries

Carbon offset projects and their eligibility criteria are usually registered and tracked through various independent registries. Every registry uses unique forest carbon accounting protocols, which ultimately results in different costs to the project developer. A carbon project viable under one registry may not be viable under a different registry's protocol. It is important to understand the nuances within registry protocols to select which measurement and verification standard is best for your potential project. Three of the most common registries are the American Carbon Registry (ACR), Climate Action Reserve (CAR), and Verified Carbon Standard (VCS).

Table 3. Carbon project registries and their description.

Carbon Project Registries	Description

American Carbon Registry (ACR)	• The American Carbon Registry was the first private registry in the voluntary market, founded in 1996. • ACR protocols have been approved by ARB and offset projects registered with ACR can trade their credits on California's cap-and-trade market. • ACR has created protocols for all three types of forest carbon projects.
Climate Action Reserve (CAR)	• The Climate Action Reserve operates in the voluntary market but its protocols have also been verified by ARB. Projects registered with CAR can trade their offset credits on California's cap-and-trade market. • CAR was formed in 2001 by the State of California to serve the voluntary market. Since CAR is tied to California's regulatory body overseeing the cap-and-trade marketplace, it makes it a good candidate for projects developed in North America. • CAR also allows all three types of forest carbon projects.

Verified Carbon Standard/Verra (VCS)	• The Verified Carbon Standard is the most widely used registry in the voluntary market, worldwide. • VCS registers offsets for IFM, AC, and reforestation projects. • Once a carbon project is validated under VCS protocols the project developers are issued Verified Carbon Units (VCUs), which can then be traded.

Carbon Project Development and Implementation Process

There are several private groups such as Finite Carbon and TerraCarbon work closely with landowners in developing carbon projects and their trading in the market. Feasibility or validation studies determine qualification for an offset protocol. Feasible offset projects are then listed or registered with a carbon offset registry. To ensure eligibility and list a project, one must submit details including project type, location, ownership, forest types, and condition and estimated performance. Once a project is validated and listed, the project development stage begins with the design and installation of a carbon inventory of all standing above and below ground as well as standing dead carbon stocks (Jenkins, 2018).

After carbon is quantified and inventoried, carbon stocks are modeled and averaged over the project time requirement, typically 100 years, and compared with regional common stocking levels. The difference between the initial stocking and what is common regionally is the basis for the project's initial offset volume and revenue. Thereafter, annual offset credits and their revenues depend on

how a landowner manages their forest's net annual biological growth. In the following reporting periods, growth left in the forest can then be measured, verified, and sold as additional offsets (Jenkins, 2018).

In the case of California's trading scheme, completion of the Offset Project Data Report by a third-party auditor follows project development and acts as verification. Audits include ground-truthing every six years and annual review of ownership records. Once a project is verified, it is formally registered, and the regulating agency issues offsets to project owners (Jenkins, 2018). If an offset project is out of compliance, the project can be invalidated and the project manager must replace the offset credits issued (California Air Resources Board, 2019).

Can Carbon Be a Viable Income Source for Forest Landowners?

With well-established carbon offset markets over the years, forest landowners can monetize carbon sequestration services that their forests provide. Participating landowners must enter into a supply agreement with the purchasers of the carbon credits. The supply agreement (contract) ensures that a landowner will provide a certain amount of carbon storage for an extended period of time, often up to 100 years. Payments for carbon sequestration diversify revenue streams from their land.

Currently, many challenges exist to access carbon markets especially for small landowners. Upfront project development costs are substantially high, usually over $100,000, which vary by project size and standards. Also, long-term agreements (100 years) can make some landowners wary. Similarly, some of the other challenges include overly complex and dynamic project standards, and increasing verification and regulatory review periods, and long-term monitoring obligations. Legislative uncertainty under California's action plan/ program are other limitations that can shape the future development of the carbon markets. However, for the right landowner access to this new revenue-generating forest product can be a great way to diversify their income stream.

Project Aggregation—Is It Feasible?

Currently, project size is the largest barrier of entry for land owners wishing to participate in the carbon markets. Generally, in order for forest carbon projects to be profitable they need to be a minimum of 1,500 acres (Kerchner and Keeton, 2015). However, family forest landowners in the United States own on average 67.2 acres of land, and more than 80% of ownerships hold less than 500 acres of forestland (Butler et al. 2016), which indicates that the vast majority of landowners have no or limited access to carbon markets from a financial perspective. In order to minimize the costs of project development and maintenance, similar to group certification schemes, there could be the potential to aggregate many small landowners under one carbon project. The aggregation of small-scale landowners into one large single project significantly reduces the costs for each individual landowner. Aggregated forest carbon projects could introduce additional complexities and risks in developing and administering such projects, however. For instance, what happens if one of the landowners in the project wants to remove their parcel of land from the project or violates terms of the carbon protocol? These additional complexities should be well thought out prior to project initiation. If the parcels of land are separated by significant distances or have different/diverse tree species, combining noncontiguous and diverse tracts may increase monitoring and verification costs.

While all carbon registries have put together guidelines for aggregating forest carbon projects, successful aggregated projects are relatively scare. Recently, using funding from the Natural Resource Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP), several agencies put together a regional program in Oregon and Washington to support non-industrial private forest landowners to participate in carbon markets (Pinchot Institute, 2019). Through this regional conservation partnership program, interested landowners even having a small tract of forestland receive financial and technical assistance in the carbon offset project development including initial carbon assessment, forest inventories, and management planning. Since higher upfront costs in project development and forest inventory and monitoring are reportedly the main barrier for family forest owners, such coordinated efforts providing financial and technical assistance would greatly increase the access of small-scale landowners to the carbon markets.

Currently, Appalachian State University, in coordination with North Carolina State University and other institutions, is exploring the viability of small-scale forest carbon offsets in North Carolina to make carbon markets accessible to millions of forest owners. The team is examining alternative methods for measuring and accounting for carbon that could potentially bring down the costs of

project development and verification for small-scale forest owners. Parallel to this, a business plan/ portfolio is being developed to investigate the possibility of group participation of small-scale forest landowners, with the goal of identifying costs, revenue streams, and related tax implications. The proposed model will consider ways for owners to offset costs with other revenue streams that can be generated with a sustainably managed forest, and serve as a potential vehicle for impact investment from private industry and institutional investors.

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