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What do landowners need to know about the carbon market facing the opportunity of a new carbon income?[1]

Ziwen Yu[2]

Introduction

Adjusting farming and landscaping management practices in forests, farm, and marginal lands, such as adopting Climate-Smart Agriculture and Forest (CSAF) practices supported by the U.S. Department of Agriculture (USDA) and best management practices (BMPs) from the Florida Department of Agriculture and Consumer Services (FDACS), may bring benefits in terms of both ecosystem services and agricultural profit. The carbon market (CM) is an emerging mechanism to provide long-term financial incentives to certain industries (e.g., agriculture) in exchange for atmospheric carbon dioxide sequestration meant to offset the greenhouse gas (GHG) emissions from other industries. Thus, farmers and landowners who apply CSAF practices may potentially obtain a new stream of stable income by joining this market.

Climate change is a reflection of the imbalance of the global carbon (C) cycle with emissions overwhelming sequestration (Bhadha et al. 2023). CM was established as a financial mechanism to incentivize C sequestration practices that offset the extra GHG emissions. Previous Ask IFAS publications (Her et al. 2022; Irizarry et al. 2022) have briefly introduced the way in which CM operates and its potential for farmers. However, the impacts of CM on farmers and the related restrictions have not been thoroughly explored. This publication discusses information about the structure of CM in the United States and some restrictions on participation. It also provides an overview of the benefits and barriers of farmers' or landowners' participation in CM, especially for Florida. After reading, the audience is expected to have knowledge of the different stakeholders in CM and to understand the relationships among them. Farmers or landowners who are interested in participating in CM will learn whether they are currently eligible and identify whom to contact to proceed. A solution is proposed to address the existing restrictions by enhancing the preparedness of farmers or landowners through research and Extension resources. The primary audience is agricultural producers, landowners, farmers association managers, and Extension faculty.

Status of CM and the Contribution of Agriculture and Forests

The market size of CM is projected to increase from $1 billion in 2021 to $50 billion in 2030, according to McKinsey (Blaufelder et al. 2021). The C credits contributed by the natural system, such as agriculture and forests, are usually

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2. Ziwen Yu, assistant professor, big data analytics, Department of Agricultural and Biological Engineering; UF/IFAS Extension, Gainesville, FL 32611.

in two types: soil C and forest C. However, the combined portion of these credits is small in CM, indicating both current difficulties and future opportunities. The limitations stem from the mechanism of CM and the lack of relevant knowledge of the potential participants. On one hand, there is a lack of flexible and actionable standards to accommodate diverse ecosystems in different locations, which are essential for quantifying, validating, and verifying C credits. Developing these standards poses a challenge. As a result, only lands with specific management practices and environmental features can participate in CM. On the other hand, the knowledge, mechanisms, and requirements of CM are new and can be unclear. Associated education and guidance to participants are severely limited. Existing resources are mainly provided by project developers focusing on participant eligibility, but these have no or limited information about the nature of the market, farmers' or landowners' role in the entire value chain, and adjustment of practices.

Many engineering methods and projects exist in CM for fast capture of GHG from the atmosphere [e.g., retaining CO_2 in an alkaline solution (Keith et al. 2018), bipolar membrane electrodialysis (BMED) (Sabatino et al. 2020), etc.] and require other chemicals as well as power. Sequestering C by natural processes is slow, but it is also more cost-effective and can be widely applied, especially for farms and forests. Plant photosynthesis mainly contributes to the process. Carbon is stored in biomass or soil organic matter (Norman and Kreye 2023; Silveira et al. 2018). Speed of sequestration and storage capacity are ununiformly distributed because they are subject to diverse local eco-environmental conditions. The associated ecosystem service (e.g., improved soil fertility, biodiversity, hydrology performance), including climate resilience, may also bring benefits to farm and forest businesses and their surrounding environment systems on various scales.

Structure of CM

CM contains stakeholders with four main roles: protocol registries, project developers, participants or landowners, and third-party verifiers. In a previous Ask IFAS publication, Irizarry et al. (2022) briefly introduced each role's responsibilities. To better reflect the mechanism under which the market operates, Figure 1 illustrates a hierarchical structure involving all these stakeholders.

Protocol registries function as the standard developers in CM. These standards, called protocols, specify what a project developer adopting them can do to generate C credits. They also establish guidelines for verifying all related projects. Registries certify C offsets and enforce specific guidelines for verification and validation. A protocol can only be developed by a protocol registry under the review of experts or the public from various industries with different backgrounds. While limited information is available about the process of determining a board, protocol registries usually choose members themselves, as described in a conversation the author had with one of the protocol registries in CM. The rules and parameters defined in a protocol are used to determine the credibility of a C credit or, in other words, the existence of the sequestered C. Project developers will then use these rules and parameters as a baseline to develop one or multiple C projects in different eco-environmental systems (i.e., rainforest in a tropical region, hardwood forest in the Canadian Arctic tundra) that can be included in CM. For example, a protocol designed for C in clay or loamy soil may not be appropriate for lands in Florida or Georgia where sandy soil is typical. Each C project can involve multiple participants whose lands are in the appropriate eco-environmental system and are managed according to practices that meet the requirements of the project. For example, a protocol could precisely define a commercial forest as one managed through an eight-year cycle of planting and harvesting. This management aims to produce timber and mulch, rather than firewood, in a local sawmill. Typically, a single piece of land can only be involved in one carbon project. In very rare cases, a single land can be involved in multiple C projects by demonstrating its C credits are generated from different sources independently.

Once farmers or landowners decide to join or are already in CM, a third-party company will conduct an audit to verify that the C credits generated in the land are under the rules and parameters of the corresponding protocol. Until the verification is passed, the C credits cannot be registered in the marketplace to be purchased by buyers from other industries.

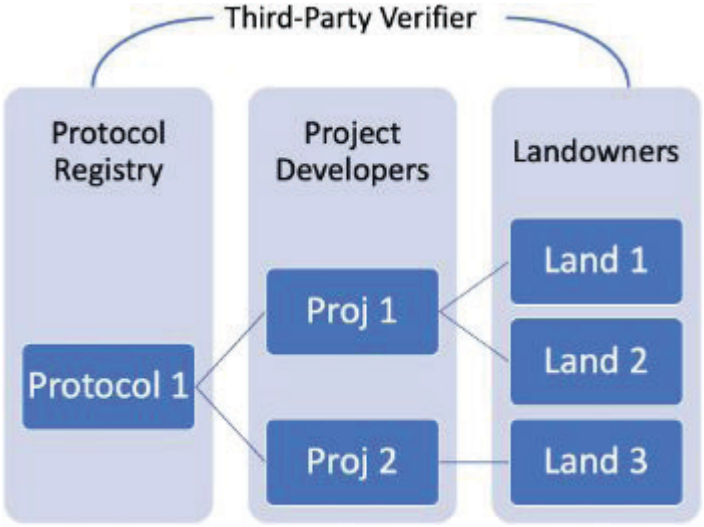

Figure 1. Relationship among different stakeholders in the carbon market.
Credits: Ziwen Yu

Participant Procedure

The procedure of successful C credit trading can be generally summarized below.

1. A landowner identifies a project whose requirements can be met by the land management.

2. A landowner contacts the corresponding project developer to learn about the required documents for participation.

3. The project developer submits documents to a third-party verification body to verify the agreement between the practices of the land management and the protocol.

4. The verification body follows standards to issue guidance, verify projects, generate reports, etc.

5. A protocol registry reviews project verification.

6. The project is established at the registry.

7. Land is monitored for adherence to project protocols that dictate the quantification of C credits.

8. C credits are issued at the end of the project and traded in CM by the registry or the developer.

The first two steps for farmers and landowners are straightforward. However, the rest of the process could be very complicated and time-consuming, often taking around six months. Depending on different projects or protocols, required documents might vary widely, from a receipt for a conservation tiller bought five years ago to receipts of cover crop seeds in the last seven years. These documents may also include details about the species, and/or planting and harvesting dates for the crop rotations in the land since adopting accepted CSAF practices.

Navigating through these documents can be quite a task. Contracting, in particular, can pose challenges due to diverse protection terms regarding potential risks, such as natural disasters (e.g., hurricanes), termination of CSAF practices, property transfers, failed verification, and more. Different project developers may interpret and evaluate these risks differently, leading to distinct terms that even experts might struggle to fully comprehend. Failure to understand these terms and documents could result in income losses for farmers and landowners.

The Benefits for Participating Landowners

Participating in CM can bring landowners various benefits. The most obvious benefit is a new and continuous income to their business. Note that the amount of this potential income could vary drastically depending on the specific ecosystems or cropping systems. After talking with multiple project developers (e.g., FiniteCarbon, CarbonTerra, Nori), we found that none of them would be willing to provide even a typical average income for a specific land setup due to this significant variance.

The second benefit is for the ecosystem service. Carbon sequestration can contribute to a certain degree of restored ecosystem functionalities, including increased soil health and biodiversity. Such improvements could enhance the infiltration rate and water retention capacity of soils, provide habitats for organisms that control pests, and reduce topsoil erosion, among other benefits. The returns to a farm or forest from these improvements can be seen in the lowered cost of management with reduced irrigation and fewer applications of chemicals and fertilizers (Harnish 2023; Mattila et al. 2022; Popkin 2023).

Additionally, C income is resistant to some common risks for farming or forestry businesses. For example, soil C is sequestrated by the microbiological system in the soil, which can be sustained by a live root system. While crop yield may be impacted by weather uncertainties, pests, or diseases, the sequestration of soil C continues as long as the plants are alive. Given the increasing demand, the price of C credits has been increasing in recent years and is very likely to continue growing in the future (Jennifer L. 2023). This indicates that purchasers may be willing to pay more for credits of superior quality.

Requirements of Participation

Irizarry et al. (2022) introduced a brief procedure of enrollment for landowners. However, landowners need to be aware of many restrictions and requirements. Most importantly, the features of C credit, such as additionality, permanence, and leakage, are fundamental concepts that all participants must understand (Irizarry et al. 2022).

Farmers or landowners need to provide specific information to demonstrate the validity of their C credits. For additionality, evidence (e.g., purchase receipts for new equipment [such as conservation tillers], cover crop seeds, or new trees) is needed to demonstrate that additional practices have been adopted, which may sequester more atmospheric C than the natural system does in their lands. Because C sequestration is a slow process, a long recorded history of these practices is usually required before participation.

To ensure permanence, a long-term commitment is commonly signed in CM, ranging from 5 to 20 years or even longer depending on different projects.

Violations of additionality and permanence are usually called leakage. Leakage needs to be checked through regular verification on a 3- to 5-year basis, at a cost of approximately $5,000 each time for each project. This cost could be shared across all participants in a project or charged on their C credits income, subject to the contract terms between participants and their project developers.

There are also technical limitations that restrict participation.

1. Many protocols and projects exist in the market for various ecosystems and business setups. However, it is very difficult and time-consuming for participants to locate and identify a project that fits their specific land and management strategies. Once they do, contracting and related risk management can also be complicated, even for an expert.

2. The existing quantification methods for C credits in agriculture, especially soil C, are not sophisticated enough to provide accurate measurements and can only be applied to certain cropping systems (e.g., row crops with certain rotations).

Who is underserved?

Given the requirements and restrictions related to CM participation, different types of landowners or farmers have greater enrollment-related difficulties and are consequently underserved by CM.

1. Small landowners or farmers may encounter a significant barrier to initial investment and recurrent expenses related to the purchase of new equipment and regular verification fees. Due to the limited size of their lands and business, it could be very difficult for farmers to break even with these extra expenses using the C income.

2. New farmers cannot immediately join CM due to a lack of records to prove a long history of adoption of CSAF practices (usually 5 years or longer). If the previous landowner does provide this information, a new farmer needs to implement and record CSAF practices for at least 5 years before enrolling.

3. Specialty crop farmers, especially in Florida, and ranchers are technically ineligible for CM because their cropping and farming systems cannot be modeled well by existing methodologies used in CM. Unless new technologies or other practices are invented, no projects can facilitate these "special" systems outside of the modeling capacities.

What should you do?

With the quick and dynamic growth of CM, advancement of technologies, and newly created protocols, numerous opportunities emerge for farmers and landowners to become eligible for CM participation. For those who are already eligible, gathering the necessary information for participation might prove to be an involved and challenging process.

The fundamental question is whether farmers and landowners are ready for CM in terms of both knowledge and practices. Given the scarcity of relevant educational resources, self-education becomes paramount for farmers and landowners to enhance their knowledge about CSAF practices and CM. Swift adjustments in farming practices are also crucial, because many C projects necessitate a long history of CSAF implementation.

In addition, gathering data related to environmental features, such as soil organic matter, becomes a critical step. This holistic approach is pivotal in ensuring the success of landowners' and farmers' participation in CM.

Summary

The carbon market will continue to grow due to the increasing demand for sustainability on a global scale. Contributions from agriculture and forestry can play a bigger role compared to their current status. However, different requirements and restrictions narrow the potential participation of all landowners. Those who are planning to enroll should be aware of these constraints and adjust their land management accordingly.

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