The Opportunity for Agriculture: Becoming Climate-Smart and Sequestering Carbon

An Illustration of the Steps in Project Development

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FOREST TRENDS

Introduction

The future of agricultural productivity is intertwined with climate change. Agriculture is a significant contributor to GHG emissions (10-12% of all emissions); at the same time, many agricultural areas are facing changes in mean temperature, precipitation, and increasing climate variability, all of which may impact their harvests. As a result, it will be essential for farmers to adopt climate-smart practices that can increase resilience.

One approach to increase productivity that numerous farming systems around the world are using is the adoption of practices that keep carbon in the soil, as increased soil carbon correlates with increased yields. At the same time, soil carbon sequestration offers the potential to sequester carbon, thereby mitigating climate change. As a result, this approach could address two of the main challenges that we face in the coming years: feeding 9 billion people by 2050 and preventing dangerous build-up of green-house gases (GHGs) in the atmosphere.

This brief illustrates how to develop soil carbon projects, using the experience of two pilot projects, from the concept through planning stages and ultimately, it is hoped, implementation.

What Is Soil Carbon Sequestration?

"Historically, land-use conversion and soil cultivation have been an important source of greenhouse gases (GHGs) to the atmosphere. It is estimated that they are responsible for about one-third of GHG emissions. However, improved agricultural practices can help mitigate climate change by reducing emissions from agriculture and other sources and by storing carbon in plant biomass and soils.

Agricultural soils are among the planet's largest reservoirs of carbon and hold potential for expanded carbon sequestration and thus provide a prospective way of mitigating the increasing atmospheric concentration of CO_2. It is estimated that soils can sequester around 20 Pg C in 25 years, more than 10% of the anthropogenic emissions.

At the same time, this process provides other important benefits for soil, crop, and environment quality, prevention of erosion and desertification, as well as for the enhancement of biodiversity.

Carbon sequestration activities have been supported through the CDM (Clean Development Mechanism) under the Kyoto protocol and are considered the most effective and readily measurable means to sequester carbon as biomass both above and below ground. In the post-Kyoto negotiations, efforts are being made to give due attention to the huge carbon sequestration potentials in rangelands and to soil carbon sequestration."

Source: Excerpted from: http://www.fao.org/nr/land/sustainable-land-management/soil-carbon-sequestration/en/

Background, Opportunity and Challenges

A variety of options exist for mitigating GHG emissions in agriculture. The most prominent mitigation practices are (1) improved crop and grazing land management (agroforestry, residue management, soil and water conservation etc.), (2) restoration of areas drained for crop production, and (3) restoration of degraded lands.[1]

Through climate-smart agricultural practices multiple benefits can be combined, including rural economic development, food security, as well as climate adaptation and mitigation. While adaptation and food security are priorities for smallholder farmers around the world, mitigation measures may also give access to new, more immediate sources of finance.

[1] Smith, P., D. Martino, Z. Cai, D. Gwary, H.H Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, B. Scholes, O. Sirotenko, 2007, Agriculture. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

The potential for climate finance to initiate a move toward sustainable agriculture is real. Multilateral and bilateral agencies, along with their developing country partners, can act on existing financial mechanisms to pilot, demonstrate, and scale activities in the agricultural sector. The longer-term work of creating a more sustainable, low-emission agriculture sector around the world will be a multi-decade project.

Yet, a prerequisite to accessing significant amounts of climate finance in developing countries is the aggregation of small-scale farmers, as well as forging partnerships that will provide investor assurances. Another hurdle to leveraging climate finance--in order to assist with the transition of farmers' practices--is establishment of cost-effective carbon measurement and monitoring techniques as well as effective farmer outreach. At present, lack of knowledge, high project design costs and investment uncertainties have hampered project development and the supply of significant climate finance. Additional difficulties stem from limited access to technical and financial expertise. Finally, working with smallholder farmers in Africa, Asia and Latin America requires significant lead time, due to issues such as: the need to mitigate livelihood risks, protect multiple ecosystem services concurrently, address asymmetric negotiating power, secure up-front financing to defray project development costs, contend with complex land and resource tenure issues, and aggregate large numbers of smallholders.

Approach to Climate-Smart Agriculture and Soil Carbon

Over the past few years, Forest Trends, UNIQUE, Climate Focus, and the Nature Conservation Research Centre (NCRC), with support from the Rockefeller Foundation, have laid the groundwork to design "Climate-Smart Agricultural Finance" models that will deliver climate resilience and mitigation gains, improve agricultural productivity, protect natural ecosystems, and leverage public as well as new private sector finance. Our goals are to demonstrate practical designs and build political support for climate finance that leverages private sector investments. These investments provide access to the technology and financing needed to overcome barriers that currently impede both greater resilience and increased productivity in a sustainable manner. Based on this, we developed broadly applicable models, which can be calibrated for specific sites, regions, and countries as well as particular crops.

Our experience shows that the steps needed to undertake any soil carbon project include:

- **Select Soil Carbon Screening and Evaluation Tools** to identify legal, commercial, and institutional preconditions as well as specific commodities most amenable to transformation programs and key gaps to be addressed.
- **Identify or Craft Pilot Transaction Models**, such as approaches to financing practice changes.
- **Create a Community of Practice**, which fosters ongoing learning as well as increased implementation of climate-smart agricultural practices.

These steps can be illustrated in two cases that are currently in development: climate-smart coffee agriculture, in Ethiopia, and cocoa, in Ghana.

Pilot 1: Climate-Smart Cocoa in Ghana

In Ghana, the process of crafting a climate-smart agricultural initiative for the cocoa sector began with the formation of a coalition whose purpose was to develop a joint plan for altering the economics of deforestation from unsustainable cocoa farming. The goal is to provide cocoa farmers and cocoa-farming communities the opportunity to benefit from climate finance while also gaining improved access to agronomic, economic and information resources. This initiative is working at both the national scale and the local level.

At the national sector level, our local partner NCRC has convened a Climate-smart Agricultural Finance (CAF) working group comprised of key public and private cocoa sector stakeholders. This working group is focused on developing a business model and critical pathway towards climate-smart cocoa production in Ghana. It also works on attracting fast-start climate finance that can help support the development of private sector mechanisms, including (1) loan guarantees and insurance products; (2) up-front funding to support the costs of implementing new policies and practices, notably the provision of extension and input supply services and products; and (3) financial support to reduce initial uncertainty and risk for the private sector.

At the local level, the project goals are three-fold:

(1) to reduce emissions from deforestation associated with expansion into Forest Reserves and other high carbon-stock lands, and to enhance carbon stocks in low-shade systems;

(2) to improve livelihoods through significant yield increases on-farm and access to mitigation and adaptation benefits;

(3) to promote biodiversity conservation and ecological resilience of the cocoa-farming landscape.

Multiple field visits assessed the suitability of sites and identified changes in practices that would sequester more carbon while still enabling for strong cocoa productivity. These findings were entered into computer models for assessing carbon sequestration gains that could occur through changes in agricultural practices.

This work has led to a proposed pilot scale of approximately 110,000 hectares in which the recommended sustainable intensification strategy combines increased shade cover with other activities. In the proposed soil carbonproject scenario, cocoa management would result in higher productivity, while increasing the climate resilience of the cocoa systems as fertilizer and shade trees would contribute to higher yields via intensification, better litter decomposition rates and higher drought resistance. The project scenario will also reduce the degradation and deforestation pressure on forest reserves and forest/trees in the off-forest reserve areas resulting in the maintenance and enhancement of carbon stocks in this landscape. Maintaining these gains over time will require strict enforcement of land-use planning at the community level to prevent situations where increasing productivity will increase deforestation. This enforcement is likely to be most effective, based on past experiences, if it occurs through the Community Resource Management Areas (CREMA) structure.

Illustrative Steps in Land Use-Focused Carbon Project Development

Step 1: Identify prospective project sites, which entails identifying carbon project opportunities and gathering information on direct project benefits (such as carbon sequestration, financial costs/returns, and land productivity) as well as indirect benefits (or co-benefits) associated with biodiversity, improved livelihoods, and other factors.

Step 2: Conduct detailed assessment of both financial and legal questions, such as land and carbon rights ownership, socio-economic impacts, and current carbon sequestration rates (the project baseline), in order to accurately assess measuring, reporting, and verifying activities in the future.

Step 3: Design carbon project, which is comprised of documenting a range of factors, including:

- Project site and land ownership (through formal legal titles and assessments of who is using the land),
- Current carbon stocks and baselines,
- Alternative land management practices needed to sequester carbon (and livelihoods),
- Socio-economic impacts of changing current land management practices and feasibility of adoption rates being maintained over time,
- Implementation/management and monitoring plans, and
- Support/infrastructure (such as extension services, etc.)

Step 4: Forge formal agreements which delineate monitoring timeframes as well as external verification and validation, if these elements are part of the agreement. All paperwork must be filed with the appropriate authority related to any covenants placed on the land around carbon, registration of carbon, international carbon sales that may have tax implications, and other such details.

Step 5: Implement, monitor, verify and validate, which are a series of tasks that commonly occur over many years.

Overall, based on the field work and carbon models, it is estimated that this pilot project has the potential to deliver estimated emissions reductions of approximately 8.9 million tCO_2 over a period of 20 years with an annual average of 440,000 tCO_2. If monetized on an annual basis, the total value of the sequestered carbon or avoided carbon emissions will amount to US$ 480,000 in year 1, increasing to US$ 3.2 million in year 9.

Pilot 2: Climate-smart Coffee in Ethiopia

In Ethiopia, coffee is an important part of the economy, contributing about 40% of the nation's entire foreign exchange earnings. 95% of it is produced by smallholder famers. Approximately one-third of the rural population is engaged in coffee production. Coffee in Ethiopia also lends itself to the implementation of approaches that increase productivity and carbon stocks through improved agronomic practices and shade tree planting. For example, field-based assessments in combination with carbon modeling found that planting 40 shade trees per hectare can increase annual biomass and soil carbon from 60 tCO_2/ha in year 1 to 168 tCO_2/ha in year 20, close to the carbon equilibrium. It is estimated that activities will double productivity while enhancing livelihoods and climate resilience of smallholder farms.

The largest climate-smart coffee production intensification potential was identified in the garden coffee systems in West and East Harerghe, home to one of the most famous coffees. The recommendation for the pilot project is to start with about 15,000 coffee farms in these zones and expand to 190,000 coffee farms over a 5-year period. Drawing upon the existing extension system, existing workers would be trained and 15 new extension workers recruited to provide farmer groups with the skills to adopt and to monitor best coffee management practices and related climate mitigation and adaptation benefits. Based on these experiences, we describe below the elements any prospective soil carbon agricultural project should include:

Essential Elements of a Prospective Soil Carbon Agricultural Project

1) A Technical Management Approach, which includes:

- identification of potential for intensification and needed improvements in inputs;
- recommendations for agronomic and management practices (including the use of shade trees), harvesting, processing, and marketing; and
- creation of an economic analysis of expected cash flows (costs and revenues), including a sensitivity analysis to parameters such as coffee and labor prices, as well as the identification of risks and mitigation strategies.

2) An Investment Case for the private sector supported by climate public finance. A public donor would provide upfront project development costs, including an MRV system and a loan guarantee or interest rate discount to a local financial institution, for a credit line to qualified borrowers: the Coffee Union, cooperatives, farmer groups and private sector intermediaries.

3) A set of actors on-the-record with political support, such as the national government Environmental Protection Agency, Ministry of Agriculture, the climate change bodies and other relevant actors, for example private banks, farmers cooperatives and other community or national NGOs that could be associated with implementation.

Concluding Thoughts & Resources

Development of soil carbon projects requires a combination of detailed on-the-ground field work and measurements along with modeling of carbon sequestration and building political support. It is a time-consuming process that will follow similar steps and face similar challenges as other carbon project and payment for ecosystem services initiatives.

An additional challenge is that the costs of developing soil carbon projects vary greatly. Costs can include staff time to reach out to prospective landowners—who may be sellers of carbon, such as farmers—through engaging remote sensing specialists to assess historical land cover or international experts to verify and develop project opportunities.

There are a wide range of factors that affect project development costs, including:

- The number of landowners involved,
- The status and clarity of land ownership,
- The status and clarity of local carbon rights laws,
- Carbon sellers' familiarity with carbon agreements and the relative effort required to ensure prior informed consent, and
- Climate finance providers' (and/or buyer)s' demand for projects that follow particular offset standards, including third-party verification.

Costs are higher for projects that seek formal validation and verification according to standards. Implementation costs also vary significantly by scale. Project size can affect required staff time, project materials, consultants (ranging from legal advisors through third-party verifiers), and other transaction costs.

Looking Ahead

Large terrestrial carbon projects are, and will remain and complex undertakings across the full spectrum of issues. For agricultural carbon projects to succeed, it will be critical that they deliver benefits for farmers, in addition to offering climate mitigation impacts.

Fortunately, terrestrial carbon project developers can now draw on twenty years of experience in the related forest carbon domain. As a result, they now have better tools for screening opportunities than just a few years ago, understanding expectations and managing for multiple ecosystem services. At present, trail blazers are developing significant industry infrastructure, project standards and methodologies, and expert resources for designing climate-smart agricultural projects that focus on soil carbon sequestration. Ultimately, it is hoped that the two proposed pilot projects laid out in this brief demonstrate that:

- climate finance can catalyze significant benefits for smallholder farmers through the adoption of climate-smart agricultural practices that concurrently increase (risk-adjusted) average yields and capital stocks, build climate resilience, and diversify household income;
- it is possible to develop cost-effective monitoring and evaluation systems to demonstrate adaptation and mitigation benefits that justify increasing climate finance and agricultural investments;
- the strategic use of new sources of finance can increase access to agricultural knowledge and information, inputs and financial services such as investment loans, and leverage significant private investment in smallholder agriculture, and
- agricultural programs can contribute to a country's climate goals through the strengthening of integrated adaptation and mitigation performance.

The pathway forward is now from concept into pilot testing and practice.

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