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Helping smallholder farmers mitigate climate change

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Key messages

- Smallholder farmers can contribute significantly to climate change mitigation but will need incentives to adapt their practices.
- Incentives from selling carbon credits are limited by low returns to farmers, high transaction costs, and the need for farmers to invest in mitigation activities long before they receive payments.
- Improved food security, economic benefits and adaptation to climate change are more fundamental incentives that should accompany mitigation.
- Designing agricultural investment and policy to provide up-front finance and longer term rewards for mitigation practices will help reach larger numbers of farmers than specialized mitigation interventions.

Farmers have experienced increases in maize yields after intercropping maize and fertilizer trees such as Calliandra. Photo credit: Charlie Pye-Smith

Introduction

Farmers can significantly reduce climate change by selecting agricultural practices that reduce greenhouse gas emissions or store carbon. To encourage more farmers to use these practices, various incentives have been proposed, including payments for carbon credits. Yet in developing countries smallholder farmers' priorities are often to get immediate benefits from farming and ensure their own food security. Climate change mitigation among smallholders is thus more likely to occur where it is a co-benefit or outcome of practices that farmers pursue for improved income or reduced risk. In many cases these practices serve multiple goals, including increased yields, and improved ecosystem and livelihood resilience.

As developing countries prepare commitments to mitigation activities in agriculture, investments should be guided by a thorough understanding of the appropriate incentives to encourage farmers to innovate and adopt new mitigation practices. This policy brief examines the benefits and costs of mitigation practices, financing opportunities, institutional arrangements and enabling conditions that could motivate mitigation.

Why incentives?

Global greenhouse gas (GHG) emissions derived directly from agriculture amount to approximately 5.1–6.1 Gt CO_2-eq. per year (Smith et al. 2008), which is roughly equivalent to the transport sector. The majority (74 percent) of agricultural emissions originate in low- and middle-income countries, where smallholder farmers are most common. Mitigation efforts in agriculture, such as enhancing soil carbon, could potentially offset 24 to 84 percent of current agricultural emissions (Smith et al. 2008).

There is a large gap, however, between what is technically feasible and what farmers are willing or able to do. Farmers will not adopt mitigation practices if there are trade-offs against farm productivity or food security. To make mitigation attractive, new practices must provide tangible benefits and be linked to improvements in productivity and livelihood security, including adaptation to climate change (see Box 1).

Financial and non-financial incentives that could help make mitigation practices more attractive include: (i) improved farm production, efficiency or adaptability to climate change; (ii) income and other benefits from selling offsets in the carbon market or payments for ecosystem services (PES) schemes; (iii) increased prices for sustainable, low climate impact products; (iv) improved opportunities to attract investment; and (v) better alignment with values and social norms.

For example, the Kenya Agricultural Carbon Project is supporting farmers to improve their soil productivity and crop yields through agroforestry and other improved practices. The farmers increase their returns by improved planning and management of resources. They also expect to receive payments for the carbon they are helping to store.

Box 1. Smallholders in mitigation and adaptation: Thailand case study

(Adapted from Srang-iam 2011, in Havemann and Muccione, 2011)

A recent study in Thailand highlighted the differences in concerns between farmers and government mitigation schemes: farmers' main concern was their ability to secure their livelihoods in the face of climatic uncertainty, while the government's aim was to achieve net GHG reductions. The government interventions did not explicitly consider local resilience impacts.

The most vulnerable farmers were most likely to adopt high-GHG emitting farming practices, yet were excluded from government mitigation programs, such as tree planting schemes, because they lacked tenure documents. National climate policies need to consider how to work with marginal farmers to develop low carbon adaptation strategies.

How much?

Benefits

Many mitigation practices can provide food production, economic and environmental benefits. Sustainable land management (SLM), as a suite of practices, offers the largest potential for synergies between food security and mitigation. SLM includes reduced tillage, integrated nutrient management, improved organic residue management, and agroforestry or restoration of degraded lands (McCarthy et al. 2011).

Other options with demonstrated mitigation and agricultural yield benefits include improved nutrient and manure management, rice cultivation using alternate wet and drying irrigation, and sustainable grazing management. Dry climatic zones generally offer lower mitigation benefits per hectare than humid zones because of their lower biomass production (Branca et al. 2011). Because of their extensive nature, however, their total contribution is potentially large.

Costs and financing

Assessing the costs of establishing and maintaining mitigation activities can provide an indication of finance needs. Table 1 provides examples of the costs associated with different practices. The data show that establishment as well as maintenance costs can be significant for materials, labor and equipment such as specialized planting implements or biogas generators. Climate finance can help farmers overcome these costs (Box 2).

Box 2. Climate finance to support smallholder adoption of new practices
(Adapted from Streck et al. 2012)

A lack of investment and credit are among the most important barriers to the uptake of new practices by smallholders. Policies that address financial incentives for individual farmers can be divided into four types: (i) output and results-based payments; (ii) direct access to loans or other financial products; (iii) risk-sharing mechanisms; and (iv) incentives for enhanced private investment.

Climate finance can provide support to smallholders in different forms, including:

- transition funds to reimburse costs of adoption and address lack of credit
- payments for ecosystem services related to sustainable agriculture, where upfront finance is not needed
- coverage of insurance and guarantee costs to reduce risks and encourage smallholders to invest and intensify production
- support for capacity building and transaction costs, to cover costs of aggregation of smallholders, measurement, reporting and verification, training extension agents and certification costs.

Institutional arrangements and enabling conditions

Carbon markets

Carbon markets and payments for mitigation services have received much attention as sources of finance for mitigation, but have yet to demonstrate that they can provide strong incentives. Four factors have hindered carbon markets in agriculture: limited markets, low returns to farmers, hidden costs and the need for advance funding. Carbon market options are at an early stage of development, however, so further innovation and experience may help improve these conditions.

Limited markets

The most important general carbon trading mechanism has been the Clean Development Mechanism (CDM). For agriculture, mitigation methodologies allowed under the CDM are limited to tree planting, management of biogas from animals and irrigation in rice. Smallholders have found the CDM extremely difficult to access because of its high transaction costs, the expense of measurements and the technical expertise required.

Agricultural carbon credits for sustainable land management are also available in the voluntary

Table 1. Examples of investment and maintenance costs of sustainable land management options

Technology options	Practices	Case study	Establishment costs US$/ha/year	Average maintenance costs US$/ha/year
Agro-forestry	Various argro-forestry practices	▸ *Grevillea* agroforestry system, Kenya	160	90
		▸ Shelterbelts, Togo	376	162
		▸ Different agroforestry systems in Sumatra, Indonesia	1,159	80
		▸ Intensive agroforestry system (high-input, grass barriers, contour ridging), Colombia	1,285	145
Soil and water conservation	Conservation agriculture (CA)	▸ Small-scale conservation tillage, Kenya	0	93
		▸ Minimum tillage and direct planting, Ghana	220	212
		▸ Medium-scale no-till technology for wheat and barley farming, Morocco	600	400
	Improved agronomic practices	▸ Natural vegetative strips, The Philippines	84	36
		▸ Grassed *Fanya juu* terraces, Kenya	380	30
		▸ *Konso* bench terrace, Ethiopia	2,060	540
	Integrated nutrient management	▸ Compost production and application, Burkina Faso	12	30
		▸ *Tassa* planting pits, Niger	160	33
		▸ Runoff and floodwater farming, Ethiopia	383	814
Improved pasture and grazing management	Improved pasture management	▸ Grassland restoration and conservation, Qinghai province, China [1]	65	12
	Improved grazing management	▸ Rotational grazing, South Africa	105	27
		▸ Grazing land improvement, Ethiopia	1,052	126

[1] Project estimates
Source: McCarthy et al. 2011: 25. Costs include labor (farmers' own labor and paid labor), equipment and materials.

market. This market has been more nimble in creating arrangements suited to farmers' needs, such as accounting for risk in agriculture through discounted credits, but it also tends to offer lower carbon prices. Private investors' interest in agricultural carbon markets also has been low, limiting the scope for engaging large number of farmers. At current carbon prices and project scales, returns occur only after 10–15 years and are not competitive with other sectors. Private investment could be enhanced though public funding to demonstrate the feasibility of agricultural carbon and to support risk sharing. Insurance or other buffering mechanisms may also help reduce the risk of farmers not delivering promised credits. If carbon prices increased to US $20, $50 or even $100, as some models have suggested, these conditions would be likely to change substantially.

Without a global regulated market for agricultural credits and a higher carbon return, the demand for agricultural carbon credits remains low.

Low returns to farmers

Smallholder households in existing carbon projects are projected to earn only US $2 to $10 per year at current carbon prices. While farmers value the new potential income, most seem to adopt new practices because of the prospect for improved yields rather than payments. One option to increase payments is to aggregate

farmers, for example using Programs of Activity, which enable project developers to treat different groups of farmers using the same mitigation intervention as 'one program' and thereby reduce project development costs. Another option is to bundle mitigation with rewards for other ecosystem services such as biodiversity or water conservation.

Hidden costs

Carbon market projects involve huge implementation costs to organize farmers and provide technical assistance. Because project developers often have previous, lengthy involvement with farmers, many costs have already been absorbed or are subsidized by donor funding and are not accounted for in carbon project business plans or figures. The cost of mitigation is therefore often underestimated and current projects are unlikely to be replicable without similar prior engagement and development infrastructure.

Need for advance finance

Carbon markets may prove more viable for smallholders if financing can be provided upfront to encourage technical innovation. Carbon payments are usually only made once the carbon credits have been produced and verified, which means that funds are not available for the transition to new practices. The Plan Vivo program (www.planvivo.org) provides a stream of payments to farmers from the start of the project cycle for this reason.

REDD+ and payments for ecosystem services

Reducing Emissions from Deforestation and forest Degradation (REDD+) and payments for ecosystem service (PES) schemes are potentially new income sources for smallholders that could support agricultural mitigation. REDD+ aims to provide mechanisms under which developed countries pay land managers in the developing world to avoid deforestation and forest fragmentation. PES schemes similarly aim to pay land mangers to provide defined environmental services. Such schemes need to be adjusted to provide up-front investment to farmers to finance the adoption of best management practices, certified against credible standards.

Nationally appropriate mitigation actions

Nationally appropriate mitigation actions (NAMAs) are a policy tool under discussion by the countries participating in the United Nations Framework Convention on Climate Change (UNFCCC) to channel funding to developing countries for their mitigation actions (see Box 3). Local government should also play a role in developing Locally Appropriate Mitigation Actions (LAMAs), to ensure that proposals are sensitive to local needs and agroecological conditions.

Box 3. Nationally appropriate mitigation actions in agriculture

(Adapted from Streck et al. 2012)

NAMAs are commitments made by developing countries to reduce GHG emissions. These are submitted to the UNFCCC and act as tools for securing international climate financing. NAMAs are expected to follow a performance-based logic and to be linked to real and measurable emission reductions. Where NAMAs are implemented with international support, they are subject to both national and international measurement, reporting and verification (MRV). Financing and implementation modalities remain undefined. Regardless of the eventual rules for international support to NAMAs, public sector finance alone will not be able to fully finance low-carbon development in developing countries.

Two countries (Papua New Guinea and Morocco) have established sector-wide agricultural mitigation targets without specifying the actions to be taken, while some countries (Brazil, for example) have submitted agricultural reduction targets for specific actions such as no-till agriculture or increased use of biofuels. Other countries have tended to identify broad priorities for development of the agricultural sector or just a list of specific actions, such as crop residue management or the restoration of grasslands.

Agricultural finance

The widest and most enduring impacts for farmers are likely to occur where agricultural development institutions mainstream mitigation into finance and technical support programs. In the public sector, for example, the transition to new mitigation practices could be supported through new forms of credit, risk sharing or insurance mechanisms, agricultural development funds, sectoral policies, and local government agricultural infrastructure and technical facilitation.

The private sector could provide similar transition finance through contractual agreements related to grower schemes, certification or labeling that specify low climate impacts, as well as credit and insurance schemes. Public and private sector cooperation may improve the quality of technical extension and harmonize the provision of technical service delivery.

Table 2 summarizes some of the ways agricultural finance linked to mitigation could meet smallholders' livelihood needs.

Differentiating incentives

Incentives need to be appropriate to the livelihoods of women and men farmers in specific contexts, farming systems and agro-ecosystems. Some farmers will always be more cost-effective and reliable at implementing climate change mitigation activities. These farmers may require lower levels of payment to achieve a given

Table 2. Smallholders' needs and how they can be met by GHG mitigation-linked benefits

Potential revenue enhancing and risk-reducing support to address need		
	Primary benefits (direct)	
Smallholder assumptions	Tangible (Value is quantifiable)	Intangible (Value difficult to quantify)
Little, seasonal and insecure household revenue	▸ Payment for GHG mitigation units ▸ Provide new income generating opportunities e.g. new produce, processing facilities, employment ▸ Improved earnings through provision of quality and consistent extension service ▸ Improved earnings by receiving more per unit of produce ▸ Dividends/profit share from selling product associated with project	▸ Clarification and improvement of tenure ▸ Improved market access ▸ Institutional development ▸ Decreasing irregularity of smallholder incomes e.g. by introducing new, diverse income sources and providing access to storage ▸ Agricultural training and techniques
High relative household and production costs	▸ Support to displace or reduce production costs e.g. inputs, energy ▸ Support to displace or reduce living costs	▸ Improvement of local facilities (healthcare/ schools)
High vulnerability to events that impact on production	▸ Provide access to facilities that can extend the life of products e.g. processing and storage facilities ▸ Provide access to formal production and family insurance	▸ Access to savings opportunities ▸ Improved information access (e.g. on weather) ▸ Training on nutrition and health ▸ Increased local resilience
	Co-benefits (indirect)	
▸ Training in financial literacy ▸ Smallholder political representation ▸ Gender awareness		

mitigation impact and may be attractive for targeted funding because of their efficiency.

Reaching resource-poor farmers requires extra effort. Support for mitigation should be weighed carefully against the costs. Extension services and projects tend to be biased towards 'early adopters', who are generally better-off households and men. Overcoming this bias will require safeguards, extra measures and clear gender-appropriate strategies. Measures to reach women and the poor include designing projects based on the needs of target groups; project evaluation indicators and rules on participation or benefit distribution, taking account of land tenure and women's rights; direct provision of benefits to target groups; creating in-kind incentives that are unlikely to be co-opted by others; and rigorous monitoring of project processes and impacts.

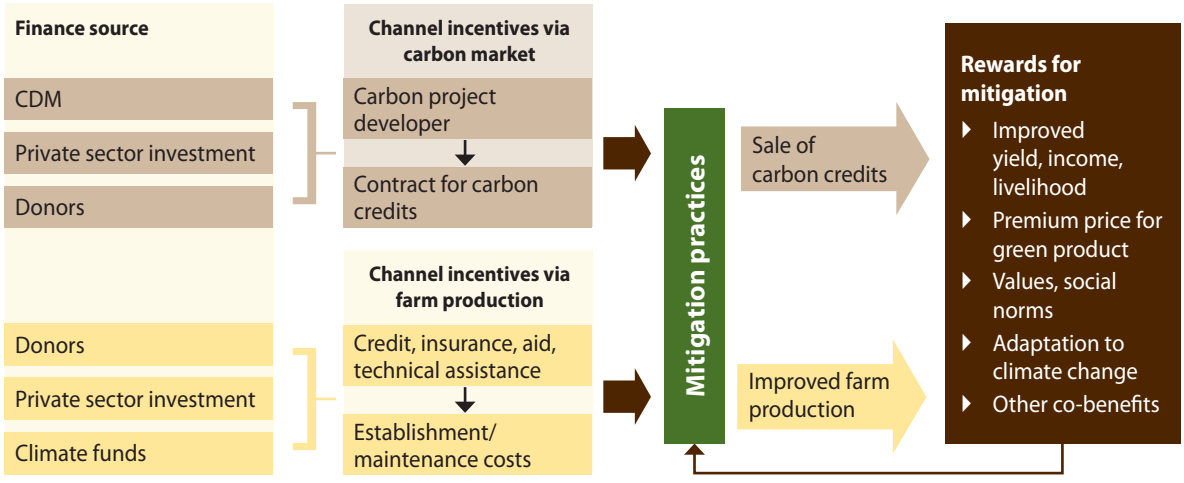
Conclusion

To achieve mitigation in agriculture, a variety of incentives can be used to encourage farmers to establish and maintain new practices. While carbon markets are one source of finance, more fundamental change is likely to occur where farmers can see that changes in practices directly improve their livelihoods. This turns the question around: rather than seeking to change farming practices to minimize climate impacts, the goal must be to achieve food security, sustainable agricultural development and adaptation to climate change, while also minimizing emissions.

To have a significant impact, national governments can improve the conditions that help farmers adopt and sustain practices that reduce impacts on the climate. Appropriately targeted incentives that foster food security as well as adaptation to climate change, should encourage smallholders to implement the desired mitigation activities. With the right incentives these rewards could help transform agriculture to support smallholders' livelihoods, ensure food security and reduce agriculture's impact on the climate (Figure 1).

Mainstreaming mitigation incentives in the programs and institutions that deliver agricultural development is essential to produce enduring outcomes at large scales. It should also allow donors to see the added value of their interventions more readily. Mitigation incentives are thus best built into more comprehensive agricultural strategies that support enhanced productivity and food security with practices that also contribute to mitigation and adaptation to climate change.

Figure 1. Incentives for mitigation



References

Background papers:

Branca G, McCarthy N, Lipper L, Jolejole MC. 2011. Climate-smart agriculture: a synthesis of empirical evidence of food security and mitigation benefits from improved cropland management. Mitigation of Climate Change in Agriculture Series 3. FAO, Rome, Italy. Available online at http://www.fao.org/docrep/015/i2574e/i2574e00.pdf

Havemann T, Muccione V. 2011. Mechanisms for agricultural climate change mitigation incentives for smallholders. CCAFS Report No. 6. CCAFS, Copenhagen, Denmark. Available online at http://hdl.handle.net/10568/12496

McCarthy N, Lipper L, Branca, G. 2011. Climate Smart Agriculture: Smallholder adoption and implications for climate change adaptation and mitigation. Mitigation of Climate Change in Agriculture Working Paper No 3. FAO, Rome, Italy. Available online at http://www.fao.org/docrep/015/i2575e/i2575e00.pdf

Streck C, Burns D, Guimaraes L. 2012. Towards policies for climate change mitigation: Incentives and benefits for smallholder farmers. CCAFS Report No. 7. CCAFS, Copenhagen, Denmark. Available online at http://hdl.handle.net/10568/21114

Other References

Giller KE, Witter E, Corbeels M, Tittonell P. 2009. Conservation agriculture and smallholder farming in Africa: The heretics' view. *Field Crops Research* 114(1): 23–34.

Smith P, Martino D, Cai Z, Gwary D, Janzen HH, Kumar P, McCarl B, Ogle S, O'Mara F, Rice C, Scholes RJ, Sirotenko O, Howden M, McAllister T, Pan G, Romanenkov V, Schneider U, Towprayoon, S. 2007. Policy and technological constraints to implementation of greenhouse gas mitigation options in agriculture. *Agriculture, Ecosystems and Environment* 118:6–28.

Smith P, Martino D, Cai Z, Gwary D, Janzen HH, Kumar P, McCarl B, Ogle S, O'Mara F, Rice C, Scholes RJ, Sirotenko O, Howden M, McAllister T, Pan G, Romanenkov V, Schneider U, Towprayoon S, Wattenbach M, Smith J. 2008. Greenhouse gas mitigation in agriculture. *Philosophical Transactions of the Royal Society* 363:789–813.

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