Green agricultural policies and poverty reduction

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Executive summary

Developing countries typically have large agricultural sectors. As a result, green agricultural policies are a key part of their shift to a low-carbon economy.

Green agricultural policies drive increased use of farming practices and technologies that simultaneously:

- maintain and increase farm productivity and profitability while ensuring the provision of food and other ecosystem services on a sustainable basis;
- reduce negative externalities such as soil erosion, inorganic agro-chemical pollution, and agricultural greenhouse gas emissions; and
- rebuild or preserve ecological resources, such as soil fertility, forest, water, air and biodiversity, including animal and plant genetic diversity.

To gain political support in developing countries, green agricultural policies must also reduce poverty and deliver wider development objectives. However, this can be difficult to achieve.

This policy brief provides a practical guide to successfully designing and implementing green agricultural policies based on the outcomes of more than 20 projects in 17 countries. The policies explored include payments for environmental services, subsidies and unconditional incentives, community-based natural resource management and training and extension services.

This policy brief highlights the importance of targeting policies at the poorest people and making it easier for them to participate. It finds that local economic, social and cultural factors should be an important consideration when choosing and implementing policies. In particular policy-makers should consider:

- the availability of credit;
- property rights and land ownership arrangements;
- labour market conditions;
- the strength of local institutions and legal context; and
- social and cultural norms.

Implementation of green agricultural policies should be guided by two general rules:

- They should be complemented with policies or initiatives that tackle local market imperfections, such as low availability of credit or limited off-farm opportunities. For example, where deforestation is being tackled by payments for environmental services, which will restrict on-farm labour, there may also need to be labour market policies that create alternative off-farm jobs. This type of policy works best where good information is available about local socio-economic and institutional conditions.

- They should allow participants in green agricultural initiatives to choose appropriate interventions from a menu of options. This makes the best use of their knowledge and enables them to best match the options to their individual circumstances. For example, policies to conserve soil, which can fail to engage poor farmers with insecure land rights, may be more palatable if participants can plant trees along plot boundaries in exchange for carbon sequestration payments - a move that can also help them consolidate their rights on the plot.

Smart and informed policy design can help to ensure that green agricultural policies do not interfere with poverty reduction and exploit potential synergies. Indeed, the projects that were analysed suggest that green agricultural policies can alleviate poverty if some important issues relating to the design and implementation are properly addressed.

1. Introduction

Developing economies tend to have a large agricultural sector, so agricultural policies shape the growth of the wider economy and directly affect most people. For example, agriculture accounts for approximately 20 percent of India's GDP and 50 percent of employment; in Kenya it accounts for 30 percent of GDP and 60 percent of employment; and in Ethiopia it accounts for 45 percent of GDP and 80 percent of employment (World Bank, 2012). Policy-makers in these countries, and particularly developing countries in Africa (Diao, Hazell and Thurlow, 2010), have to be mindful of the impact that achieving environmental objectives through green agricultural policies has on socio-economic wellbeing. For green agricultural policies to succeed they will have to both protect the environment and reduce poverty.[1]

The greening of agriculture, as defined in the Green Economy Report (UNEP 2011), refers to farming practices and technologies that simultaneously:

- maintain and increase farm productivity and profitability while ensuring the provision of food and other ecosystem services on a sustainable basis;
- reduce negative externalities, such as soil erosion, inorganic agro-chemical pollution, and agricultural greenhouse gas emissions; and
- rebuild or preserve ecological resources, such as soil fertility, forest, water, air and biodiversity including animal and plant genetic diversity.

There is a broad range of carbon abatement opportunities in agriculture (Smith et al., 2008), but the sector still plays a marginal role in international efforts to reduce carbon emissions (for example, via certified or voluntary emission reductions in carbon offset markets).

Partly, this is because green agricultural policies can conflict with the fundamentals of poverty-reducing growth in developing countries, such as high labour intensity, migration, urbanisation and shifting economic activity away from agriculture towards manufacturing and other sectors. (e.g. Dercon, 2012). In some circumstances they can even increase poverty, for example if the fiscal burden of the policies is not distributed fairly or if policies lead to job losses that the local

1 The agricultural sector accounts for 14 percent of *global* anthropogenic greenhouse gas emissions, which rises to 30 percent if carbon emissions and sequestration from upstream (fertilisers, deforestation, etc.) and downstream sources (bio-energies, etc.) are taken into account.

labour market cannot absorb in other areas. Whether or not green agricultural policies conflict with poverty reduction largely depends on the context and the policy instrument(s) chosen. However, with smart design, conflicts can usually be overcome.

This policy brief provides a practical guide to successfully designing and implementing green agricultural policies based on the outcomes of more than 20 projects in 17 countries (details of all the projects that have been analysed can be found in the appendix). It shows that greening agriculture and poverty reduction can go hand-in-hand, but it also highlights instances where green agricultural policies have increased poverty. These examples provide important lessons for future policy design and underline the inevitability of trade-offs. The findings also highlight the importance of context in shaping policy instruments and how they are implemented. They also illustrate that a mix of policy instruments can deliver growth, emissions reduction and poverty alleviation.

Section 2 provides an overview of the methodology for the analysis and section 3 describes green agricultural policies and provides more information about the environmental goals they deliver. Section 4 explores how green agricultural programmes can be designed to meet dual environmental and poverty reduction goals and section 5 addresses issues and opportunities associated with implementation.

This policy brief draws on a systematic review of the current evidence of the impact of green agricultural policies on poverty by Lovo, Bezabih and Singer (2014).

2. Methodology

The findings described in this brief are based on a review of the latest relevant literature. However, despite wide coverage and the recent nature of the evaluations, this literature varies in focus, breadth and depth so that a uniform analytical methodology could not be drawn from it. As a result, this review focuses on qualitative analysis of the results of the individual papers.

While great effort was devoted to selecting studies that show rigorous empirical foundations, this policy brief is also based on descriptive analysis of poverty reduction and environmental conservation measures. In-depth empirical evaluations are sparse and some effects, especially relating to landless individuals and broader spill-over effects on non-participants, have not been properly analysed. Rigorous empirical research is needed to expand knowledge of the impact of green policies on non-environmental outcomes and the local economy as a whole.

More details about all of the green agricultural programmes used in this analysis can be found in the appendix.

3. Green agricultural policies and their goals

3.1 Key green agricultural policies

Green agricultural policies include payments for environmental services, unconditional incentives, community-based natural resource management, and training and extension services. A detailed description of each policy can be found in the following paragraphs. Green agricultural programmes often use a combination of these polices.

Payments for environmental services

This approach uses conditional payments for environmental services. The key elements are that payment is conditional and participation is voluntary. Compliance is often monitored by buyers, who can stop paying for environmental services if outcomes are unsatisfactory. Sometimes, payments for environmental services involve explicit contracts between consumers and suppliers. Payments for environmental services can be area-based (targeting a specific vulnerable zone) or product-based (targeting specific more sustainable products such as those that guarantee biodiversity conservation (Wunder, 2005)).

Unconditional incentives

Unconditional incentives, as the name suggests, do not impose conditions about payments for environmental services contracts. They often take the form of direct subsidies, tax exemptions or subsidised credit. Subsidies can include both cash and in-kind payments. These instruments have been extensively used to promote technology adoption and enhance land productivity (for example, Malawi's Agricultural Input Subsidy Programme (AISP)) and more recently to promote sustainable agriculture and preserve rural ecosystems.

Community-based natural resource management

This strategy involves communities becoming responsible for managing natural resources. Recently, it has been recognised that organised civil society can help to internalise externalities and provide natural resources. Participatory resource management can reduce information asymmetries, incentive incompatibility, lack of effective monitoring and maintenance (Adhikari, 2005). The natural resources in question include forests, open woodland or grasslands for livestock grazing, wood supply, medicines and famine foods; farm land for gleaning, grazing after harvest, and crop residues; wildlife for game meat and safari incomes; fish in fresh water lakes; and aquifers, tanks, and irrigation channels for domestic and livestock water supply and irrigation (Adams et al., 2004).

Training and extension services

Training programmes educate farmers to adopt sustainable strategies, make better-informed choices and reduce the impact of agriculture on the environment, usually through community-level courses or targeted extension services.[2] In most cases, sustainable strategies are taught together with other useful practices. In the widespread farmer field school (in place in 78 countries) farmers are helped to develop more general skills, such as analytical skills, critical thinking, and creativity, and learn to make better decisions (Davis et al., 2012).

2 'Extension services' describes a range of support activities that are designed to help farmers improve decision-making and provide them with information on the most recent developments in agricultural inputs, farming techniques and local prices.

3.2 Types of environmental goals set for green agricultural policies

Green agricultural policies aim to deliver at least one of the following environmental goals: carbon sequestration and storage, watershed management, biodiversity conservation and pollution control.

Carbon sequestration and storage

There are three main ways to use agriculture to remove carbon and store it in soil or biomass:

Afforestation and reforestation

Afforestation and reforestation policies establish forest in areas of non-forest land or restock existing forests or woodlands. These encompass REDD (Reducing emissions from deforestation and degradation) programmes.

Minimum or zero tillage

Minimum or zero tillage initiatives improve soil conservation by encouraging farmers to till the soil less intensively, not completely inverting it or leaving part of the soil surface covered with crop residues or plant residue. This helps recapture lost carbon from agricultural soils, conserve moisture and reduce water and wind erosion.

Soil conservation

Soil conservation encompasses various forms of contour farming aimed at slowing down runoffs and creating detention storage. Contour farming can be achieved by aligning plant rows and tillage lines at right angles, by creating earth or stone bunds, or by planting trees and grass.

Watershed management

Watershed management aims to guarantee that watershed resources are distributed sustainably and enhance watershed functions that can affect plants, animals, and human communities. These are particularly important in semi-arid tropics, where the capacity of watersheds to capture water during rainy periods is extremely important for its subsequent use in dry periods. Improving water-holding capacity must be done sustainably by protecting the upper reaches against erosion and so requires measures to conserve soil and reduce grazing and firewood collection in the surrounding areas.

Biodiversity conservation

Biodiversity conservation policies aim to conserve the biological diversity among living organisms and the ecological complexes of which they are part through multi-crop planting or tree and bush planting.

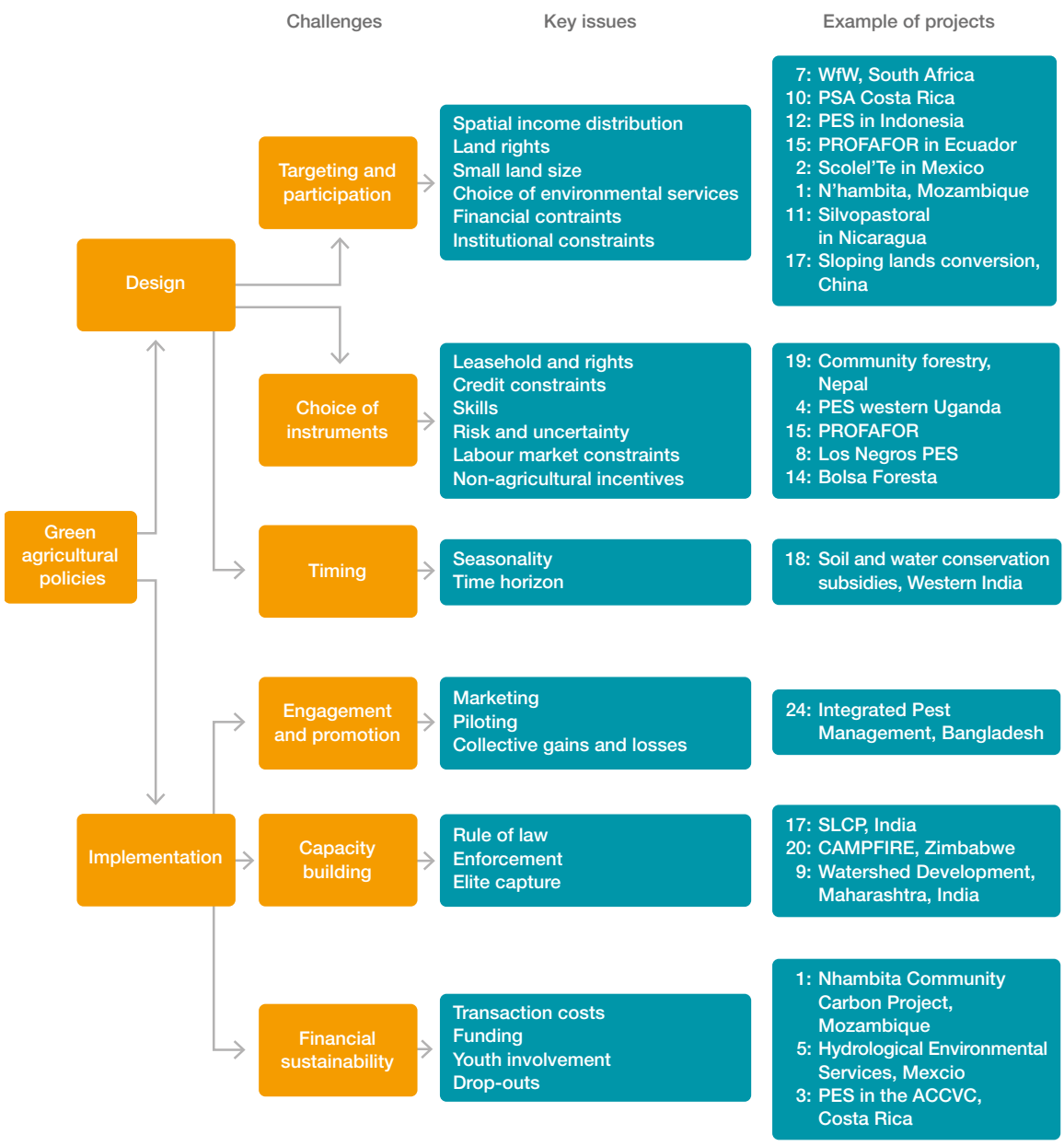
Pollution control

Pollution control policies mainly aim to reduce agricultural by-products that contaminate or degrade the environment and surrounding ecosystem. In many developing countries, governments have promoted the use of pesticides to expand agricultural output per acre and their use has accelerated in the last three decades. Most policies in this area promote sustainable farming practices that prescribe the correct use of pesticides, fertilizers and other agrochemicals or the use of natural parasites and predators to control pest populations.

The choice of policy, or package of policies, is likely to depend on the ability to simultaneously deliver environmental objectives and reduce poverty. Such policies are often described as 'pro-poor'.

How green agricultural policies and programmes are designed and implemented is likely to affect the extent to which they are pro-poor. An overview of the issues and challenges that must be met to achieve pro-poor green agricultural programmes is contained in Figure 1 and described in detail in sections 4 and 5.

Figure 1. Overview of the key factors for the effectiveness of green agricultural policies in reducing poverty



4. Designing green agricultural policies and programmes

The literature shows that smart design is important to help green agricultural policies and programmes meet dual environmental and poverty reduction goals, with three issues particularly important: how policies are targeted, which policies or combination of policy instruments are used and the timing of policy delivery.

4.1 Targeting and participation

Meeting both environmental and socio-economic objectives through green agricultural policies and programmes is challenging.

Pagiola and Platais (2007) argue that for green agricultural policies to work best, they should target areas or communities with the highest potential to produce environmental services. However, these might not be the areas where poor people are located so policies will fail to cut poverty. To benefit the environment and cut poverty at the same time, policies must be targeted at the poorest people and it must be made easier for them to participate in green agricultural programmes. The best example is the South African Working for Water Programme (Project 7) that explicitly targeted the poorest and most vulnerable people. The programme employed about 24,000 previously jobless people (Turpie et al., 2008) at the same time as delivering environmental benefits.

A number of factors are important in ensuring green agricultural policies are targeted effectively.

Spatial income distribution

Poverty is usually greater in areas of high environmental degradation, so it may seem that by targeting these areas with policies such as payments for environmental services, both environmental and poverty reduction aims will be met. However, the income distribution in these areas can be surprisingly varied (Pagiola et al., 2005) and careful targeting is required to ensure that policies benefit those most in need.

Land rights

Land rights are a common enrolment requirement for green agricultural programmes because they give assurances about the legitimacy of local landownership arrangements. However, many small farmers, who are often the poorest, do not hold formal land titles.

Land rights are not necessary for policies to be effective if green agriculture schemes adapt to local agreements about land-ownership arrangements and use these as the basis for participation.

The payments for environmental services programme in Costa Rica (Project 10), for example, abandoned formal land title as a requirement for participation and greatly improved the number of poor people taking part in the programme (Pagiola, 2008). In Indonesia (Project 12), a payment for environmental services programme may even have strengthened previously weak property rights and given local communities a stronger negotiation position against logging companies (Engel and Palmer, 2008).

Small land size

Most green agriculture policy instruments, and especially payments for environmental services, cost more per hectare for farmers with smaller land areas. As a result, some programmes explicitly target large landowners to reduce transaction costs. For example, the PROFAFOR project in Ecuador (Project 15) demands a minimum contract size of 50 hectares (Wunder and Alban, 2008).

One way to overcome high transaction costs is to enable groups of individual farmers with small plots of land to come together under green policy programmes. For example, the Scolel'Te project in Mexico (Project 2) allowed farmers to participate either individually or as part of a community, encouraging households with smaller land holdings to take part. Jindal et al. (2008) find that contracting with groups can reduce the prohibitively high transaction costs associated with small-scale projects in environmental services schemes in Africa.

However, community-based contracts face the challenge of ensuring the benefits are fairly distributed, which requires a fair distribution of power in the community (Corbera et al., 2007). Ostrom (1990) points out that, if this is not the case, then, to achieve a fair and sustainable solution, all stakeholders must be meaningfully involved and customary rights must be recognised and compensated accordingly.

For some green policy initiatives, such as integrated pest management, broad coverage is essential to their success, so providing the flexibility for both groups and individuals to take part is very important (Dasgupta et al., 2007).

Choice of environmental services

Offering a menu of environmental services can help to reach poorer households by allowing them to choose the service best suited to their circumstances. The N'hambita Community Carbon Project (Project 1), for example, allows participants to choose from agroforestry systems such as tree planting, orchards or intercropping. Similarly, the Silvopastoral Ecosystem Management Project in Nicaragua (Project 11) is likely to have had more poor people taking part because they could chose the most cost-effective option from a range of schemes, such as cheap land use changes or more costly fodder banks (Pagiola et al., 2008). However, this might increase transaction costs due to increased monitoring and supervision (Jindal et al., 2012).

Financial constraints

Up-front subsidies can encourage a greater number of poorer households to take part. Such subsidies can be expensive, although this can be addressed by targeting them only at constrained households. None of the projects considered here have tried such an approach. Designing subsidies based on participants' characteristics requires investigation and might be complex and costly. Groom et al. (2010) identify land endowments, education level, household structure, and the institutional environment of recipient households as useful indicators to help identify and target constrained households. The Sloping Lands Conservation Programme in China (Project 17) provides two levels of subsidies, based on regional characteristics, to try to match the needs of different participants. Relating subsidies to specific household characteristics as well could substantially improve the programme's efficiency.

Institutional constraints

Accompanying agricultural policies and programmes with policies that can remove institutional barriers, such as poorly defined property rights or low availability of credit, can help poor people to take part (Groom et al., 2010) without interfering with environmental objectives.

4.2 Choice of instruments

To cut poverty and improve the environment, green agricultural policies and programmes must be sensitive to local economic, social and cultural factors. This often requires complementary non-agricultural policies that solve wider problems, such as limited access to credit and non-farm jobs.

Leasehold and rights

A lack of formal land rights can stop poor households taking part in green agricultural programmes. One way to overcome this is to facilitate the provision of leasehold or private property rights as part of the design and implementation of programmes, as was successfully done in the community forestry programme in Nepal (Project 19) (Adhikari, 2005).

Introducing land rights as part of the design of green agricultural programmes could also challenge local and project-based power relations and hence transform the socio-economic status of small farmers and poor households (Corbera et al., 2007). However, the extent to which this happens in practice depends on power relations within the community. Established networks of power and influence generally govern the equity of the outcome, and social and cultural factors, such as the status of women, are likely to have an influence.

Credit constraints

Liquidity-constrained households are less likely to participate in environmental programmes because the way they provide finance, for example monthly payments of a consistent amount in arrears, fails to match their financial needs. Analysing a payment for environmental services programme in western Uganda (Project 4), for example, Jayachandran (2013) indicates that, while a steady stream of regular payments suits participants who are used to receiving regular incomes from forest products, it is not appropriate when participants need to sell larger amounts of forest products to cover emergency costs or make large investments.

Complementing conditional payments in arrears (i.e. as part of a 'payments for environmental services' programme) with better access to credit would help to involve more liquidity-constrained households. Alternatively, cash-strapped households could be offered some upfront payments so that they have reserves available in case of emergency.

Skills

Green agricultural programmes should be accompanied by training schemes and provide technical assistance to improve skills and earning capacity for those taking part. For instance, the Pimampiro payment for ecosystem services project (Project 6) and PROFAFOR (Project 15) schemes have been relatively successful in reaching their environmental objectives and improving recipients' welfare by offering training in forest management (Wunder and Alban, 2008). A programme in Los Negros, Bolivia (Project 8), offered a package of beehives and apicultural training because many participants had no experience of beekeeping (Asquith et al., 2008). Such training can help poor households to retain the full benefits of sustainable practices.

Risk and uncertainty

Because risk and uncertainty are also major barriers to adopting improved agricultural practices, payments could be combined with other group schemes, such as insurance, to help farmers share risk (Graff-Zivin and Lipper, 2008). This can stimulate agricultural development and cut poverty. However, none of the projects considered here provide insurance schemes for participants.

Labour market constraints

Finally, implementing labour-saving green measures, common in afforestation projects, might require separate interventions, such as job and skills training or migration incentives, to make it easier for people to obtain jobs elsewhere and to switch permanently to off-farm activities (Groom et al., 2010).

Non-agricultural incentives

Green policies can combine various incentives and conditions that could help reduce poverty. The Bolsa Floresta in Brazil (Project 14) rewards families' commitment to stop deforestation by paying those that enrol their children in school, sign a zero deforestation commitment and attend a two-day training programme on environmental awareness.

4.3 Timing

The timing of policy implementation and of payments, subsidies and training courses is crucial for the success of any pro-poor programme since poor farmers are more likely to be labour- and/or capital-constrained. The timing of a training course, for example, is among the most important conditions for its success (Feder et al., 2004).

Seasonality

Subsistence agriculture offers few income opportunities and poor farmers often have to seek off-farm work during the dry season. As Smith et al. (1998) suggest, based on projects across western India (Project 18), this spare labour capacity makes the dry season the opportune time for conservation work. Failing to provide farmers with the right incentives at this time of the year will prevent them from participating. In addition, courses should be synchronised with farmers' seasonal needs to ensure they receive useful information (for example, about traditional seed varieties in time for the planting season). Seasonal needs vary across countries but also across agro-climatic zones within a country or region. Therefore these needs should be investigated before the programme is implemented.

Time horizon

Pagiola and Platais (2007) argue that 'payments for environmental services' programmes should generally be on-going rather than finite unless the new recommended practices will happen anyway because they are more profitable than current practices.

5. Implementing green agricultural policies and programmes

Engaging with the communities affected by green agricultural policies and programmes is particularly important, as is building the capacity of local institutions to oversee projects and ensuring long-term financial sustainability.

5.1 Engagement and promotion

Engagement is a key part of scaling-up green agricultural programmes over time. The challenge is to involve more poor households and stop them dropping out.

Marketing

Poor households often lack access to resources and information, so extra effort is needed to get and keep them involved in green agricultural programmes. Sometimes programme designs do not take into account socio-cultural and economic agro-ecological settings, and participants are not properly consulted. Participatory approaches are likely to lead to better and more sustainable implementation (Axin 1988; Braun, Thiele, and Fernandez, 2000).

Piloting

Some schemes, like 'payments for environmental services', are likely to be more successful if a pilot is run prior to full implementation. Running a pilot allows programme administrators to understand how contractual arrangements will work and to identify any unforeseen impacts. It also gives participants insights into how they will be affected. Pilot studies should follow the guidelines for policy analysis (for example, by randomising participation) to obtain a correct preliminary assessment of the project.

Collective gains and losses

Strategies to encourage participation should emphasise the collective gains (or losses) from adopting (or not adopting) particular sustainable practices (Dasgupta et al., 2007) to promote co-operation among farmers and introduce some degree of moral pressure. An Integrated Pest Management programme in Bangladesh (Project 24) shows that while it brings substantial health and ecological benefits, if neighbours continue to rely on chemical pesticides, they will also kill helpful parasites and predators, and expose adopting farmers and local ecosystems to chemical spillovers from adjoining fields.

5.2 Capacity building

Many developing countries have weak institutions, both structurally and technically. Rule of law, enforcement and the prevention of elite capture are important in these settings. Designers of green agricultural polices and programmes also need to take into account capacity limitations.

Rule of law

Establishing a sound legal framework that secures contractual agreements and ensures the collection of payments or fees is crucial to involve more people and to distribute the benefits fairly, particularly amongst the poorest and least influential members of the society. Programmes might benefit only the wealthy and powerful, even when they are specifically targeted at poor and marginalised people, due to lack of legal knowledge and weak implementation (Deininger et al., 2008).

Enforcement

Alongside a sound legal framework, there must be appropriate enforcement otherwise the benefits of a programme are unlikely to be fairly spread. For example, Zheng et al. (2011) observe that participants in the Chinese Sloping Lands Conservation Programme (Project 17) were not fully paid, which reduced the number of subsequent land conversions. Similarly, in the Campfire initiative in Zimbabwe (Project 20), district authorities retained benefits that should have been passed on to local communities.

Elite capture

Capacity-building for community organisations and governments can also help reduce the scope for elite capture at the expense of the poor, particularly when land rights are insecure or informal and customary rules exclude certain members of the society from accessing economic opportunities. The Watershed Development project (Project 9), which sought to prevent soil erosion in Maharashtra, India, initially negatively impacted women because it limited the use of the communal lands from which they derived much of their livelihoods. Ensuring that women were represented in the organisations overseeing the project was crucial to achieve both environmental and poverty alleviation objectives (Kerr, 2002).

5.3 Financial sustainability

Financial sustainability is important for successful green agricultural programmes. It should be assessed before implementation and there should be an ongoing evaluation of transaction costs, stability of funding and dropout rate.

Transaction costs

Transaction costs in green agricultural policies and programmes emerge when they are set up (design or negotiation costs) and implemented (administration, monitoring or sanctioning costs). Reducing transaction costs is a major challenge for most programmes given the risks associated with under-spending for important activities such as monitoring (Wunder et al., 2008). The level of transaction costs depends highly on how effectively programmes are targeted. Reaching individual farmers is likely to be costly, reducing the already-low returns to soil conservation. High transaction costs prevent poorer farmers with less land taking part in green agricultural programmes, as shown in Nicaragua (Project 11, Pagiola et al., 2008) and Colombia (Project 13, Rios and Pagiola, 2010) where small farmers are excluded.

Group-based schemes may be more effective in limiting costs (Jindal et al., 2012). As proposed in the N'hambita Community Carbon Project (Project 1), combining carbon sequestration for individual plots with payments for community forests helps reduce transaction costs relative to overall project benefits. Wunder et al. (2008) find that green interventions tend to be more effective and efficient when they are user-financed, for example when downstream water users pay for upstream watershed services, (such as the Pampiro (Project 6), Los Negros (Project 8) and PROFAFOR (Project 15) programmes) instead of governments (such as the SLCP (Project 17) and CAMPFIRE (Project 20)). User-financed projects tend to be more closely tailored to local conditions and needs, have better monitoring and demonstrate greater willingness to enforce conditionality.

Stability of funding

Swallow and Goddard (2013) emphasise the importance of stable and sustained funding for programmes to be successful. This is not always guaranteed, especially if the programme is connected to carbon offset markets.

In the case of watershed management projects, funding is likely to be more stable if those delivering the project, usually farmers, receive the payments directly from those who benefit (i.e. water consumers). This was done successfully in the Payment for Hydrological Environmental Services project in Mexico (Project 5) where farmers were paid via a levy on consumer water fees.

Youth involvement

Involving children and young people in programmes can help their long-term durability (Miranda et al., 2003). Today's children will grow up to form the civil society of the future and will eventually decide how resources should be managed. The Área de Conservación Cordillera Volcánica Central (ACCVC) project in Costa Rica (Project 3) encourages forest protection by providing environmental education and fairs for children in public areas and gardens, as well as promoting sustainable agricultural methods.

Drops-outs

During the early stages of programme design the potential yield losses should be assessed, in particular when proposed projects require farmers to commit to long-term contracts. Any perceived welfare loss by the households is likely to result in them resisting or withdrawing from the project (Hegde and Bull, 2011).

6. Conclusions and research gaps

Green agricultural policies can be designed in a way that minimises adverse poverty effects or exploits synergies. In many developing countries, making green policies compatible with wider development and growth objectives is essential for political support.

This policy brief discusses the key challenges of designing and implementing green agricultural initiatives that cut poverty and benefit the environment, and makes recommendations to address them. It highlights that it is essential to target policies at the poorest people and make it easier for them to take part. It finds that local economic, social and cultural factors should be an important consideration when choosing which policies to use and how to implement them. In particular policy-makers should consider:

- the availability of credit;
- property rights and land ownership arrangements;
- labour market conditions;
- the strength of local institutions and legal context; and
- social and cultural norms.

Implementation of green agricultural policies should be guided by two general rules:

- Complement green agricultural policies with measures that tackle local market imperfections, such as low availability of credit or limited off-farm opportunities. For example, where deforestation is an issue it may be prudent to complement a 'payment for environmental services' policy, which will restrict on-farm labour, with labour market policies that create other non-farm jobs. This type of policy works best where there is good information about local socio-economic and institutional conditions.

- Allow participants in green agricultural initiatives to choose appropriate interventions from a menu of options. This makes the best use of their knowledge and enables them to best match their individual circumstances. For example, soil-conservation policies, which can fail to engage poor farmers who have insecure land rights, may succeed if participants can choose to plant trees along plot boundaries, in exchange for carbon sequestration payments, which can also help them consolidate their rights on the plot.

With smart and informed policy design, adverse impacts of green agricultural policies on efforts to reduce poverty can be greatly reduced and potential synergies exploited. Indeed, the analysed projects suggest that green agricultural policies can also reduce poverty, but only if some design and implementation issues are properly addressed.

There is an urgent need to examine the sustainability and scalability of green agricultural policies and programmes. For instance, 'payment for environmental services' schemes where there is a willing buyer and a willing provider of environmental services, are likely to be more sustainable, since there is no dependence on grant finance or subsidies beyond the set-up stage. Similarly, in poverty-environment interventions where there are highly localised implementation constraints, institutional failures and political economy issues, it can be difficult to exploit the economies of scale of interventions.

Table A1: Projects and evaluations by goal and instrument						
	Policy, project and evaluation	Main environmental goal/impact				Socio-economic impacts
		Carbon sequestration	Watershed management	Biodiversity conservation	Pollution control	
Payment for environmental services (PES)						
1	**N'hambita Community Carbon Project, Mozambique** 1) Jindal et al. (2012) 2) Palmer and Silber (2012) 3) Hegde and Bull (2011)	Afforestation and reduced deforestation	–	–	–	Positive but small effect on participating households' livelihood through additional income
2	**Scolel Te, Mexico** 1) De Jong et al. (2007) 2) Soto-Pinto et al. (2010) 3) Corbera et al. (2007)	Afforestation and reduced deforestation	–	–	–	Communal ownership led to equitable outcomes, but only if power distributed equally within community
3	**PES in the The Área de Conservación Cordillera Volcánica Central (ACCVC), Costa Rica** Miranda et al. (2003)	Afforestation and reduced deforestation	Through forestry	–	–	Limited impact on poor people as participants were wealthy
4	**PES in western Uganda** 1) Jayachandran (2013)	Afforestation and reduced deforestation	–	Multiple tree species	–	Credit constrained households less likely to participate
5	**Payment for Hydrological Environmental Services, Mexico** 1) Muñoz-Piña et al. (2008) 2) Alix-Garcia et al. (2010) 3) Garcia-Amado et al. (2011)	–	Through forestry	–	–	Income of poor people increased, except the poorest

Table A1: Projects and evaluations by goal and instrument

	Policy, project and evaluation	Main environmental goal/impact				Socio-economic impacts
		Carbon sequestration	Watershed management	Biodiversity conservation	Pollution control	
6	**Pimampiro municipal watershed-protection scheme, Ecuador** 1) Wunder and Alban (2008)	–	Through forestry	–	–	Higher incomes, but very small landowners did not participate
7	**Working for Water (WfW) programme, South Africa** 1) Turpie et al. (2008)	–	Through removal of alien plants	–	–	Positive impacts on income and employment of the poorest and landless people
8	**Los Negros PES programme, Bolivia** 1) Asquith et al. (2008)	–	Through forestry	No land-clearing or hunting	–	More diversified income from beehives and training
9	**Watershed Development in Maharashtra, India** 1) Kerr (2002)	–	Through water harvesting structures and soil conservation	–	–	Positive impact on landholders, but landless women suffered from restrictions on common land
10	**Pago por Servicios Ambientales (PSA) programme, Costa Rica** 1) Pagiola (2008) 2) Zbinden and Lee (2005) 3) Arriagada et al. (2009) 4) Pfaff et al. (2007)	Afforestation, reduced deforestation, soil conservation	Through forestry	Forest conservation in biodiversity priority areas	–	Positive, since poor live on environmentally targeted land - abandoning land titles improved participation of poor people
11	**Silvopastoral Ecosystem Management Project, Nicaragua** 1) Pagiola et al. (2007) 2) Pagiola et al. (2008)	Afforestation, reduced deforestation, soil conservation	–	Vegetation diversity	–	Transaction costs disadvantaged poor people, as a smaller land area was contracted

Table A1: Projects and evaluations by goal and instrument						
	Policy, project and evaluation	**Main environmental goal/impact**				**Socio-economic impacts**
		Carbon sequestration	Watershed management	Biodiversity conservation	Pollution control	
12	**PES in Indonesia** 1) Engel and Palmer (2008)	Afforestation, reduced deforestation, soil conservation	–	Vegetation diversity	–	Unknown – PES may have secured property rights by increasing land value
13	**Silvopastoral Ecosystem Management Project, Colombia** 1) Rios and Pagiola (2010)	Afforestation, reduced deforestation, soil conservation	–	Vegetation diversity	–	Positive income effect due to participation of poor people, but disadvantaged by transaction costs
14	**Bolsa Floresta Program, Brasil** 1) Lima (2011)	Afforestation, reduced deforestation, soil conservation	–	Vegetation diversity	–	Increased schooling due to conditionality of the programme
Unconditional incentives						
15	**PROFAFOR, Ecuador** 1) Wunder and Alban (2008)	Afforestation	–	–	–	Higher incomes, but very small landowners could not participate
16	**Programa Agricultura de Baixo Carbono (ABC), Brazil** 1) IPAM (2004)	Afforestation, no-tillage, soil conservation, NO_2-free fertilizers	–	–	–	Unknown – institutional barriers to participation

Table A1: Projects and evaluations by goal and instrument						
	Policy, project and evaluation	**Main environmental goal/impact**				**Socio-economic impacts**
		Carbon sequestration	Watershed management	Biodiversity conservation	Pollution control	
17	**Sloping lands conversion programme, China (Also PES)** 1) Groom and Palmer (2012) 2) Xu et al. (2004) 3) Uchida et al. (2007) 4) Uchida et al. (2009) 5) Groom et al. (2010) 6) Zheng et al. (2011)	–	Through afforestation and soil conservation	–	–	Targeted area populated by poorer household increased participation by poor people – significant and beneficial increase in off-farm employment, but constraints on migration
18	**Soil and water conservation subsidies, western India** 1) Smith et al. (1998)	Soil conservation	Afforestation, irrigation systems	–	–	Positive impact, but may have increased dependency on government – poor environmental outcomes
Community based natural resource management						
19	**Community forestry, Nepal** 1) Adhikari (2005)					Community-based management may have disadvantaged poor people as relatively more dependent on resource
20	**CAMPFIRE wildlife programme, Zimbabwe** 1) Frost and Bond (2008)	–	–	Conservation of wildlife	–	Moderate impacts but district authorities retained resource benefits from local authorities, disadvantaging poor people

Table A1: Projects and evaluations by goal and instrument						
	Policy, project and evaluation	**Main environmental goal/impact**				**Socio-economic impacts**
		Carbon sequestration	Watershed management	Biodiversity conservation	Pollution control	
21	**Noel Kempff Mercado Climate Action Project, Bolivia** 1) Robertson and Wunder (2005) 2) Asquith et al. (2002)	Afforestation and reduced deforestation	–	Vegetation diversity	–	Positive impact on livelihoods, but disrespecting communal law may have disadvantaged less powerful members
22	**Community seed banking, Ethiopia** 1) Bezabih (2008)	–	–	Crop biodiversity	–	Significant productivity increase, but less for households headed by women
Training and extension services						
23	**Farmer field schools, Various countries** 1) Van den Berg and Jiggins (2007) (Asia) 2) Feder et al. (2004) (Indonesia) 3) Davis et al. (2012) (East Africa)	–	–	–	Ecological pest management	Poverty reduction due to productivity increases
24	**Integrated Pest Management, Bangladesh** 1) Dasgupta et al. (2007)	–	–	–	Ecological pest management	Mixed evidence. Poverty alleviation due to cost reductions, but depended on spillover effects

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