

Part I

PAYING FARMERS
FOR ENVIRONMENTAL
SERVICES

Part I





1. Introduction and overview

Ecosystems sustain human life. They supply food and drinking water, maintain a stock of continuously evolving genetic resources, preserve and regenerate soils, fix nitrogen and carbon, recycle nutrients, control floods, filter pollutants, pollinate crops and much more. Despite their importance to human well-being, many of these services are under threat throughout the world.

Agricultural ecosystems are by far the largest managed ecosystems in the world. Of the total land area of about 13 billion hectares, crops and pasture occupy almost 5 billion hectares. Forests and woodlands add another 4 billion hectares. Inland, coastal and marine fisheries ecosystems also generate crucial services for humans.

Today, the provision of ecosystem services generally, and agriculture-based services in particular, is being challenged as never before by the combined effects of expanding populations, rapid economic growth and greater global integration. Agriculture is being asked to provide an ever-growing supply of ecosystem-based goods and services.¹ The world's population is expected to increase by 50 percent between 2000 and 2050, with the developing countries home to almost all of that growth. Analyses indicate that there is likely to be sufficient overall food production at the global level to meet expected increases in effective demand, although such analyses have not yet incorporated the recent surge in

demand for biofuels. About 80 percent of the increase in land-based agricultural production is expected to derive from increased input use and improved technology on existing agricultural land, while area expansion in parts of South America and sub-Saharan Africa is expected to account for the remaining 20 percent (FAO, 2003a). Both sources of increased production can exacerbate damage to land-based ecosystems. Expansion in environmentally fragile areas is especially harmful to biodiversity. Poorly managed intensification can result in soil erosion pressure on water supplies, rising nitrate levels in ground- and surface water, salinization, and growing air and water pollution from livestock wastes. Coastal and marine ecosystems are also under pressure.

In response, the search for ways to enhance ecosystem services is gaining attention from policy-makers as well as non-governmental and private decision-makers. This search provides the motivation for this report. The chapters that follow examine the incentives farmers face when making choices that affect the provision of ecosystem services and focus particularly on a mechanism that has generated growing interest in recent years – direct payments to farmers to enhance the delivery of selected ecosystem services.

Agriculture's role in the provision of ecosystem services depends critically on the incentives available to farmers. Such incentives currently tend to favour the provision of conventional outputs such as food and fibre over that of other services that are generally produced jointly with them, in varying degrees, such as water

¹ The term "agriculture" is used to include the production of crops, livestock, fish, and forest products, and the term "farmer" to include all producers of agricultural products.

filtration and climate regulation. Incentives can be influenced by policies; it is the goal of this report to shed light on policy measures that can modify the incentives available to farmers to induce them to provide a mix of ecosystem services that better addresses society's changing needs.

Of the myriad of ecosystem services, this report concentrates primarily on three that have attracted the most interest in payment programmes to date: climate change mitigation, enhanced water quality and quantity, and biodiversity preservation.

Ecosystem services and agriculture

Healthy ecosystems provide a variety of critical goods and services that contribute, directly or indirectly, to human well-being. Ecosystem services are created by the interactions of living organisms, including humans, with their environment. These services provide the conditions and processes that sustain human life. A specific landscape might provide a range of ecosystem services. A forest at the top of a watershed not only provides timber but also facilitates or enhances soil retention and water quality (filtering contaminants from the water as it flows through roots and soil), flood control (regulating the movement of water through the watershed), pollination (provided by the pollinators inhabiting the edge of the forest), carbon sequestration (in the form of additional biomass), biodiversity conservation (including the forest habitat and the wide range of species it harbours) and landscape aesthetics.

While ecosystem services can be categorized in any number of ways, the most common approach is the one employed by the recent Millennium Ecosystem Assessment.² The Assessment classified ecosystem services into four broad categories, namely provisioning services, regulating services, cultural services and

supporting services (Figure 1). Biodiversity, while not classified under any of the four categories, plays an important overarching role in the provision of ecosystem services. For example, biodiversity is directly related to food production, the maintenance of genetic resources and the aesthetic value of a landscape, and changes in biodiversity have direct implications for the production of all ecosystem services.

Of the 24 provisioning, regulating and cultural services examined by the Millennium Ecosystem Assessment, 15 were identified as being degraded or used unsustainably (Millennium Ecosystem Assessment, 2005a). Only four services were identified as having been enhanced over the past 50 years, and three of those (crops, livestock and aquaculture) were related to food production. In the report's words (p. 1):

Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber and fuel.

...

The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people.

...

The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals.

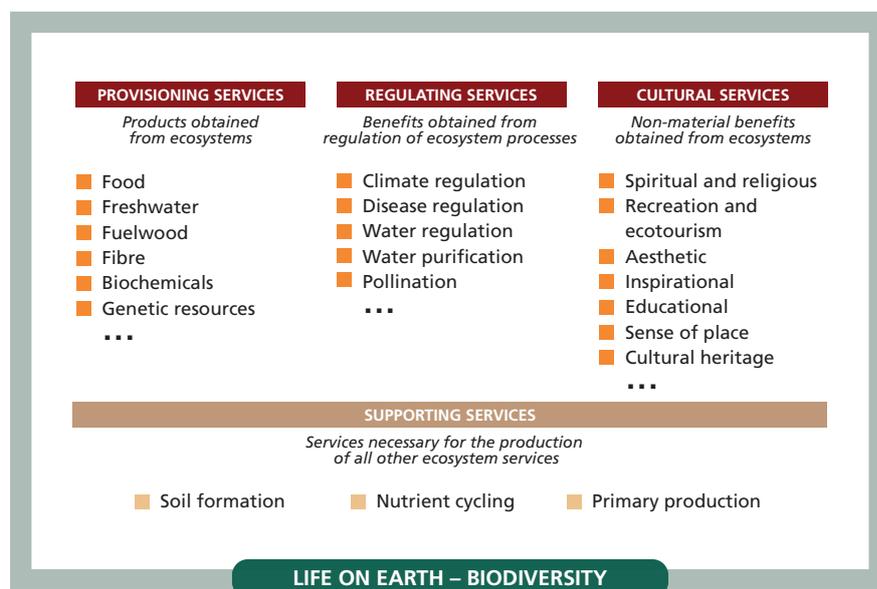
In essence, human ingenuity applied to the production of food and other commodities has allowed production to keep pace with population growth and income-driven demand, but at the cost of considerable degradation of other ecosystem services.

The role of farmers

Ecosystems and ecosystem services can be considered as nature's equivalent to produced capital stocks (e.g. roads, buildings,

² The Millennium Ecosystem Assessment was called for by the United Nations Secretary-General Kofi Annan in 2000 and undertaken during the period 2001–05, drawing on the contributions of more than 1300 authors and reviewers worldwide. Its objective was to assess the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being.

FIGURE 1
Ecosystem services categories



Source: Adapted from *Ecosystems and human well-being: a framework for assessment* by the Millennium Ecosystem Assessment. Copyright © 2003 World Resources Institute. Reproduced by permission of Island Press, Washington, DC.

machinery) and the services deriving from these stocks. In most regions of the world, per capita income is rising, but this trend has often been accompanied by the drawing down of natural capital stocks, thereby jeopardizing the future provision of ecosystem services. Furthermore, many of the world's poorest people live in marginal ecosystems and depend on ecosystem services for their food and livelihoods. If poverty is to be reduced, ways must be found to enable these people to increase their productivity and that of the natural resources they depend on.

Degradation of ecosystems differs from depreciation of produced capital in several important ways. The key difference, and the most important source of ecosystem degradation, is the perception that many of nature's services are free – in the sense that no one owns them or is rewarded for them. Examples include carbon storage, flood control, clean water provision, habitat provision and biodiversity conservation. While these services have great value to society, individuals have little incentive to protect them. In addition, subsidies that explicitly encourage the production of

marketed goods at the expense of other ecosystem services can cause ecosystem degradation.

Farmers constitute the largest group of natural resource managers on Earth. They both depend on and generate a wide array of ecosystem services. Their actions can enhance and degrade ecosystems. Thus, understanding what drives their decisions is critical in designing new strategies that enhance ecosystem services and contribute to sustainable growth.

Farmers derive most of their agricultural income from the food and fibre they produce. In producing these goods, however, they may also generate other impacts – positive or negative – on ecosystem services. Positive effects could include the preservation of scenic rural landscapes or ensuring groundwater recharge; negative effects could include the runoff of harmful nitrates from cropland to downstream catchments or soil erosion from overgrazed hillsides. Whether positive or negative, these impacts are not typically reflected in farmers' incomes; therefore their provision is not a key consideration in most farmers' choices. Such impacts, in economists' terms,

BOX 1

Ecosystem services, environmental services and externalities

The report uses the Millennium Ecosystem Assessment (2003, p. 3) definition of ecosystem services as “the benefits people obtain from ecosystems”. Ecosystem services include all outputs from agricultural activities, including outputs as diverse as food production and climate regulation.

Outputs such as food are generally produced intentionally for sale or direct consumption, and buyers or consumers can influence the production of these outputs through the prices they are willing to pay for them. Many other ecosystem services, however, are provided only as “externalities”, in that they are unintended consequences of the primary activity (e.g. food production), and the individuals who are affected by these consequences cannot influence their production. Externalities typically involve “off-site” impacts that affect others, in contrast to “on-site” impacts felt directly by farmers. Externalities can be either

positive or negative, according to the perspective of those affected by them.

This report examines the incentives available to farmers when deciding what mix of outputs to produce and how to produce them. It focuses on the use of payments to providers of ecosystem services from beneficiaries of those services as a way of reducing negative externalities and enhancing the provision of positive externalities.

The term “ecosystem services” is sometimes used interchangeably with the term “environmental services”. In this report, the term environmental services is used to refer specifically to the subset of ecosystem services characterized by externalities. Programmes to implement payments for these services are variously referred to as payment for ecosystem services programmes, payment for environmental services programmes, or simply PES programmes.

are described as “externalities”. In this report, the subset of ecosystem services characterized by externalities are referred to as “environmental services” (Box 1; see also Swallow *et al.*, 2007a). It is precisely because markets typically fail to reflect their value that this report focuses on environmental services.

As demand for food and fibre increases, fuelled by growing populations, rising incomes and global integration, the magnitude of these effects on environmental services also increases. A key question, therefore, concerns how society can motivate farmers to reduce negative side-effects while continuing to meet the increasing demand for agricultural produce. Whether payments are an appropriate tool in this context depends partly on who holds the rights to the services in question. In the case of negative side-effects from industrial production, it is generally accepted that the polluter should pay; in the case of agriculture, this has not historically been

the case. The difference may stem from the relative difficulty of identifying the source or magnitude of negative side-effects, historical precedent or equity considerations. Regardless, the distinction becomes blurred where agricultural production occurs on a large and concentrated scale, as in the case of large concentrated livestock operations, and in fact such operations are increasingly treated more like industrial “point sources” (see p. 22) of pollution (Ribaud, 2006). The focus in this report is on payments to smaller farmers whom society has historically, at least in practice, allowed to use resources in ways that may have adverse environmental impacts.

But the issue extends beyond reducing negative effects from agriculture. Could it also be effective to pay farmers to change their agricultural practices to address environmental problems generated in other sectors of the economy? The growth in effective demand and emergence of market institutions for ecosystem services

such as carbon sequestration or biodiversity conservation may create new income-generating opportunities for farmers in the short term as well as longer-term productivity benefits.

Either way, altering agricultural production systems to enhance the provision of hitherto uncompensated environmental services may entail costs in terms of agricultural productivity growth and local food security. Understanding whether trade-offs exist and, if so, what is at stake, is crucial in designing effective interventions to enhance environmental services.

Payments for environmental services

The concept behind payments for environmental services is straightforward. Because producers of environmental services are not usually compensated for providing them, they tend to be undersupplied or are not supplied at all. Payment for environmental services (PES) programmes are an effort to “get the incentives right” by sending accurate signals to both providers and users that reflect the real social, environmental and economic benefits that environmental services deliver.

It is important to emphasize that payments are only one of the potential tools for increasing the provision of environmental services. Others include information provision, policy reforms to reduce market distortions, command-and-control regulations and taxation. Assessing the potential of PES programmes to improve the environmental and economic benefits from agricultural ecosystems, identifying the circumstances where these benefits are most likely to be obtained, defining key challenges for designing efficient programmes, and evaluating the implications for poverty reduction are the key issues addressed in this report.

For the purposes of this report, PES transactions refer to voluntary transactions where a service provider is paid by, or on behalf of, service beneficiaries for agricultural land, forest, coastal or marine management practices that are expected to result in continued or improved service

provision beyond what would have been provided without the payment. The payment may be monetary or in some other form. PES transactions can involve a wide range of parties – including farmers, communities, taxpayers, consumers, corporations and governments – across a wide range of transaction types – from direct payments between downstream beneficiaries and upstream providers to consumers paying for a cup of “shade-grown” coffee beans produced on the other side of the world.

This definition of payments for environmental services is considerably broader than that used by some practitioners, who focus on direct voluntary payments by service users to service providers (Pagiola and Platais, 2007; Wunder, 2005). This broader definition, in contrast, also includes payments by governments to service providers on behalf of society (which may include some members who benefit from a particular environmental service as well as others who do not), together with other tools. Both broader and narrower definitions recognize the importance of financial incentives in influencing farmers’ decisions concerning production practices that affect the provision of environmental services. An important difference between the two is that more narrowly defined PES transactions can be sustained if, and only if, private demand supports them, while other approaches (such as government payment programmes) depend in part on political criteria. The two definitions can have significantly different implications for sustainability, efficiency and equity.

While the concept of payments for environmental services is fairly simple, their implementation can be challenging. Many of these services arise from complex processes, making it difficult to determine which actions affect their provision, to identify precisely who the providers and beneficiaries are and to agree on who holds the rights to enjoy those services. Beneficiaries not used to paying for a service might show resistance to doing so. Suppliers may need to adopt novel practices with some degree of uncertainty. Key challenges in implementing a PES approach include creating a mechanism for valuing (or at least measuring) a service

where none currently exists, identifying how additional amounts of that service can be provided most cost-effectively, deciding which farmers to compensate for providing more of the service and determining how much to pay them.

The report closely examines this policy instrument in terms of its possible role in managing agriculture in such a way as to meet current agricultural and environmental demands and its potential to contribute to poverty alleviation. Although the PES approach is not yet implemented widely in developing countries, important lessons can be learned from the experiences to date in developed countries and some developing countries.

Current experience with payments for environmental services

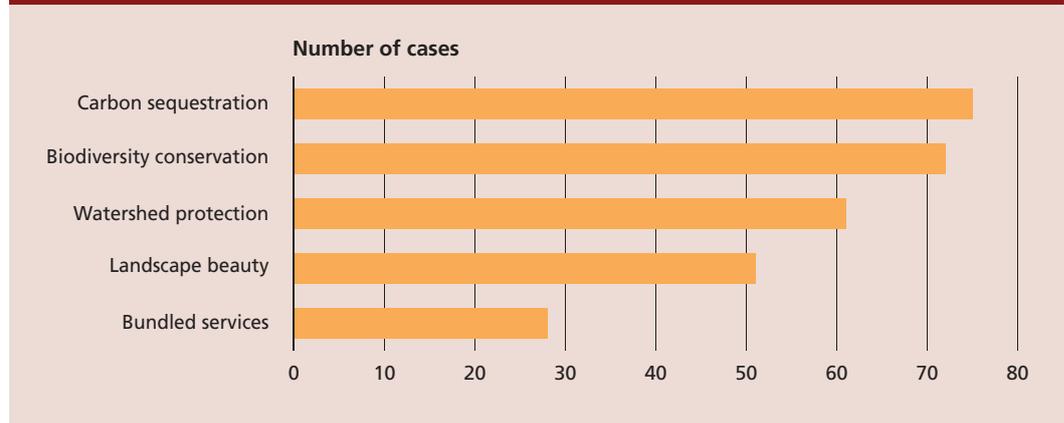
PES initiatives currently in operation have two main origins: agricultural policy in Organisation for Economic Co-operation and Development (OECD) countries, dating from the 1980s, and forest conservation initiatives in Latin America, which began in the 1990s (FAO, 2007a).

PES programmes implemented in OECD countries represent a response to environmental degradation resulting from intensive farming practices (Regouin, 2003). For example, the Conservation Reserve Program (CRP) in the United States of America was introduced in 1985 with the

aim of preventing soil erosion in cropland (see Box 5 on p. 38). Landowners enrolling in the voluntary programme receive annual rental payments in exchange for retiring their farmland from crop production for 10 to 15 years. Similarly, in the United Kingdom, through the Environmentally Sensitive Areas Scheme created in 1987, farmers in eligible areas receive direct payments as compensation for adopting less intensive farming practices that conserve landscape and wildlife values. Generally, agri-environmental payments in OECD countries are designed to compensate farmers for forgoing more intensive and more profitable farming practices. Environmental cross-compliance is also an important tool used in many OECD countries to leverage compliance with existing environmental legislation.

The first PES programmes implemented in developing countries formed part of forest conservation initiatives in Latin America, following the limited success of the traditional regulatory approach that emphasized protected areas (Landell-Mills and Porras, 2002). One of the most notable programmes, initiated in Costa Rica in 1996 (FAO, 2002a; FONAFIFO, 2005; Pagiola, 2002; Rosa *et al.*, 2003), was designed to enhance various forest environmental services (carbon sequestration, hydrological services, biodiversity conservation and provision of scenic beauty) through compensation payments to land and forest owners in exchange for multiyear contracts for reforestation, sustainable forest management

FIGURE 2
PES programmes in the forest sector: breakdown by service



Source: Landell-Mills and Porras, 2002.

and forest protection. The main sources of financing for this programme have been proceeds from a fossil fuel sales tax, revenues from hydroelectric companies, loans from the World Bank and grants from the Global Environment Facility (GEF). Mexico, also, has recently initiated a national PES programme for forest-based environmental services.

The growing role of the PES approaches today reflects underlying changes in environmental policy and the private sector worldwide. "From a situation dominated by centralized regulatory approaches to environmental governance, there is now a greater emphasis on decentralization, flexible mechanisms, the private sector as a provider of public services, corporate self-regulation, consumer sovereignty, and civil regulation. Greater flexibility opens opportunities for PES mechanisms, with both the public and the private sectors taking advantage of this flexibility" (B. Swallow, personal communication, 2007).

Hundreds of PES schemes are now being implemented, in both developing and developed countries, primarily for forest-based environmental services. A global review conducted by Landell-Mills and Porras (2002) examined 287 cases of market-based initiatives in the forest sector. Figure 2 shows the breakdown of these cases by service.

To date, relatively few PES programmes have targeted farmers and agricultural lands in developing countries. Of those that have, one of the most prominent is China's Grain for Green programme, initiated in 1999 by the central government to address concerns about erosion, water retention and flooding (see Box 17 on p. 83). The goal is to convert 14.67 million hectares of cropland to forest by 2010. Farmers are paid to plant forests on sloping and degraded lands (Bennett and Xu, 2005).

There have also been relatively few examples of private payment mechanisms for the provision of environmental services in agriculture. One is the Scolel Té project in Chiapas, Mexico, in which farmers and rural communities are paid by private individuals and firms for voluntary carbon emission offsets, generated by the adoption of agroforestry practices (Tipper, 2002). Other examples include ecolabelling schemes such as the SalvaNATURA certification for shade-grown coffee from El Salvador.

Implications for poverty

There are considerable expectations about the potential for PES programmes to contribute to poverty reduction as well as improved environmental management, based largely on the perceived links between the two. Where poverty is associated with environmental degradation, paying poor producers to adopt production systems that are more environmentally friendly is likely to generate a "win-win" outcome, with both poverty reduction and environmental benefits obtained. However, such a positive outcome is not the only potential impact of PES programmes on the poor. Indirect effects on agricultural wages and food prices might adversely affect poor labourers and consumers. Increased land values following the implementation of PES programmes could create greater competition for lands to which the poor have, at best, only an informal right of access, with a resultant loss of control to more powerful interests. Even among groups of the poor, PES programmes may favour some more than others, with implications for overall poverty reduction as well as the welfare of certain segments of poor populations.

The impact of a PES approach on the poor is highly dependent on who holds the rights to use resources; this, in turn, depends on the distribution of land ownership. In some countries, land ownership is highly skewed; in others it is not. A more even distribution is likely to result in more of the benefits accruing to the poor.

Main messages from the report

The following chapters review the issues introduced above in greater detail.

Chapter 2 provides an overview of the technical relationship between agriculture and environmental services and discusses how agriculture can increase its supply of environmental services. Chapter 3 discusses the basis of the demand for environmental services, the differences between public- and private-sector programmes and the current market situation for the three main services focused on in this report. Chapter 4 addresses the supply of environmental

services, starting from the farmers' decision-making process; it lays out policy options to enhance the supply of these services and the role that payment programmes can play. Chapter 5 reviews in detail the various issues involved in designing PES programmes in agriculture with an emphasis on cost-effectiveness. Chapter 6 examines more closely the implications of PES programmes for poverty and possible synergies between environmental service provision and poverty alleviation. Finally, Chapter 7 pulls together the conclusions of the report and lays out the main issues involved in developing the potential of PES programmes.

The main messages emerging from the report can be summarized as follows.

- **Demand for environmental services from agriculture will increase.** Two forces are generating a growth in demand for these services: a greater awareness of their value; and their increasing scarcity, arising from mounting pressures on the Earth's ecosystems. At the same time, environmental policy worldwide is increasingly characterized by greater emphasis on decentralization, flexible mechanisms, the private sector as a provider of public services, consumer sovereignty and civil regulation. Nevertheless, the question of who will bear the cost of providing environmental services remains difficult to resolve.
- **Agriculture can provide a better mix of ecosystem services to meet society's changing needs.** Farmers depend on, and generate, a wide range of ecosystem services. Their actions can enhance and degrade ecosystems. Through changes in land-use and production systems, agricultural producers can provide a better mix of ecosystem services, expanding the share of those characterized by positive externalities, to meet society's changing needs.
- **If farmers are to provide a better mix of ecosystem services, better incentives will be required. Payments for environmental services can help.** Farmers lack incentives to consider the impacts of their decisions on environmental services. Improved information and regulations can influence farmers' decisions in ways that enhance the environment – as can payments to farmers from those who benefit. The relative merits of the different approaches vary according to the different environmental services. Payment programmes range from highly competitive exchanges to public-sector programmes with strong equity objectives. Programmes also vary in terms of the source of payments, the transaction costs involved and the impacts on agricultural production and poverty reduction. The type of programme that is most suitable for any one context will vary. Policy-makers need to be clear as to what societies' priorities are, recognizing the synergies and trade-offs involved in alternative programme designs, as well as the need for careful monitoring and evaluation to ensure value for public expenditures.
- **Cost-effective PES programmes require careful design based on the characteristics of the service and the biophysical and socio-economic context.** Programme design involves four main steps: identifying what should be paid for, who should be paid, how much should be paid and what payment mechanism(s) should be used. These are challenging in practice and have important implications for programme results; careful, context-specific design of each PES programme is therefore critical, as are monitoring and enforcement to ensure compliance. Getting the science right is crucial and requires a clear understanding of the biophysical relationships between farmers' actions and their environmental consequences, as well as the economic motives and constraints facing suppliers and beneficiaries of environmental services. Equally important are the institutional innovations needed to link suppliers and beneficiaries as well as an appropriate enabling environment.
- **Payments for environmental services are not primarily a poverty reduction tool, but the poor are likely to be affected and implications for them must be considered.** Payments can increase the incomes of farmers who produce environmental services. Other poor

households may also benefit, for example from increased productivity of the soils they cultivate or improved quality of the water they drink. However, the distribution of benefits depends on who produces the environmental services, and where. In some cases, payments may also

have adverse impacts on poverty and food security, for example if they reduce demand for agricultural employment or increase food prices. Nevertheless, PES programmes have been shown to be potentially accessible and beneficial to the poor if properly designed.