

Developing markets
for watershed
services and
improved livelihoods



All that glitters

A review of payments
for watershed services
in developing countries



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Acronyms and abbreviations

C&B	Costs and benefits
CARs	Corporaciones Autonomas Regionales (Colombia)
CONAFOR	Mexico National Forest Commission
DFID	Department for International Development (UK)
ES	Environmental service
FAO	Food and Agriculture Organization of the United Nations
FONASA	El Salvador National Environmental Services Fund
FONAFIFO	Costa Rica National Forestry Fund
FONAG	Ecuador National Water Fund
GEF	Global Environment Facility
GIS	Geographic information system
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
ICO	Eastern Training Institute (in Spanish)
ICRAF	World Agroforestry Centre
IFAD	International Fund for Agricultural Development
IIED	International Institute for Environment and Development
KSWP	Kanla-on Spring Water Plant (the Philippines)
MAGA	Ministry of Agriculture, Ranching and Food
MEA	Millennium Ecosystem Assessment
MES	Markets for environmental services
NGO	Non-governmental organisation
NTFP	Non-timber forest products
PASOLAC	Programme for Sustainable Agriculture on the Hillsides of Central America
PCJ	Piracicaba, Capivari and Jundiá (Brazil)
PES	Payments for environmental services
PRESA	Pro-poor Rewards for Environmental Services in Africa
PSA	Payments for Environmental Services (in Spanish)
PSAH	Payments for Hydrological Environmental Services (in Spanish)
PWS	Payments for watershed services
RISEMP	Regional Integrated Silvopastoral Ecosystem Management Project
RUPES	Rewarding the Upland Poor in Asia for Environmental Services They Provide
SDC	Swiss Agency for Development and Cooperation
SFM	Sustainable forest management
SWAT	Soil and Water Assessment Tool
TNC	The Nature Conservancy
WfW	Working for Water (South Africa)
WWF	World Wide Fund for Nature

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Executive summary

This report reviews the current status of payments for watershed services in developing countries. It highlights the main trends in the evolution of these schemes, synthesising the available evidence on their environmental and social impacts, and drawing lessons for the design of future initiatives.

The interest in payments for watershed services (PWS) as a tool for watershed management in developing countries is growing, despite major setbacks. This review identified 50 ongoing schemes, 8 advanced proposals and 37 preliminary proposals for PWS. A previous review published by the International Institute for Environment and Development (IIED) on markets and payments for environmental services (*Silver Bullet or Fools' Gold?* (Landell-Mills and Porras 2002)) identified just 41 proposed and ongoing PWS schemes in developing countries, which suggests a considerable growth in interest in this approach.

However, relatively few of the 41 proposed and ongoing PWS schemes reported in 2002 are definitely still proceeding six years later, and it seems that many of the early proposals did not materialise. The reasons vary and include political unrest and lack of political and financial support. However, in some cases it was not possible to obtain enough information to verify the current status of some of the initiatives. This review applies a stricter definition of payments for environmental services (PES) than in *Silver Bullet or Fools' Gold*, with the result that some of the schemes included in the earlier publication do not qualify and are classified as borderline in this review. The review's criteria for PES stress the importance of a continuing externality related to watershed management and which is addressed through a payment, either to landholders, or from water users, or both. The borderline cases include land acquisitions and intra-village agreements where the buyers and the sellers are indistinguishable.

The PWS cases covered in this review vary greatly in scale: from a pilot project in Nicaragua that rewards just five families on 13 hectares of land, to a massive Chinese project that aims to reach 15 million farmers in 27,000 villages over 32 million hectares of land by 2010. Almost half of the local schemes are part of a larger project, either a national programme or linked to an international project to promote or test PWS schemes.

Most of the cases are located in Latin America, where governments at the national and local level, conservation groups, and international funding agencies have

been enthusiastically promoting PWS. Asia shows fewer schemes, although the areas they cover are much larger than those in Latin America once the two national programmes in China are included. Most efforts in Africa are currently concentrated in South Africa, although in East Africa a large network has been launched to support and facilitate exchanges within the area.¹

National programmes are emerging as the way for up-scaling. The Costa Rican PSA (Payments for Environmental Services, PSA, *in Spanish*) programme has been adapted in different countries, like Mexico and El Salvador. The World Bank is promoting the format in other countries as well. However, small local schemes, such as those being developed in Nicaragua, Bolivia and Ecuador, contribute important lessons that can inform development of national programmes.

Local schemes tend to target one or two specific watershed services as it is considered easier to convince water users to pay. In contrast, most national programmes aim to deliver a bundle of environmental services. This enables them to tap into a diverse range of funding sources.

Because of the challenges in measuring and attributing changes in the provision of watershed services, all of the ongoing PWS schemes identified follow a land-based approach. Providers of watershed services are paid for changes to their land-management practices that are believed to have a high probability of resulting in the desired impact on watershed services. One exception is the Rewarding the Upland Poor in Asia for Environmental Services They Provide (RUPES)-promoted RiverCare scheme in Sumberjaya, Indonesia, which is experimenting with payment according to extent of sediment reduction achieved.

Four main types of land-use proxy for watershed services are currently being used in PWS schemes. The most common approach both in local and national initiatives is improved land practices, improved agricultural and ranching practices, agroforestry, and sustainable forest management. Conservation and protection of existing ecosystems, for example forest conservation, is the other main approach. Reforestation is promoted in some schemes but rarely as the sole activity. Rehabilitation of degraded ecosystems for protection is used in a few cases.

The suppliers of watershed services in most ongoing schemes are private landowners with clear ownership of their land, particularly in national programmes. This reflects the need for security that those paid can control the land and hence deliver the service. However, the Mexico national PSAH programme (Payments for Hydrological Environmental Services, *in Spanish*) targets communally held forestland. In local

1. The Pro-Poor Rewards for Environmental Services in Africa (PRESA) is coordinated by ICRAF. It received a four-year grant from IFAD in October 2007 to begin works in Kenya, Tanzania, Uganda and Guinea.

schemes, there is a greater diversity of tenure arrangements, and in a few cases it is an agency managing a national park that receives the payments.

Although over 70% of the local schemes receive some funds from the private sector or from fees paid by water users, there is still heavy dependence on government and international donors both for start-up costs and the payments themselves. Reallocation from central government is the main source of income for all but two of the national programmes. The private sector has been slow to commit significant funds to PWS, and when it does it is often for public relations reasons rather than perception of environmental benefit.

The ways in which supply and demand have come to be linked in PWS schemes are rather varied. In most cases several different organisations are involved. Concerns about water and flooding have been a primary driving factor in just under half the schemes but a significant proportion are supply driven, with PWS seen as a way of financing the solution to a perceived resource management problem upstream. The national schemes in Costa Rica and Mexico were both introduced to address threats to deforestation. Although government intervention and enabling legislation has been important for some schemes, particularly the national programmes, some local schemes have gone ahead without changes in national legislation and in some cases without changes in local government legislation. Facilitating organisations, non-governmental organisation (NGOs) mostly, have played a key role in bringing suppliers and water users together in the absence of government intervention or in getting greater uptake of government PWS schemes.

Payment levels are mostly determined administratively in the national programmes. In the local schemes, negotiation through an intermediary is more common. Direct negotiation between supplier and buyer occurs in very few cases, where there are special conditions; in particular, few stakeholders are involved and only one downstream buyer. Funds and transfer of payments are in most cases managed by an intermediary, often a specially set up trust fund. The few exceptions are the schemes involving hydroelectric companies in Costa Rica and local water utilities in Central America, which already have systems in place for collecting and managing funds from electricity and water customers.

Payment structures when cash payments are used are generally very simple, with flat rates per hectare for different activities regardless of location. Only a few schemes have payments which differ by location: the Mexico PSAH programme, which pays a higher rate for cloud forest, and the Sloping Land Conversion Programme in China, which pays more in an area where agricultural yields and hence opportunity costs are higher.

Most schemes involving cash payments to landholders make use of cash payments. These are mostly continuous or fixed-period cash payments. In a few schemes, rather than payments, soft loans or guarantees are offered to farmers. One-off in-kind benefits, including technical assistance and inputs, are being used as the sole form of payment in 16 local schemes but are also commonly used in combination with cash payments. The conditionality attached to the payment is therefore low, making the activities on the supply side little different from a conservation project. The difference is on the demand side as the funds come from the water users. The Los Negros scheme in Bolivia, which uses beehives as a form of payment, was the only scheme identified with a periodic in-kind payment with some form of conditionality.

Monitoring of compliance with contracts is based on inspection of land use and varies from site visits to use of satellite images. The most common sanction applied in case of non-compliance is to suspend payment.

Land that is communally owned and likely to be associated with poorer groups is not well represented in the PWS schemes, the main exceptions being the national programme in Mexico where most forestland is held communally, and the targeting of indigenous reserves in Costa Rica. The inclusion of small farmers is case-specific and happens more by accident than design. For Costa Rica, the available evidence indicates that poor farmers are not well represented in the national scheme (at least until 2002).

However, some of the newer schemes being developed, such as the RUPES programme in Southeast Asia and Cuencas Andinas in South America, are actively targeting poor farmers and communities living in uplands.

Evidence of benefits to sellers of watershed services is mixed. The Pimampiro scheme in Ecuador reports payments equal to 20–30% of household income, but schemes in Nicaragua and Honduras report payments that are low relative to local incomes and to the money that could be made from keeping to conventional land uses and practices such as converting forests to agriculture. With one or two exceptions, the cash payments appear to be relatively insignificant and there is an opinion that they function more like supports or a bonus than a real incentive for land-use change (Ortiz Malavasi *et al.* 2003; Kosoy *et al.* 2005b).

As financial payments are often considered insignificant, non-financial benefits must be part of the explanation why farmers participate and continue to participate in these schemes. Strengthening of property rights, capacity building, and improvements in social organisation and in quality of life are the main benefits cited, but mainly by those running the schemes or involved as facilitators.

There is little indication that PWS schemes for watershed services are adversely affecting access to water for poor households. Not more than 15 of the local schemes in our sample involve either a surcharge on the standard domestic water-user fee or designation of a PWS share in a negotiated increase of the water-user fee. In three of these schemes (Jesus de Otoro, Honduras; Cerro San Gil, Guatemala; and ESPH, Costa Rica), payments are a low percentage of users' income and are considered acceptable (Kosoy *et al.* 2005a). In another two, San Pedro del Norte, Nicaragua (Corbera *et al.* 2006) and Pimampiro, Ecuador (Echavarría *et al.* 2004), the payment scheme and the PWS user fee has been introduced without meeting any protest from water users. Another four schemes have mechanisms to reduce the impacts on the poorest users such as a lifeline tariff system (Cuenca, Ecuador; Echavarría *et al.* 2004) or voluntary contributions (Fidecoagua (Contreras 2005) and Zapaliname (Canales 2006), both Mexico) or payment in kind through contribution of labour (Esteli, Nicaragua; Ardón-Mejía and Barrantes 2003a).

Evidence of the delivery of watershed services has proved elusive. In many schemes, the reported impacts on water flow and quality are based on the views of users, local people or the scheme's administrators rather than on on-site measurements and modelling of land use and water relationships.

Linkages between land use and water quality are well documented, and there is some consensus in the literature (Calder 2005). The links between forests and water quantity are more difficult to demonstrate. In both cases, impacts depend on a range of site-specific factors relating to topography and management of land after conversion. A key constraint on measuring environmental impact is that many of the schemes cover small areas, often because of their pilot nature. Even with detailed measurement it is unlikely that they would be able to demonstrate service delivery as they do not achieve a critical threshold level.

Changes in water quality have proved easier to link with PWS schemes. In China, silt run-off from lands reforested under the Sloping Land Conversion Programme is 22–24% less than from comparable farming lands in the same area (Changjin and Chen 2005). This probably also reflects the large scale of this programme.

Evidence based on the characteristics of land included in payments schemes calls into question their effectiveness in impacting watershed services or environmental impacts upstream. Significant proportions of land included the Sloping Land Conversion Programme in some Chinese provinces were found to be low slope and hence not at risk of erosion. Research on the Mexican and Costa Rican national programmes suggests that their additionality has been limited.

Overall, although there is considerable enthusiasm among donors, governments, NGOs and researchers for payments for watershed services, there is little evidence yet that the schemes are matching up to the high expectations placed on them. However, a second generation of schemes is emerging which have tried to incorporate lessons from the early schemes. At the same time, some of the early schemes have made a series of modifications to promote participation of small farmers and to strengthen evidence of land use and hydrological linkages. There is increasing interest beyond forests to the contribution of other land-use change such as agroforestry and organic agriculture.

Payment schemes, if they are to be financially self-sustaining, whether through private or public money, need to be driven more by the water users and become an integral part of water resource management and allocation policy. For this to happen, better evidence is needed of the beneficial impacts of sustainable land-management practices on water flow and quality and on the ability of payments to influence the behaviour of landholders. This can enable legislation that acknowledges and promotes land-based activities as means to provide watershed environmental services.

Better evidence of land management and delivery of watershed services, coupled with enabling legislation, may be effective in bringing in more private companies as buyers. However, judging by current experience, PWS schemes are unlikely to be the route to major sources of new private money. Proponents of PWS will increasingly need to make the case for earmarking tax or water revenue rather than (or as well as) tapping private willingness to pay.

If dependence on public money is to continue, there needs to be a better case made that PWS has advantages in meeting public objectives over other approaches. This requires better targeting of land to ensure effectiveness in delivering watershed services. Targeting can also be used to achieve social objectives such as promoting the participation of certain vulnerable groups and preventing adverse social impacts. Better understanding is needed of the effectiveness of such approaches and of the tradeoffs involved with the achievement of watershed service delivery and other environmental objectives.

It is also necessary to be realistic about what PWS can achieve in contexts where there are serious deficiencies in water infrastructure, where water is provided free or at subsidised rates to certain groups or where commercial agriculture is heavily subsidised. This underlines the importance of deploying PWS as one element in a water-resource management policy. PWS is likely to work best when it is coherent with water-resource allocation and pricing.

1 Introduction

1.1 The problem: watershed services as a public good

Ecosystems provide multiple direct and tangible benefits to humankind as well as intrinsic cultural services.² However, as demonstrated in the Millennium Ecosystem Assessment, (MEA), many of these ecosystem services are being degraded or used unsustainably. The MEA also noted that actions to increase one ecosystem service such as food production often causes the degradation of other services (*ibid.*). Among the ecosystem services that have been degraded globally over the past 50 years are those associated with watersheds, namely supply of fresh water and water purification, and to a lesser extent water-regulation services (MEA 2005). Economic growth and increases in human population are leading to higher demand for water resources, while increasing pressure on the ecosystems that provide watershed environmental services. Economic policies to promote agriculture have raised demand for water for irrigation and led to widespread clearing or modification of natural ecosystems.

It is generally accepted that land-use decisions can affect the provision of watershed environmental services, although there is sometimes disagreement about the extent and nature of the effects (Bruijnzeel 2005; Calder 2005; Van Noordwijk 2005; and others – see Table 1).

Table 1

Watershed services that can be influenced by land use

Watershed service	Description
Quantity or total water yield	Water transmission (total water yield per unit rainfall)
Evenness of flow	Buffering (above average river discharge per unit above average rainfall), gradual release of stored water supporting dry-season flows
Quality of water (for its use as drinking water, other domestic uses, industrial use, irrigation or as a habitat for fish and other organisms)	Maintaining water quality (relative to that of rainfall) Stability of slopes, absence of landslides Tolerable intensities of net soil loss from slopes by erosion
	Microclimate effects on air humidity and temperature

Source: based on Van Noordwijk (2005).

2. Broadly speaking, “environmental or ecosystem services” refers to the benefits people obtain from natural ecosystems, in contrast with man-made structures that could be substitutes. Benefits can be direct, such as provisioning services (i.e. food or water) or regulating services (i.e. control of floods, erosion regulation and water purification and waste treatment; or indirect, through supporting services which for the functioning of ecosystem processes (i.e. nutrient cycling; soil creation; and photosynthesis). Ecosystems also provide people with non-material benefits such as aesthetic pleasure, recreational opportunities, and spiritual and cultural sustenance (MEA 2005).

However, managing land and water interactions is difficult because of the public good characteristics³ of watershed services. Landholders upstream can affect water quantity and water quality downstream through their decisions on land-management practices, but they have little incentive to consider these impacts because they are not affected directly. Water users have little incentive to pay for improved watershed service provision if they cannot exclude non-payers from enjoying these benefits (Pagiola *et al.* 2002).

The conventional approach to influence land-management practices has been through regulation, with restrictions on land uses such as prohibition of forest clearing. These have proved difficult to enforce in practice. They also raise equity concerns because they often limit livelihood options for poor farmers and users of natural resources.

Market-based mechanisms for the provision of environmental services are thought to offer potential in several ways. They can complement these regulatory approaches, or they can become the key tool to deal with environmental problems in the absence of a regulatory framework. They can support decentralisation by enabling local resource management problems to be tackled at the local level. They also appear to offer a way of improving livelihoods, or at least lessening the adverse livelihood implications of land-use restrictions.

The challenges involved in creating market-based mechanisms for the provision of watershed services are numerous. However, recent years have seen a significant increase in interest worldwide. Experiences range from small, pilot projects in Nicaragua, to very large-scale national programmes in China. International funding agencies such as the Global Environment Facility (GEF) and bilateral donors are including projects on PES in their portfolios. Governments, especially in Central America, are laying the foundations for new legislation dealing with environmental services.

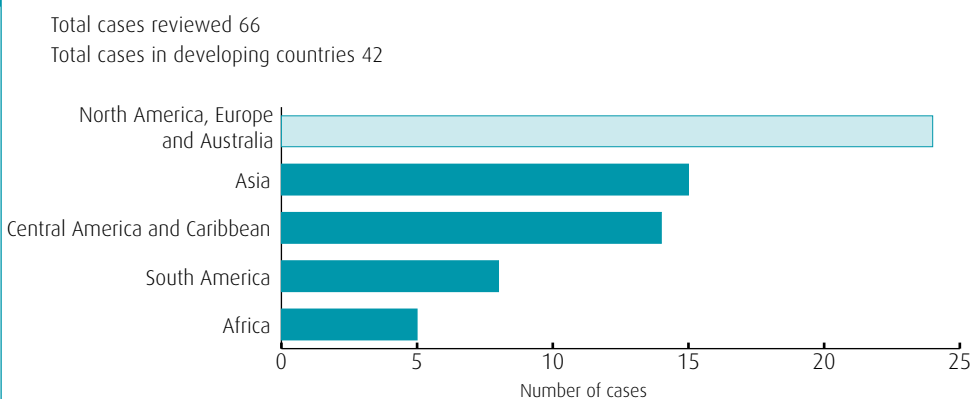
1.2 Background to the project on markets for watershed services and improved livelihoods

Market-based mechanisms for watershed protection were one of four main types of environmental-service market reviewed by Landell-Mills and Porras in 2002. They identified 66 market-based incentives (including bundled schemes), of which 42 were located in developing countries (Figure 1).

3. Public goods are a type of externality. Depending on the service, they can have different degrees of non-excludability (it is difficult to exclude people from using them) or non-rivalry (consumption by one person does not affect the overall pool of the service).

Figure 1

Regional breakdown of watershed service markets reviewed by Landell-Mills and Porras (2002)



Note: the total number of cases includes those reported originally as 'bundled'.
Source: Landell-Mills and Porras (2002).

The review urged both optimism and caution about the win-win potential of markets, payments and incentive systems for environmental services. It also called for special attention to be given to the potential pitfalls as well as opportunities facing poorer groups.

IIED and its partners sought to respond to this challenge by engaging with, and attempting to shape, efforts to set up payment and market mechanisms for watershed services. The project Developing Markets for Watershed Protection Services and Improved Livelihoods was initiated in October 2001. An inception phase involved diagnostic studies in India, South Africa, Indonesia and four Caribbean Island States.⁴ A three-year implementation phase of the project began in late 2003 and was designed to "increase understanding of the role of market mechanisms in promoting the provision of watershed services to improve livelihoods" (IIED 2003). Both phases of the project have been funded by the UK Department for International Development (DFID).

An important component of the project was to disseminate lessons learnt from existing schemes and to promote exchange of experience. The decision was taken therefore to revisit the 2002 review to examine progress with the ongoing and proposed schemes identified in it, to identify new initiatives and to provide an update on the lessons in sustainable development emerging from the initiatives.

4. These reports are available from the website <http://www.iied.org/NR/forestry/projects/water.html>.

This comprehensive review of the state of the art of market mechanisms for watershed services would complement the more site-specific action learning activities in the pilot countries. A web-based database was compiled of ongoing and proposed market initiatives for watershed services in developing countries, building on those identified in *Silver Bullet or Fools' Gold?*. Profiles of the cases identified were prepared and presented on a website developed specially for this purpose: www.watershedmarkets.org.

1.3 Terminology: from markets to payments

The earlier review, *Silver Bullet or Fools' Gold?*, focused on markets for environmental services, using the term in a broad way to cover any situation where there was a buyer and a seller of an environmental service, whether government, private sector or individuals or communities. The effect of this broad definition was that initiatives involving use of economic instruments such as taxes and subsidies were included in the review under the banner of markets. Yet, as pointed out in Pagiola *et al.* (2002), a market transaction, strictly defined, would meet two criteria. It would be a voluntary transaction and the price would reflect the conditions of supply and demand. Many of the initiatives covered in *Silver Bullet or Fools' Gold?* were not markets according to this strict definition, but could be considered as market-based mechanisms, or economic incentives.

A variety of other terms have been used in the literature and by practitioners, each with slight difference in emphasis. However, a notable trend is the use of the term “payment” rather than “market”, whether for environmental services (Wunder 2005) or for ecosystem services (Bishop 2005; UNEP 2006). The pioneering scheme in Costa Rica was given the name *Pago por Servicios Ambientales* (Payments for Environmental Services). Many schemes created afterwards have adopted the same term or adapted to the service concerned, for example the national scheme in Mexico, *Pago por Servicios Ambientales Hidrológicos* (Payments for Hydrological Environmental Services). Other terms in the literature include compensation for environmental services (Rosa *et al.* 2003) and rewards for environmental services (van Nordwijk *et al.* 2004).

Of the terms listed above, PES is used most widely and is not associated exclusively with a particular organisation. Many of the schemes we are examining in this review are formally called “payments schemes” rather than “markets”. For these reasons, and to avoid confusion related to broad definitions of markets, from this point on in the review, we use the term “payments for environmental services”⁵ (PES) and more specifically “payments for watershed services” (PWS). We thus diverge from the terminology adopted in *Silver Bullet or Fools' Gold?*.

5. See 2.3.1 for a discussion of the defining characteristics of payments for environmental services in the context of watersheds.



Beneficiaries of downstream watershed services include biodiversity

1.4 Objectives of the review

This review draws from the case profiles prepared for each PWS initiative. The ultimate aim is to provide lessons from existing experience on how and to what extent PWS schemes can be designed to be economically efficient, effective in meeting environmental objectives and equitable in terms of improving livelihoods or at least not causing adverse social impact.

To achieve this aim this review sets out to:

1. Examine the trends in promotion and implementation of payments for watershed services initiatives since the publication of *Silver Bullet or Fools' Gold?* in 2002.
2. Review the main characteristics of these schemes, developing a case profile to allow comparisons across the schemes.
3. Assess the evidence on the economic, social and environmental impacts of the ongoing initiatives.
4. Highlight the most important lessons for promotion and design of payments for watershed services schemes.

1.5 Structure of the report

The next chapter sets out the approach taken to conduct the review, including the criteria for defining and categorising PWS schemes and the sources of information. This is followed in Chapter 3 by an analysis of the trends in the development of PWS schemes since the previous review in *Silver Bullet or Fools' Gold?* in 2002. Chapter 4 provides an analysis of the key characteristics of ongoing and proposed PWS schemes in different regions. Chapter 5 reviews the evidence on the socioeconomic impacts of the ongoing PWS schemes. Chapter 6 examines the evidence on the environmental impacts of the schemes, in particular their ability to deliver watershed services downstream. Chapter 7 summarises the lessons that can be drawn for future development and operation of PWS schemes and makes recommendations. A series of annexes gives a complete listing and key statistics on the PWS schemes reviewed, explanations of terminology and the template used for the case profiles.

2.1 Identifying the PWS schemes

In identifying the cases, we initially took a very broad approach, including any ongoing or proposed schemes relating to watershed services labelled as markets for environmental services (MES), PES, compensation, rewards or other similar terms by their promoters or by researchers. Our starting point was the 41 schemes included in *Silver Bullet or Fools' Gold?*. Additional information on new schemes was obtained from an FAO workshop in Arequipa, Peru, in 2003. Some further schemes were identified from other international events, in particular the Katoomba Group meetings and country reviews of markets and payments for environmental services by researchers. At this stage we identified 123 schemes (listed in Appendix 2).

The aim was to achieve complete coverage of ongoing and proposed PWS schemes in developing countries. However, because the situation changes very rapidly, with many new proposals being introduced each year and proposals reaching implementation stage, we cannot guarantee that coverage of our review is complete.

2.2 Preparation of the case profiles

The next step was to prepare detailed profiles of each of the identified cases. At this stage it was necessary to exclude 21 cases, mostly early proposals identified in *Silver Bullet or Fools' Gold?*, because it appeared highly likely that they had been abandoned.

Information on the remaining 102 cases was then sought to prepare a case profile, following the template in Appendix 1. The aim of the Case Profile was to provide details on:

- The background to the introduction of the PWS scheme or proposal: the main drivers.
- The stakeholders involved in the scheme: the suppliers of watershed services, the buyers or users of watershed services, and the various intermediaries and facilitators that bring them together.
- Market design: the mechanisms for linking supply and demand, the terms of payment and the institutional and legislative framework.
- Economic, social and environmental costs and benefits of the schemes.

The profiles were prepared from published and unpublished material and Internet searches. Information was also sourced from presentations on schemes and contacts

made at international workshops. Direct contact with key protagonists in the initiatives was pursued as much as possible to fill gaps and provide detail of the particular schemes. However, it was beyond the scope of this project to conduct fieldwork in each case site. In several cases it was possible to draw on fieldwork conducted as part of IIED projects or by other researchers/organisations (Table 13). Except where a specific source is provided, the information on the individual schemes described in this report is drawn from the case study profiles on www.watershedmarkets.org

2.3 Narrowing down for multi-case analysis

Before statistically analysing the cases, it was necessary to ensure that our final sample was restricted to cases that met minimum criteria for PWS. It was also necessary to distinguish between ongoing schemes and those that were only at the proposal stage.

2.3.1 Criteria for PWS

To determine which initiatives could be considered as PWS, we adapted the criteria for PES set out by Wunder (2005). Wunder's five criteria are:

1. A voluntary transaction where
2. a well-defined environmental service (ES) (or a land use likely to secure that service)
3. is being "bought" by a (minimum of one) ES buyer
4. from a (minimum of one) ES provider
5. if, and only if, the ES provider secures ES provision (conditionality).

We consider these too restrictive for our purposes, as they would exclude too many of the schemes. For example, the PES scheme in Costa Rica and several others that are primarily funded through government tax revenue (see 4.3) cannot be considered to involve voluntary transactions on the part of the buyer.

As emphasised in Robertson and Wunder (2005), no so-called PES initiative in Bolivia would meet all these five criteria simultaneously. The key criterion for inclusion in our review is that some form of payment is being used to address an externality affecting watershed services. This distinguishes PWS schemes from conventional approaches to dealing with externalities such as regulation of landholders and government projects. Either payments are received by land or resource holders, or water users are paying to address an external impact of land management on the watershed. In some cases, both types of payment are combined in the same scheme.

It is necessary to distinguish between payments received by the provider and payments made by water users, as they are not always present in the same scheme. In some schemes, a central government agency makes the payments to landholders; water users have little involvement in the decision. In a few schemes, however, the externality is addressed more from the demand side. Private water users and decentralised government agencies make payments to a fund or to a government programme to finance watershed protection projects which do not necessarily involve payments to landholders.

Box 1

Working for Water, South Africa: water users paying to address an externality

Working for Water (WfW) is a government-led programme that aims to alleviate poverty by providing employment on watershed enhancement projects, involving mainly the removal of invasive alien plants. Problems of water scarcity and reduction in stream flow have been attributed to the spread of invasive alien plants that consume large amounts of water and cause other environmental problems such as flooding, fires, erosion, siltation and strain on native species.

Most of the funding for the programme (about R500 million) comes from the government's poverty relief fund, but about 10–15% comes from water users. The annual contribution of the Department of Water Affairs to the WfW programme amounts to about R58 million. The water price charged to its users (33,000 domestic, industrial, agricultural and forestry water users) includes a "water resource management fee". This fee covers clearing of alien invasive plants as well as planning and implementation, pollution control, demand management, water allocation and water use control.

The public company TCTA, the specialised liability management body for bulk water supply, has also contributed R8 million to the WfW programme (over three years).

Some local governments, interested in preserving or increasing water supply, contribute to the programme with regular annual donations to fund the removal of alien invasive plants in the catchment areas where they derive their water. In Hermanus municipality, for example, a block rate tariff was introduced to control high water use and a significant percentage of the revenues collected transferred to the WfW programme. Similarly, Georges municipality has committed R400,000 per year to the programme as a parallel investment to the new augmentation scheme to supplement the capacity of its Garden Route Dam.

Where the externality is internalised through payments to landholders, this in turn requires that landholders can decide whether to take up the economic incentive; that is, it is a voluntary transaction from the perspective of the service provider, otherwise it would be little different from regulation. It also implies that there is some conditionality associated with the payment. To access the payment, landholders have to meet certain conditions.

Our criteria can be summarised as follows:

1. Environmental externality addressed through a payment: there is a provider or seller of environmental services responding to the offer of a payment whether from a private company, NGO, local or central government agency, and/or there is a user of watershed services, who is distinguishable from the seller and is not a central government agency, making payments so that watershed services can be enhanced or protected through land management.
2. Voluntary in principle on the supply side: the provider of environmental services enters voluntarily into the transaction.
3. Conditionality in principle: the payment is conditional on previously agreed land use that is expected to provide an environmental service.

Table 2

Borderline PWS schemes

Schemes	Reason for exclusion
Arvari (India), Myrada (India), Eastern Training Institute (ICO, Bolivia)	Intra-village arrangements where buyers and sellers not distinguishable
Uganda Breweries (Uganda)	Company is paying compensation for its polluting impact rather than paying to address an externality associated with the management of the wetland
Working for Wetlands (South Africa)	Government programme to improve wetland management with no indication of payments being made to landowners or payments being made by water users
ICO (Bolivia), Campoalegre (Colombia), Shutan Bajo (Ecuador)	No continuing environmental externality Downstream users buy land upstream to influence land management

Environmental externality

Application of the first criterion resulted in the exclusion of seven initiatives, some of them previously included in *Silver Bullet or Fools' Gold?*, in which there was either no continuing environmental externality associated with land management or the externality was not being addressed through payments. Table 2 lists the schemes and the reasons for excluding them.

These are considered as “borderline” examples of watershed service deals and are included in the case profiles because they offer some useful lessons. However, they are not included in the general statistics for the analysis.

Voluntary in principle

All the schemes identified could be considered voluntary in principle on the supply

side, so no exclusions were made on this criterion. However, not all of the schemes are necessarily voluntary in practice. For example, although China's Sloping Land Conversion scheme is voluntary in principle, it appears that the selection of areas is often by the local government unit, and extent of farmer autonomy varies by area. A survey of participants and non-participants in 2003 found that only 15% of participants and 28% of non-participants felt they had any autonomy in choosing whether to participate (Xu *et al.* 2004). In other cases, it is possible that landholders are responding to hidden pressures of expropriation or eviction (Campamento in Honduras, Social Forestry programme in Indonesia) rather than making a voluntary decision.

Conditionality in principle

All the schemes involve some degree of conditionality, or at least aim for conditionality, so no exclusions were made on this criterion. However, significant differences in the extent, duration and effectiveness of conditionality in practice were identified in the course of analysis. Reasons for differences in conditionality in practice include:

- Payment is conditional on meeting initial eligibility criteria entry requirements: most funding from the Watershed Conservation Fund in the Philippines is diverted to short-term projects such as health and water supply, and has a weak link with the provision of the environmental service.
Payments diverted to poverty alleviation in Maasin (the Philippines) where people consider them as a reward "due to them" (Arocena-Francisco 2003).
- One-off transactions that result in immediate benefits that cannot be withdrawn or discontinued in case of non-compliance.
- One-off, short-term payments given to support landholders in a transition to alternative management practices; which, it is hoped, will provide sufficient on-site benefits to cover the additional recurring costs. Examples include:
 - payments for reforestation during the first five years in Costa Rica (compliance expected for at least 20 years), farmers are able to commercialise the timber;
 - switch to organic farming in Bhoj, India;
 - orange orchards in Meijiang, China;
 - shade-grown coffee in Sierra de las Minas, Guatemala; and Campamento, Honduras;
 - silvopastoral projects in Colombia, Costa Rica and Nicaragua;
 - Cuencas-Andinas project in Fuquene, Colombia, and Ambato, Ecuador.

With the exclusion of the seven borderline and 21 uncertain or abandoned cases, we were left with 95 schemes (50 ongoing, eight advanced and 37 preliminary proposals). Sufficient information was obtained to draft 81 case profiles (67 of which are now available on www.watershedmarkets.org).

2.3.2 Status of the schemes

Further criteria were needed to distinguish between ongoing and proposed PWS.

- *Ongoing schemes.* These are initiatives in which payments for watershed services were being made either by the users (direct and indirect), or were being received by the suppliers, or both. We identified 50 PWS initiatives that met these criteria (most of which have profiles available on the website).
- *Advanced proposals.* This includes those in which advanced baseline studies had been conducted, stakeholder negotiation meetings had been held, but no payments were actually taking place. Eight of the proposals had reached this stage.
- *Preliminary proposals.* This group includes proposals that had been announced but for which there was either limited information available or little background work completed. We identified 37 proposals in this category.

2.3.3 The final sample of PWS

Table 3 shows the PWS schemes in our final sample. We distinguish between national programmes and local schemes, and between ongoing and advanced proposals. We also show the spectrum of PWS schemes covered by our review based on the type of payment used. Type C is closest to a purist definition of PWS, with financial payments made by water users directly or indirectly to landholders. Moving upwards and downwards from Type C, the concept of PWS becomes more stretched. Type A includes schemes where the payments to landholders are one-off financial and in-kind or more general support to projects and in two cases to park administration, suggesting weak conditionality in practice. There are also downstream users contributing: central government or international donors cover the costs. At the other end of the spectrum, in Type E, there are three schemes, where water users are contributing to the costs of watershed management but there is no mechanism for transferring funds to landholders.

Most of the ongoing PWS schemes in this review involve payments to landholders. Somewhat fewer involve both payments to landholders and payments from water users in the same scheme (Type C). There are a few PWS schemes that are included in this review primarily because they involve payments from water users (Types D and E). These include three of the national programmes (Plan Verde, Colombia; Watershed Rehabilitation Fund, the Philippines; Working for Water, South Africa) and 17 of the ongoing local schemes.

Table 3

The final sample of PWS schemes

	National	Local	Advanced proposals
Type A One-off financial and in-kind payments, access to land, loans, guarantees, and project support to landholders only		6 Meijiang, China Sumber Jaya, Indonesia Mangla Dam, Pakistan Procuencia/Valle de Bravo, Mexico Esteli, Nicaragua Fuquene, Colombia	
Type B Financial payment (to landholders only)	5 Forest Ecological Compensation, China Sloping Land Conversion Programme, China Mexico PSAH Costa Rica PSA Direct Forestry Assistance, Guatemala	4 Silvopastoral (RISEMP), Colombia Costa Rica Nicaragua Los Negros, Bolivia	
Type C Financial payments to landholders (continuous and fixed period and including continuous in-kind) and payments from water users	1 Ecoservicios, El Salvador	14 Sukhomajri, India Cidanau, Indonesia Fidecoagua, Mexico Costa Rica local schemes: La Esperanza, CNFL, ESPH, Energia Global, Platanar, ICE, La Florida Morazan, El Salvador Jesus de Otoro, Honduras San Pedro del Norte, Nicaragua Pimampiro, Ecuador	3 Makiling, the Philippines Sierra de las Minas, Guatemala Alto Mayo, Peru
Type D One-off financial and in-kind payments, loans, guarantees and project support to landholders and payments from water users	2 Watershed Rehabilitation Fund, the Philippines Plan Verde, Colombia	15 Kuhan, India Brantas, Indonesia Kulekhani, Nepal Maasin, the Philippines Mt. Kanla-on, the Philippines Zapaliname, Mexico El Imposible,* El Salvador Tacuba, El Salvador Cerro San Gil,* Guatemala Campamento, Honduras PCJ Consortium, Brazil Cauca Valley, Colombia Cuenca, Ecuador Fonag, Ecuador Pedro Moncayo, Ecuador	5 Bhodi, India Bhoj, India Singkarak Lake, Indonesia Tarija, Bolivia Ambato, Ecuador
Type E Payments from water users only	1 Working for Water, South Africa	2 Lake Toba, Indonesia San Jeronimo, Guatemala	

*Payment is to the Park Administration, the official landholder.

2.4 Constraints and information gaps

The following constraints and gaps in the review should be noted:

- The review is based primarily on secondary information. Although efforts have been made to triangulate and check this information, it is difficult to guarantee its quality.
- Although the use of a common profile for each case facilitates comparison across schemes, not all cases had the same level of information available. The opportunity exists, however, to update these cases as additional information becomes available in the future.
- In some cases, information was mostly provided by project managers or those proposing the schemes, and it was difficult to obtain additional independent (and potentially more critical) sources.

The status of the cases can change rapidly from proposal to ongoing. It is possible that some very recent changes are not captured in this review.

3 Brief overview: general trends since *Silver Bullet or Fools' Gold?*

The interest in market-based mechanisms for watershed protection in developing countries has increased significantly since the publication of *Silver Bullet or Fools' Gold?* in 2002. This chapter presents the main trends in payments for watershed services in developing countries since 2002, setting out their status and geographical coverage.

3.1 Status: many new cases but major setbacks

Development of PWS schemes has not been easy. From 25 schemes reported as pilot or mature in 2002, only about half are still ongoing (plus two more which have been reclassified as borderline). Only three of the 17 proposed schemes reported in 2002 have proceeded to a pilot stage. A significant proportion of both pilot and proposed schemes are either known to have been abandoned or have uncertain status as no current information is available on their operation, suggesting that they have been discontinued (see Table 4).

Table 4

What has happened to cases reported in 2002?

Region	Status 2002 (<i>Silver Bullet or Fools' Gold?</i>)		Status 2006			
	Status	Number	Ongoing	Proposal	Borderline	Abandoned, discontinued or uncertain
Total	Ongoing*	25	12	0	2	11
	Proposals	17	3	3	1	10
Africa	Ongoing	3	-	-	-	3
	Proposals	2	-	-	-	2
Asia	Ongoing	11	3	-	2	6
	Proposals	4	1	1	-	2
Central America, Mexico and the Caribbean	Ongoing	6	4	-	-	2
	Proposals	8	2	2	-	4
South America	Ongoing	5	5	-	-	-
	Proposals	3	-	-	1	2

*Ongoing" represents mature and pilot cases.

Some explanations for these trends include:

- Some of the proposals listed in *Silver Bullet or Fools' Gold?* were at a very early stage. In some cases they were more early ideas than proposals, and did not proceed further. For example, the international Bermejo scheme in Bolivia and Argentina proved too complicated to take forward. However, several (independent) schemes are being developed in Bolivia. Similarly, the Watershed Fund in San José in Costa Rica or Chagres in Panama, reported by Johnson (2000), did not materialise as formal proposals.
- The PWS component of a wider initiative (usually a national programme) did not get approval, although the initiative itself proceeded. For example, in Chile, trading in water rights was implemented, but the proposal for the PWS forestry component of the scheme did not receive support at the time and was not taken further. The same applies to the Stream-Flow Reduction Licences scheme in South Africa where the “additional” water flows obtained from changes in land use cannot yet be used as an exchange commodity in the licence system.
- Political instability affected development, as in the Integrated Catchment Management in Dryland areas in Zimbabwe.
- In some cases, it was not possible to obtain further information, such as the water boards in Malawi. Five cases reported for China (the provinces of Guangdong, Jiangxi, Shiangxi, Hebei, and Northwest) have probably evolved into the national Sloping Land Conversion Programme.
- Some cases have been reclassified as “borderline”, as discussed in 2.3.

Many new proposals and initiatives are emerging all over the developing world. This review has looked into several new schemes (proposals and ongoing) in Africa, Asia, Central America and the Caribbean (including Mexico), and South America. All of these schemes are at different stages of implementation, and their scale varies from national programmes to very small, local initiatives.

3.2 Regional breakdown of initiatives

Table 3 shows the regional breakdown of payments for watershed service schemes by region and country. Most of the schemes (pilot and ongoing) are located in Latin America, primarily in Ecuador, Colombia, Bolivia, and almost all the countries in Central America (except Belize). Many of these proposals are donor-led, with significant German and Swiss cooperation and involvement from the World Bank.

There has been considerable preparatory work in Asia, especially in Indonesia and the Philippines steered by RUPES, and major international groups like the World Wide Fund for Nature (WWF); CARE and IIED are supporting feasibility studies in the area. However, so far, Asia has fewer ongoing schemes than Central and South America.

In terms of hectares covered by PWS schemes, it is probably ahead of the other regions because of the large size of the China national programmes.

Africa has seen relatively little progress with development of payments for watershed services, although there has been interest in carbon and biodiversity services. Only one case is ongoing, Working for Water in South Africa. There has been important work in other sites in South Africa, and the World Bank has recently approved a loan for background studies on PES around Lake Victoria in Kenya. Cooperation and exchange of interest and information is growing in the region. Recently, Katoomba Africa was formed and information about environmental services for the region is posted on its website (www.katoombagroup.org/africa/pes.htm). There is also a proposal led by the World Agroforestry Centre (ICRAF) to establish a cooperation network in the East Africa Region (Pro-poor Rewards for Environmental Services in Africa: PRESA) similar to RUPES in East Asia.

3.3 Geographical scale of operation: international, national and local

The PWS schemes identified operate at different levels:

- Forty-one local schemes, some of which form part of internationally linked projects (like CONDESAN in South America, or RUPES in Asia) or are linked to national programmes;
- Nine national-level programmes.

Most ongoing schemes are local, operating at a watershed level, although there is a marked emergence in national-level programmes and several multi-country coordinated programmes.

3.3.1 Local schemes

Approximately half of the local schemes reviewed either have links to a larger, international project, such as RUPES in Asia or Silvopastoril in Latin America, or are developing alongside national-level programmes. In most of these cases, the local initiative receives financial and/or technical assistance in establishing negotiations among stakeholders, preparation of baseline studies, design of mechanisms for collecting and allocating payments and general management of the scheme, and in some cases additional funds to complement those collected at the local level.

The relationship between national programmes and local schemes varies:

- National programmes support pre-existing local schemes. For example in Valle de Bravo in Mexico, funding from the national Payments for Hydrological Environmental Services programme was used to supplement the existing voluntary contributions to an environmental fund created in 2000.
- National programmes lead to creation of local schemes. For example in Costa Rica, the existence of the national-level PSA programme has provided the framework and institutional capacity to spur local-level agreements with several hydroelectric companies.

- Local schemes lead to the creation of national programmes. For example the small local schemes coordinated by the Swiss Agency for Development and Cooperation (SDC) / Programme for Sustainable Agriculture on the Hillside of Central America (PASOLAC) in Nicaragua, El Salvador and Honduras are helping to create the momentum for the creation of national-level programmes.
- Local schemes set up as a pilot for national programmes. This is the case of Coatepeque and Jaltepeque-Jiquilisco in El Salvador, where the new national programme Ecoservicios is being piloted.

At the same time, half of local schemes are emerging independently of a regional or national programme. Most of these schemes are very small scale in terms of geographical area and number of landholders targeted. They provide, however, important lessons in how to address local problems.

3.3.2 National PWS schemes

The number of national-level programmes, in which payments for environmental services are either the main component or only part of a wider policy, has increased significantly. In 2002 the main programmes reported were the Costa Rican PSA, Plan Verde in Colombia and South African Stream-Flow Reduction Licensing Systems. Currently, there are nine ongoing national-level programmes, ranging from the very large scale of the Chinese Sloping Land Conversion and Forest Ecological Compensation programmes, to the relatively small Ecoservicios in El Salvador (Table 5).

Table 5

National programmes for environmental services

Country	Programme name	Status	Description
China	Forest Ecological Compensation	Ongoing since 2004	The programme represents the beginning of a shift in Chinese environmental management policy as it provides support to managers of forests with special ecological interest and with stricter land-management requirements. In principle, this support should constitute compensation to the forest managers for the environmental services they are providing, or for their forgone land-use options
	Sloping Land Conversion Programme	Ongoing since 2002	Farmers must set aside erosion-prone farmland within critical areas of the watershed of the two largest rivers in China: the Yangtze and Yellow River (sometimes called the Huanghe River). Compensation is given in cash and in kind. Total investment is US\$4.3 million a year

Colombia	Plan Verde	Ongoing since 1999	National governmental forestry plan aiming at recovering forest cover while protecting micro-watersheds, regenerating areas affected by forest fires and degraded mangroves. Driven by the government's recognition of the need to protect the ecosystems that influence hydroelectricity production, drinking water supply and irrigation. Although the programme is effective in extracting payments from service users, it remains vague about targeting service providers
Costa Rica	Payments for Environmental Services (PSA) programme (conservation and reforestation)	Ongoing since 1997	Government-led national scheme that rewards forest owners for protection of water, carbon sequestration, biodiversity protection and landscape beauty from forests. Most of the funding still relies on state funds derived from a fuel tax, with increasing participation from the private sector (especially hydroelectric projects). The programme will get significant new funding from the newly approved water tax, to be applied to all water users in the country. The National Forestry Fund (FONAFIFO) manages the programme
	Certificates for Environmental Services (CSA)	Piloting since 2005	A recently created mechanism designed by FONAFIFO to facilitate business's participation in the PSA scheme and capture funding beyond the already over-subscribed PES scheme. Each certificate represents one hectare of forest for conservation. The first stage of the CES is focusing on protection and regeneration of 7,000 hectares of forests in the Guanacaste area. Current buyers range from these local industries, to private individuals or foreign ethical investment companies
El Salvador	Ecoservicios	Approved in 2005: specific sites relatively piloted or at early proposal stage	This is a comprehensive World Bank/Global Environment Facility(GEF)-funded project that aims at creating a national system of PES as a sustainable funding mechanism for conservation by: (1) establishing a functioning environmental services fund, FONASA (National Environmental Services Fund); and (2) designing a programme of payments for environmental services, and providing technical assistance and monitoring contract compliance by the environmental service providers

Country	Programme name	Status	Description
Guatemala	Direct Forestry Assistance Pilot	Initially branded as PES for GEF funds, it was later absorbed by the Ministry of Agriculture	The Ministry of Agriculture, Ranching and Food (MAGA) investing approximately US\$0.5 million per year for protection of forest located in strategic water areas in central and western Altiplano
Mexico	Payments for hydrological environmental services (PSAH)	Ongoing since 2002	Mexican country-wide scheme that targets areas of well preserved natural forest for protection of their hydrological function in critical watersheds and over-exploited aquifers and proximity to water sources that supply settlements of more than 5,000 inhabitants, which might in the future take over the payment through their own local government and/or water utilities
The Philippines	Watershed Rehabilitation Fund	Ongoing since the mid-1990s	Reforestation, watershed management, health and/or environment enhancement fund being managed by the Department of Energy to compensate communities hosting energy projects. This government-imposed programme demands "social responsibility" compensations from electricity generation companies to host communities of such generation facility. It could potentially become an effective mechanism to improve watershed management, although currently it still targets mostly social projects
South Africa	Working for Water	Ongoing since 1995	The Department of Water Affairs and Forestry includes a water-resource management fee in the price of water charged to consumers. This includes a charge for clearing alien invasive plants and for activities such as planning and implementation, pollution control, demand management, water allocation and water-use control. Charges for clearing alien invasive plants are levied in 13 of the country's 19 water management areas



Nicaragua has several small payments for watershed service initiatives

3.3.3 Internationally linked PWS projects

Internationally linked PWS schemes are not aimed at transboundary watersheds. Instead, they are mostly donor-led projects that support the introduction of payment initiatives in selected countries, in most cases in the same region. In general, these projects aim to take into account existing experiences and lessons from other projects. Stronger emphasis is placed on the design of baseline studies, monitoring and information sharing. Currently, the most developed regional programmes are RUPES, in East Asia; GEF/WB Silvopastoral in Nicaragua, Costa Rica and Colombia; Cuencas Andinas in South America; and SDC/PASOLAC in Central America (Table 6). IIED has also supported a series of action-learning sites in Bolivia, India, Indonesia, South Africa and the Caribbean. More recently, a consortium by WWF/CARE/IIED⁶ has supported feasibility studies in several sites in five countries (Guatemala, Tanzania, Peru, Indonesia and the Philippines), and ICRAF is shaping a RUPES-type programme in East Africa, PRESA.

6. The project, "Equitable payments for watershed services: delivering poverty reduction and conservation" specifically targets conservation of forests as means to reduce poverty and promote social justice and equity. The feasibility studies aim at probing whether it is possible to accomplish those objectives while still meeting the "business case" for downstream users.

Table 6

International projects in payments for watershed services

Project Name	Countries	Status	Description
Cuencas Andinas	Peru, Ecuador, Colombia	Mostly at proposal stage	A Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)-funded project aiming at promoting sustainable land use in 15 watersheds in the Andean region of Colombia, Ecuador and Peru, through the creation of PES schemes among other management initiatives. The objective of the project is to implement innovative methods, of which payments for environmental services can be one, which can capture the potential for sustainable development within these watersheds. The project will run for 8 years. For the first stage (2003–2006), the objectives were to improve water management plans and implement PES schemes as a new institutional arrangement to manage the watersheds. The target groups are the technical and managing staff of the municipalities, local projects and NGOs, and the local communities
SDC/PASOLAC	Central America: El Salvador, Honduras and Nicaragua	Mostly ongoing small pilot projects	PASOLAC (funded by SDC) is piloting 10 initiatives in Honduras, Nicaragua and El Salvador through local municipalities. The important lessons for PASOLAC are the evolution of relations between stakeholders and the way in which soil and water conservation technologies are introduced, based on contractual obligations between private farmers and water institutions. PES is a useful instrument to promote discussions among stakeholders and find solutions based on contracts and agreements
RUPES (Indonesia, the Philippines, Nepal)	Indonesia, the Philippines and Nepal	Different stages of implementation, but mostly proposals	RUPES is testing environmental service reward mechanisms in six sites: the Philippines (Kalahan Reserve & Ancestral Domain and Bakun), Nepal (Kulekhani) and Indonesia (Bungo, Sumberjaya and Singkarak). In addition, there are other “associate sites” where there is shared learning with partners but limited financial involvement from RUPES. RUPES is mostly funded by the International Fund for Agricultural Development (IFAD), and they work alongside a consortium of international institutions
Silvopastoral	Colombia, Costa Rica, Nicaragua	Ongoing	Funded by GEF and the World Bank, it aims to: (1) evaluate the potential of silvopastoral land uses as providers of environmental services and socioeconomic benefits for the communitiesustainable intensification livestock activities and PES

4 Key characteristics of payments for watershed services

In this chapter we examine the essential characteristics of PWS based on the evidence from our sample of ongoing schemes and advanced proposals. We start with the main environmental services demanded and the proxies used to enable payment. We then look at key aspects on the supply side, in particular the main characteristics of service providers. On the demand side, we focus on the main types of service user. This is followed by an examination of how the supply of watershed services come to be linked with demand, and how public good barriers can be overcome. We look at the legislative changes, the underlying drivers and the role of facilitating organisations. Finally, we examine the main features of the payment mechanisms.

4.1 What are the environmental services demanded?

A key expectation in payments for watershed services is that changes in land management can be linked to improvements in the provision of watershed services or that prevention of changes in land management, for example prevention of deforestation will ensure the sustained provision of watershed services.

As Table 1 sets out in the Introduction of this review, the three main changes in watershed services that can be influenced by land use relate to:⁸

- quantity or total water yield (streamflow);
- evenness of flow; and
- quality of the water.⁹

The relative importance of the watershed service depends on the on-site conditions, the direction of a land-use change, the type of water users and where they are located along the watershed. There might be cases of conflicts of interests, but also potential for collaborative work. For example, some users might be more interested in reduced sedimentation, or higher dry-season flows. Table 7 presents some examples of the types of service demanded by water users. Chapter 6 discusses in further detail the evidence on the links between land management and environmental services.

8. See section 6.1.1 for a discussion on the linkages between land use and water.

9. PES mechanisms are useful for dealing with non-point pollution, such as sedimentation. More direct approaches, like regulation, may be more effective in dealing with point pollution.

Table 7

Description of hydrological service by end user

Water user		Service demanded		
		Quantity	Quality	Examples
Hydroelectric projects	Annual and intra-annual reservoirs	Maximum water supply throughout the year (seasonality not so important). The impact on total water yield may be small unless the areas with improved land use are large	Reduced sedimentation, the importance of which depends on the reservoir capacity to accommodate sediments	Mangla Dam (Pakistan); Lake Toba and Sumberjaya (Indonesia); Watershed Rehabilitation Fund (the Philippines); Platanar, Energia Global, CNFL, La Esperanza and ICE (Costa Rican Institute of Electricity)
	Daily reservoir projects	Maximum daily supply, especially during dry seasons when rainfall is limited		
Run-of-river		Maximum water retention in the watershed to provide constant flow throughout the day. Changes from soil quick flow (saturated forest soils) to overland flows will have some effects on buffering river flows and hydroelectric operation		
Population centres: Urban and rural residential water consumers (through municipal and private water utilities)		Constant water supply throughout the year for drinking (i.e. 150lt/day/pc). Reduced flood risks in the wet season and water shortages in dry season	Improved water quality especially in catchment areas that reduces treatment costs	Most cases in Central America and Mexico; Ecuador National Water Fund (FONAG), Pimampiro, Ambato and Cuenca (Ecuador); PCJ (Piracicaba, Capivari and Jundiaí rivers, Brazil); Alto Mayo (Peru); Working for Water (South Africa); and Sukhomajri (India)

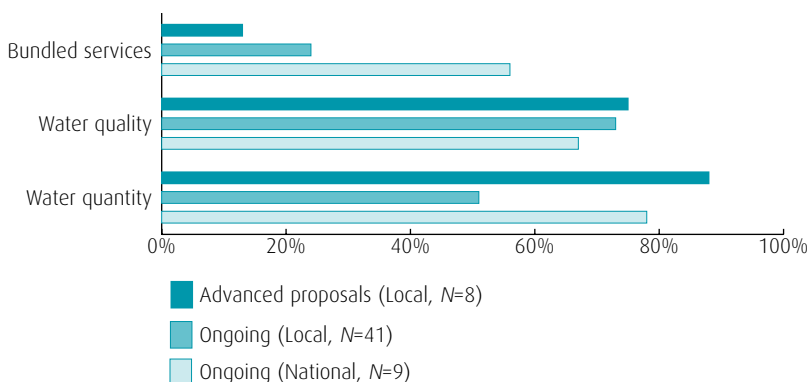
Industrial water users	Agricultural sector: irrigation projects, farmers, agricultural markets	Constant flow of water – especially in dry season – for agriculture. Reduced risk of floods	Water quality in terms of toxics, salinisation, etc	Mexico national programme; Cauca Valley, Fuquene, Plan Verde in Colombia; Ambato (Ecuador)
	Distilleries, film processors, microchip manufactures, food processors	Constant flow of water throughout year	Reduced contamination of water	La Florida (Costa Rica); Uganda Brewery; Sierra de las Minas (Guatemala); Kanla-on (the Philippines)
	Commercial fisheries, sport fisheries, fishery management agencies, etc		Reduced contamination of water. Reduced aquatic productivity and destruction of coral	Lake Coatepeque (pilot site in Ecoservicios, El Salvador)
Tourism		Water available throughout year, especially dry (tourist) season	Improved water quality, reduced degradation of tourism sites	FONAG (Ecuador), Lake Coatepeque (Ecoservicios, El Salvador); Sukhomajri (India)
Ecological flows (i.e. wetlands)		Availability of water flows especially in dry seasons	Reduced siltation, sedimentation, suspended toxins from agriculture, etc	Working for Water (South Africa); Costa Rica PSA; Ecoservicios (El Salvador)

Source: Based on The Conservation Finance Alliance (2003), Landell-Mills and Porras (2002), Van Noordwijk (2005) and information collected in this review.

In local schemes, there is a noticeable practice of targeting one or two specific watershed services (rather than watershed services in general) as it is considered easier to convince water users to pay. Almost half of ongoing local schemes (and nearly all advanced proposals) aim to change water quantity, either as total yield or as regulation of flows. Water quality is an environmental service commonly paid for in local schemes (Figure 2).

Figure 2

Summary of watershed services demanded



Note. The statistics shown in the graphics represent the environmental services specified in project documents. The selection of each service is not mutually exclusive, and each scheme, especially those at national level, might try to pursue several environmental services at the same time.

Most national programmes, in contrast, aim to produce or protect multiple environmental services. This reflects the intention to tap into multiple sources of funding (for example, from carbon sales or biodiversity conservation groups). The PSAH in Mexico and the PSA in Costa Rica specifically target conservation of forests as a means to deliver watershed services alongside other services such as biodiversity protection and landscape beauty.

Increasing water quantity is not explicitly written in any of the Costa Rican examples, as regular precipitation is usually high and the country has undergone intensive debates over the role of forests and water. There are, however, many cases where it is expected that protection of existing ecosystems will result in water security.

4.2 What is paid for?

A key challenge for the development of market mechanisms is the “packaging” of the environmental service into a commodity that can be sold or made the subject of a contract. Because of the challenges in measuring and attributing changes in the provision of watershed services, all of the ongoing PWS schemes identified in developing countries follow a land-based approach. Providers of watershed services are paid for changes to their land-management practices that are believed to have a high probability of resulting in provision of the environmental service.

The same also applies to many of the proposals. One exception is the RUPES-promoted RiverCare scheme in Sumberjaya, Indonesia, which is experimenting with payment according to extent of sediment reduction achieved (Box 2).

Box 2

Payment according to service delivery: the RiverCare experiment

In Sumberjaya, the National Electricity Company is facing problems of high sediment load and siltation in its reservoir.

RUPES set up a pilot project within one community and one sub-catchment area to test a mechanism of payment for reducing sediment. RiverCare is a community group that performs soil and water conservation practices to reduce sediment going into the hydropower reservoir. RUPES supplied technical assistance as well as taking on the role of stand-in buyer, to pay the group for their work. RUPES and the RiverCare group have drawn up an agreement which states that at the end of 2007 RiverCare will receive:

US\$1000 for a reduction of 30% or more

US\$700 for a 20–30% reduction

US\$500 for a 10–20% reduction

US\$250 for a less than 10% reduction.

The aim is to provide demonstration to the potential buyer, the National Electricity Company, that payments to RiverCare can deliver the environmental service.

Source: Suyanto (2007).

Table 8 presents several examples of how services are converted into proxy commodities in different schemes.

A solid scientific base is very important, but so are the perceptions that stakeholders have of the impacts of their land-use decisions (see Porras and Miranda (2005) for more on perceptions). At the same time, the choice of the commodity and the marketing mechanism will ultimately be affected by the local administration capacity. More sophisticated approaches that are more cost-effective (such as credits and transferable licences or spatially differentiated pricing that can improve targeting) are mostly used in developed countries such as the USA and Australia. Until now, PWS schemes in developing countries have used four main types of land-use proxy for watershed services. Their distribution in local schemes and national programmes is shown in Figure 3.

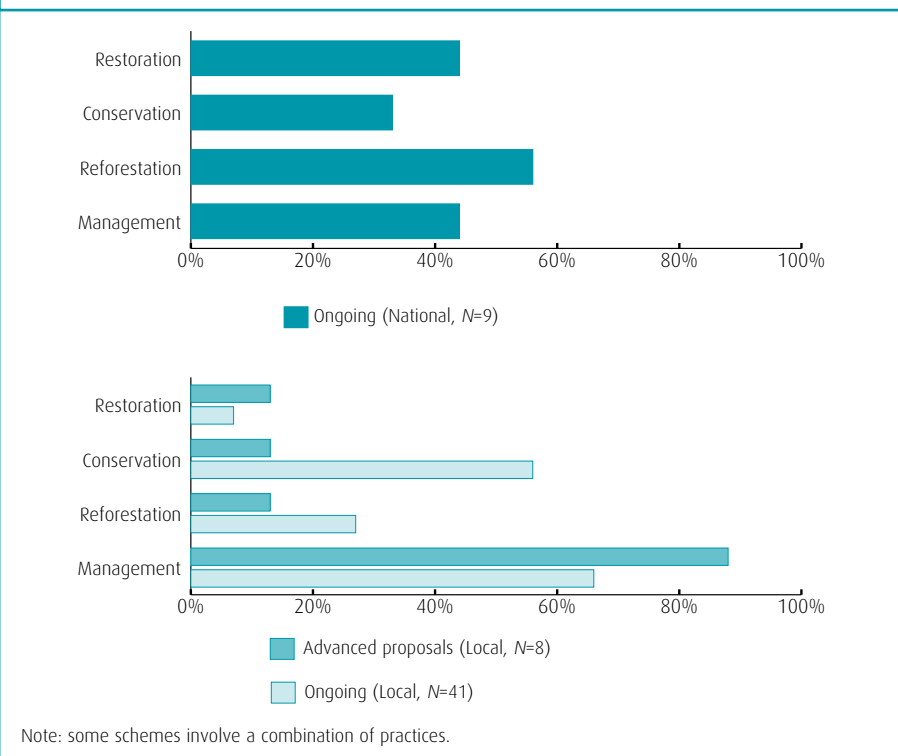
Table 8

Examples of watershed services and associated proxy commodities

Service proposed	Commodity	Place	Status
Improved water quality	Rehabilitation of degraded areas through tree planting at pilot sites	Brantas, Indonesia (LPT3-IIED)	Ongoing (pilot)
Improved water quality	Improved land practices through switch to organic agriculture	Bhoj Wetlands, India	Advanced proposal
Improved water quality and quantity	Improved land practices through soil conservation and zoning	Bhodi-Suan, India	Advanced proposal
Reduction of sediments in lake	Improved land practices through soil conservation techniques, use restriction through reduced grazing intensity and tradable water rights.	Sukhomajri, India	Ongoing
Improved water quantity	Protection of existing forests	Los Negros, Bolivia	Ongoing
Biodiversity protection, carbon sequestration, regulation of water flows and quality, reduction of environmental vulnerability to landslides, scenic beauty	Protection and restoration of existing forests	National programme EcoServicios, El Salvador	Advanced proposal (ongoing on pilot site)
Regulation of water flows and quality, reduction of landslide risk, scenic beauty, carbon sequestration, biodiversity protection	Improved land practices through combining trees with agricultural production (agroforestry, silvopastoral practices, shade-grown coffee, live fences)		
Regulation of water flows and quality, reduction of landslide risks	Improved land practices in agricultural land (mulching, low tillage, live barriers, conservation works)		
Protection, conservation and management of strategic water sources	Improved land practices mostly through soil and water conservation techniques in small watersheds; no slash-and-burn, management of crop residues, natural regeneration of forest through selective logging, management of coffee farms, conservation of forest, use of wind barriers and live fences, and use of coffee waste for compost	PASOLAC, 10 initiatives in small watersheds in Central America	Mostly ongoing
Improved water quantity and quality	Conservation of existing forests and reforestation	Mexico (national programme)	Ongoing
Improved water quantity and regulation	Mostly conservation of paramo and natural forests, but also some improved agriculture measures	Pimampiro, Ecuador	Ongoing
Reduction of sediments and improved water regulation	Mostly conservation of existing forests and prevention to conversion	Platanar, Costa Rica	Ongoing

Figure 3

Land-based proxy commodities for watershed services



The main (land-use based) proxy commodities used for PWS schemes in developing countries are:

1. Improved land practices

These practices, which are often proposed by project planners as ways to ensure the environmental service while generating medium- to long-term on-site returns to the farmer, include:

- Improved agricultural practices (alternatives to slash-and-burn, soil-conservation land techniques, organic farming or low pesticides; integrated pesticide management). Examples include the orange orchards project in Meijiang, China; and San Pedro Norte in Nicaragua.
- Agro-forestry (including shade-grown coffee). Examples include the PSA in Costa Rica; Sumberjaya in Indonesia; and Jesus de Otoro in Honduras.
- Improved ranching management (including silvopastoral schemes). The main example here is the Silvopastoral programme of projects in Colombia, Costa Rica and Nicaragua.
- Sustainable forest management. The largest example is the Forest Ecological Compensation scheme in China.

This is the most common approach in both local and national initiatives, applying to 24 of the ongoing local schemes, seven of the advanced proposals and four of the national programmes.

2. Reforestation for commercial plantations

Although reforestation could be considered as a sub-category of improved land practices, it is categorised separately here as it might not always represent an improvement for watershed services, particularly where monoculture and use of exotic species are involved. Depending on local circumstances, reforestation can help to reduce sediments and improve access to NTFP. Fast-growing species, however, can result in reduced water flows, which could be a problem in dry areas. The process of reforestation, like other changes of land use, can also be highly disruptive.

Reforestation is less commonly used than improved land-management practices and rarely as the sole activity. Six national schemes, including the two schemes in China, and the Costa Rica PSA scheme, promote reforestation. At the local level, 11 schemes include reforestation. It is notable that only one (Tarija) of the eight advanced proposals is likely to involve payment for reforestation, suggesting that concerns about the environmental and social impacts of this type of land use have reduced its appeal to PWS scheme promoters.

3. Conservation and protection of existing ecosystems

This category refers to the prohibition or restrictions of use of existing ecosystems. For example, avoiding conversion of forest to other land uses, protection of riparian areas and protection of strategic water-recharge areas. Such activities are reported in 23 ongoing local schemes and three national programmes. Key examples at the national level are the Payments for Environmental Services scheme in Costa Rica, where over 80% of payments are for forest conservation, and the Payments for Hydrological Services in Mexico, which is based entirely around the conservation of forest. In the case of Costa Rica, the high emphasis on conservation also reflects farmers' preferences as conservation implies lower initial investment than other activities such as reforestation or agroforestry. The national schemes in Guatemala and Colombia are also aimed at forest conservation, but they are less directly linked with payments to forest landholders. Schemes at the local level focusing on conservation include all watershed projects in Costa Rica (hydroelectric projects CNFL, Platanar, Energía Global, ICE, and La Esperanza, and water-based companies ESPH and La Florida), which aim to increase or protect forest cover as means to reduce potential sedimentation and reduce flash floods, Pimampiro in Ecuador, and Los Negros in Bolivia.

Interestingly, only one of the eight advanced proposals (Tarija) specifically contemplates payments for forest conservation. This suggests a shift in focus of

the promoters of PWS away from forest conservation to broader land-management issues, although the sample of proposals is too small to draw firm conclusions.

4. Rehabilitation of degraded ecosystems for protection

This refers to the promotion of activities leading to recovery or rehabilitation of degraded ecosystems that will provide environmental services. These recovered areas will be protected afterwards and productive land uses prohibited (hence the difference from agroforestry). Incentives are given to support restoration costs. In some cases, there can be a flow of payments for protection afterwards. In other cases, they can be given to comply with legislation requirements (for example, where initial conversion was illegal). Schemes promoting this approach include PCJ in Brazil, where farmers are being given assistance (or one-off in-kind payment) to restore riparian forest.

4.3 Supply: who is being paid?

There are five main categories of supplier being paid in ongoing national and local schemes:

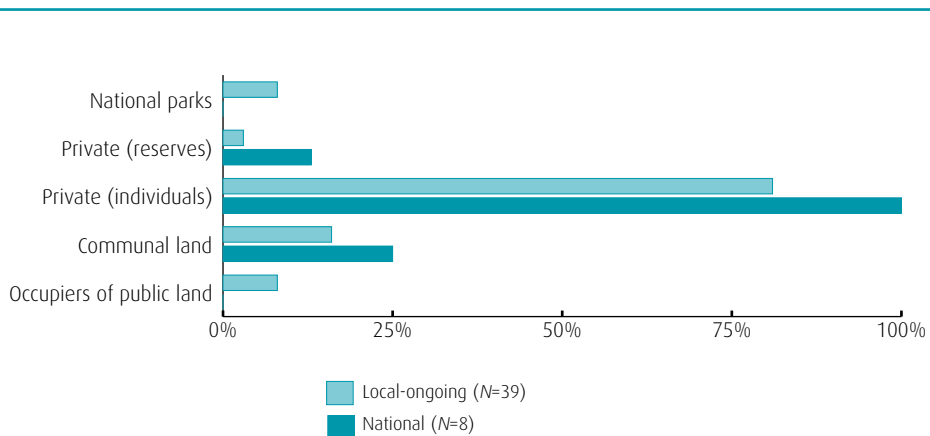
- *Private landowners.* They have clear ownership of their land, with either land titles or undisputed informal possession rights.
- *Private reserves.* Private entities (individuals or groups) registered as reserves and committed to conservation of specific ecosystems. This category is especially used in Costa Rica, where reserves (registered as private individuals, associations, or NGOs), receive payments for environmental services (i.e. in the case of La Esperanza, Rojas and Alyward 2002).
- *Informal occupiers of public lands.* This group consists of farmers living on public land (often land that has been designated as a national park or has some protected area status even if poorly enforced). In some cases, farmers may have long-standing informal rights to the land and are in dispute with the government. One example is the FONAG water fund, which focuses on the Cayambe Coca and Antisana Reserves where landowners lost their land title when these reserves were created but were never compensated (Echavarría 2002).
- *Communal landholders.* Farmers living or drawing their livelihoods from communal land. This includes the *ejidos* in Mexico, where forestland is mostly communally owned.
- *Government or NGO managing protected areas.* Most schemes in this category deal with land owned (or managed) by the government for conservation, some located along buffer areas of national parks. Cases where a national park receives payments include El Imposible in El Salvador; Cerro San Gil in Guatemala; and Cuenca in Ecuador, where funds collected through user fees are also used to help administer the Cajas National Park located in the upper parts of the watershed.

Most ongoing schemes target private landowners as their main suppliers (Figure 4). All but one of the national programmes involve private landowners as the main target group (in the PSA in Costa Rica this includes private reserves). This reflects the need for security that those paid can control the land and hence deliver the service. The exception is the Mexico National PSAH programme, where most forestland is held communally (see Box 3). There can be some flexibility about land tenure in local schemes because there is greater knowledge and trust about informal land rights. Other forms of land tenure are less common in national programmes, with only the WfW scheme in South Africa involving public lands.

The inclusion of various types of land tenure is more common in local schemes, where monitoring and adapting to local conditions is easier. Although private landowners are the most common type of supplier, other categories such as communal landholders were identified (five ongoing and three cases proposed), and occupiers of public lands (three ongoing and two proposed). Most generally, these types of tenure tend to include many people, usually grouped as communities, making management of the scheme harder. For example, over 700 farmers are farming land inside the Makiling Forest Reserve. The University of the Philippines in Los Banos manages the reserve, and is shifting its efforts from eviction to promoting active participation of the informal occupiers in land management. The FONAG project in Ecuador works with 27,000 people in small communities located in the Cayambe-Coca and Antisana Ecological Reserves.

Figure 4

Participants in markets for watershed services: payment recipients



Note: Excludes Lake Toba and San Jeronimo (no payments to landholders/suppliers).

Dealing with common property in Mexico

Current land tenure in Mexico is based on agrarian reform more than 70 years old. At that stage, large private estates and public land were redistributed among organised groups of peasants in an institutional arrangement involving both individual plots and common property areas. These arrangements are known either as *ejidos* (which include more individual plots), and *agrarian communities* (mainly common property). Reforms introduced in 1992 granted *ejido* members more clearly defined individual property rights for their plots, making them almost private property. Because it is under common property that most forests are owned, their land tenure rules have important implications for the design of PSAH.

Initially the PSAH considered two options for dealing with *ejidos*. The first option involved direct payments to individual owners in proportion to the percentage of rights over the benefits from the commons stated in their land title. This would have the advantage of directly compensating households for bearing the costs of limiting timber and firewood extraction, as well as their restraint in expanding the agricultural frontier over the forests. In the second option, payments would be given to the entire collective through their representative and executive body called the *Comisariado Ejidal*. In this case, the entire Ejido Assembly would decide what to do with the resources, either directly or through the guidelines given to their *Comisariado*. The second option was chosen by the National Forestry Commission (CONAFOR) under the argument that it had more legal support for the idea that the owner of the forest is the Ejido, not the individuals.

Source: Muñoz-Piña *et al.* 2005.

4.4 Demand: who is paying for watershed services?

It is important to make a distinction between payment for delivery of the service and financial support for the establishment of the payment scheme. Contributions for the latter often come from national and international sources.

The most common sources of funding in payment for watershed services are:

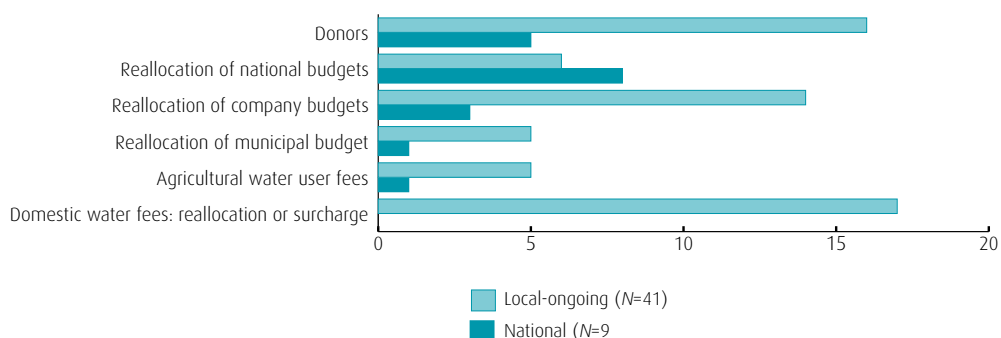
1. Government: Re-allocation of (national and local) government general budget.
For example, the Mexico National PSAH, which relocates money from irrigation to forest conservation; both China national projects; part of the funding for the Plan Verde in Colombia; and the WfW in South Africa.
2. Private sector, including:
 - Voluntary contributions from private sources (hydroelectric projects in Costa Rica, brewery), including contributions from parastatal groups;
 - statutory requirements for industry contributions to watershed management (Watershed Rehabilitation Fund, the Philippines).
3. Water user fees
Reallocation of water revenues or surcharges on domestic or agricultural user fees (environmental fees in Heredia, Costa Rica, Juntas de agua in Central America), including user associations charges (Cauca Valle in Colombia).

4. Donor funds in the form of international grants (GEF, GTZ, SDC, IFAD, etc.) and loans (World Bank).

Figure 5 shows the sources of funding for national and local schemes. National programmes are mostly funded through reallocation of general budget (eight cases) and donor funding (five cases), including loans from the World Bank (Costa Rica, Mexico and El Salvador). The sources of funding are more varied at the local level. Donors still fund a significant number of schemes, mostly to cover start-up costs, but in some cases contribute to the payments themselves (such as the national programmes in Costa Rica, Mexico, and Los Negros, Bolivia). Earmarking of water revenues or surcharges on water fees (domestic and agricultural) are used in 17 local schemes, and reallocation of general budget from private sector and municipalities are used in 14 and five cases, respectively. Allocations from national budgets also complement funding sources for several local schemes in Mexico and Costa Rica.

Figure 5

Sources of funding for national and local schemes



Note: Funding can come from several sources so totals exceed the number of schemes.

Unfortunately, there is insufficient information to assess the relative importance of the contributions from each source. However, in most cases where information exists, the private contributions are relatively small compared to the other sources of funding such as donors or public resources. This raises questions about the financial sustainability of the initiatives.

4.4.1 Re-allocation of (national or local) government budgets

National or local government agencies may act on behalf of water users and allocate funds to payments for strategic watershed services.

Reallocation from central government is the main source of income in all but two of the national programmes (the Philippines watershed rehabilitation fund, which relies on raising funds from the private sector or parastatal companies; and Ecoservicios in El Salvador, which so far has been funded by a World Bank loan with a view to leveraging private sector payments in the future). National-level programmes, like the PSA in Costa Rica or the PSAH in Mexico, have annual government budgets allocated for payments for environmental services. In Costa Rica, the main source is the 3.5% of collections from a 15% tax on fuels. In Mexico, a fixed amount of approximately US\$18 million per year, taken from a fee charged to bulk water users, is allocated to the PSAH (Munoz-Piña *et al.* 2005).

The disadvantage of public funding is that there is the risk of changes in priorities when new governments take office. For example, the Payments for Environmental Services scheme in Costa Rica has been changed several times, and pledged amounts have not been always delivered (A Saenz, FONAFIFO, personal communication 2007).

The timing of allocation and required expenditure of government funds is not always compatible with the most effective operation of the scheme. Requirements to spend budget allocations before the end of the financial year can lead to implementation problems. During the first year of the Mexican PSAH, the management unit had very few personnel to cope with a demand exceeding three times the available funds, and only had two months between publication of operational rules and the deadline to accept the 2003 beneficiaries of the programme (Braña 2004).

Also, there may be resistance from government sectors to the use of innovative mechanisms different to their standard practices. In a recent workshop in Kenya, looking at possible incentives to promote soil and water conservation in the Tana Basin,¹⁰ The Kenyan government heavily discouraged the use of cash incentives because it feared that its use might undermine the current system for promoting soil and water conservation based on technical assistance, and might raise expectations.

For local schemes, there is greater reliance on user fees (discussed below), so reallocation of budgets is less common as the sole source of funding. In Kulekhani, Nepal, the local government agreed to earmark a share of the hydropower royalty it receives through the central government from the Nepal Electricity Authority for an Environmental Services Management Special Fund. This is being used to support conservation and development projects proposed by the upland people of the watershed (Upadhyaya 2007). Other local schemes combine funding from local

10. Stakeholders' discussion during the Green Water Credits Workshop in Nairobi, 11–12 October 2006. This project is only at the stage of very early feasibility studies and is not included in the review. However, insights from the Workshop are useful as they overlap with those for the Western Kenya Integrated Ecosystem Project.

government budgets with private-sector investment, for example the three local schemes in Costa Rica involving hydroelectric companies, or more rarely with user fees, the only example being San Pedro del Norte, Nicaragua.

National programmes in some cases support existing local schemes. For example, the Coatepec municipality in Veracruz began negotiations to establish a trust fund in 2001. A small payment scheme to avoid further deforestation in riparian areas was introduced in 2002 with funds collected through a water user fee. Later on, funds from the national PSAH have allowed the municipality to extend payments to a larger area of forest beyond the strategic areas. In Valle de Bravo, Mexico, an NGO (Pro-Cuenca Valle de Bravo) began in 2000 to gather voluntary contributions to finance projects aiming to conserve the forests and rivers of the region. Subsequently, it began to access funds from the national PSAH.

4.4.2 New sources from the private sector

Company donations

The response from the private sector has been slow in terms of commitment of significant funds. Moreover, some of the most significant contributions have come from parastatal energy companies or water utilities rather than fully private companies. In some cases, private and parastatal water users are already paying taxes or royalties to government for the use of the resource. For this reason, they have been reluctant to make additional payments to upstream farmers and landholders. This was the argument made by the Nepal Electricity Authority for not making additional payments in the case of Kulekhani (Upadhyaya 2007).

Fourteen local schemes and three national programmes receive money from private and parastatal companies to fund watershed programmes. In most of these cases, the cost is not transferred to the final consumers. Instead, the funding comes from the company's profits and is usually registered as a "donation" (in many cases implying a tax concession) in their annual budgets. The public relations and goodwill motive for companies may be as important as their interest in the provision of the environmental service. In the Philippines, the company Kanla-on Spring Water Plant (KSWP), draws water from springs that can be traced to the innermost strict protection zone of the park. Its business therefore depends on the maintenance of the water quality in the watershed. The company fears that continual degradation of the forest is resulting in losses, and is investing in reforestation and local training. In all the hydroelectric projects contributing to the PSA in Costa Rica, funding for payments comes from the companies' general budgets and is not added on to the price charged to consumers. This is because prices of electricity are regulated by government.

Statutory requirements for industry contributions

Three national schemes receive funds as a result of externally imposed regulations and requirements. In the Philippines, hydroelectric companies pay a fee for watershed protection. These funds are not earmarked and therefore the link between user and provider is weak. A new law in Costa Rica (*Canon del Agua*, approved in February 2006, to be applied in stages) will enforce compulsory payments for all raw water users (including irrigation and hydroelectricity). Current payment levels for water are very low and do not even reflect delivery costs. Approximately 20% of new funds collected will be transferred to FONAFIFO, to be channelled as payments for environmental services in the watersheds where they are originated. The Plan Verde in Colombia establishes watershed management contributions from hydroelectric and agricultural users.

4.4.3 Water user fees

Domestic water users

In 17 local schemes funding for payments comes from fees charged to domestic water users. In some cases, (at least seven) the PWS part of the water user fee is clearly additional, in the form of a surcharge. A percentage premium is added to the final water bill (for example, 20% in Pimampiro, Ecuador, or 5% in Cuenca, Quito), or a flat rate per cubic metre (1.90 colones per cubic metre in the ESPH in Heredia, Costa Rica). In Zapalinamé, Mexico, where contributions are voluntary, water users can select the payment level they want, with contributions varying from 1 to 1,000 Mexican pesos per month. Most users (88%) pay less than 6 pesos per month. Once the amount is chosen, the extra fee appears in the monthly water bill.

In two cases, a share of the water revenues is earmarked for the payments and water consumers are not explicitly charged any extra to fund the payment scheme. One such case is PCJ in Brazil, where the municipalities in the watersheds of the rivers Piracicaba, Capivari and Jundiá (PCJ) formed an Inter-Municipal Basin Committee to manage a watershed protection fund, pooling contributions from the budgets of the municipal water utilities. The water utility of Piracicaba contributes R\$0.01 per m³ of distributed drinking water. The other case is Maasin in the Philippines, where the water utility is required by law to pay 1% of its gross revenues to the Maasin local government in the upstream part of the watershed.

In the other eight schemes, the distinction between earmarking and surcharge is not clearcut. For example In some of the schemes, promoted by PASOLAC in Central America, in particular, Jesus de Otoro (Honduras), San Pedro Norte and Esteli in Nicaragua, the allocation for payments has been agreed as part of a process of negotiating an increase in the water user charge.

Some user fees are introduced after consultation with the local population to establish willingness to pay, but their final amount is more a reflection of the policies of the water utility and the estimated costs of watershed protection. In some cases, user fees are ultimately determined by an independent regulating authority (such as in the ESPH in Heredia, Costa Rica). In a few cases, they are the product of intense negotiation of local stakeholders to determine a politically acceptable level both of the water use fee and the proportion that can be allocated to the payments upstream (for example, the municipality of Jesus de Otoro in Honduras).

Water utilities that belong to the public sector depend on political will, which can easily change, with different administrations threatening the long-term sustainability of the initiatives (Yaguache Ordoñez, personal communication, 2005, Pimampiro, Ecuador). The creation of these user fees is easier for water utilities already providing a good water service, with acceptable quality and distribution system (ESPH, Costa Rica). End-users can actively decide to contribute, as in Fidecoagua in Mexico where, after a period of serious drought, the mayor asked for voluntary contributions (pers.comm. Contreras-Lopez, 2005). In other cases, there has been little or no consultation, as in El Imposible in El Salvador, where most water users are not aware of their contributions, because only the projects' representatives and members of governing boards participated in the negotiation of the agreement (Rosa *et al.* 2003).

Where charges for raw water are seen as politically inappropriate (for example, water is considered a right), an environmental fee may be perceived as a first step towards the privatisation of water resources. A clear example of this is in Tarija, Bolivia, where despite evidence of downstream willingness to pay for watershed conservation, the NGO promoting the scheme decided not to pursue a the option of an additional user charge because of concerns about its political feasibility (Robertson and Wunder 2005).

Agricultural water use fees

Even though agriculture is often a major water user, only one national and five local schemes have been identified where agricultural users of water are contributing directly to fund payments schemes.

4.4.4 Grants and loans from international groups

This review has identified 16 local schemes and five national programmes using donor funding. In many cases, donor funding is primarily used to cover the costs of establishing the schemes. In Pimampiro, Ecuador, for example, an initial donation of US\$15,000 from international donors helped to set up a trust fund for the payments for an environmental services scheme. However, significant amounts of donor

funding also go to cover running costs (including the payments) of the schemes, raising concerns about donor dependence.

Two of the five national programmes (Costa Rica and Mexico) have used a loan from the World Bank to partly cover payments for environmental services. Similarly, Los Negros, Bolivia, several of the PASOLAC supported schemes in Central America, and some of the RUPES pilot projects in Asia (RiverCare in Sumberjaya) have used an initial donor grant to cover payments to farmers while local sources are firmly established. It remains to be seen whether and to what extent these schemes can be self-supporting.

In some cases, the payments are financed from donor funds but are not intended to be permanent. The payments made in the Silvopastoral schemes in Costa Rica, Nicaragua and Colombia are entirely covered by funds from the World Bank and GEF, but this is a demonstration project and the payments are not intended to be permanent but to cover the costs of transition to improved practices. It is expected that after the transition period these improved practices will be self-sustaining financially. In one case, Fuquene, Colombia, seed capital from GTZ provides the collateral necessary for commercial banks to approve loans for improved agricultural practices.

Several more projects, involving considerable donor support, are in the pipeline (Table 9).

Table 9

Environmental service schemes with support from the World Bank, GEF and German cooperation

Country and region	International cooperation contribution (US\$ millions) ¹	Description
Costa Rica (Ecomarkets)	World Bank: 32.6 GEF: 8 KfW: 12.7	Effective 2001. Supports PES programme. (German cooperation focusing on reforestation/carbon in northern region)
Silvopastoral Ecosystem Project	GEF: 4.5	Effective 2002. Piloting PES to promote adoption of silvopastoral practices
South Africa: Cape Action Plan for the Environment	GEF: 9	Effective 2004. Uses PES to conserve the Cape Floristic Region
Mexico: PSAH	World Bank: 45 GEF: 15	(Approved in March 2006.) Will strengthen and increase efficiency of the country's PES system and develop new financing sources

Kenya: Agricultural productivity and sustainable land-management project	World Bank: 4.1 GEF: 4.5	Will pilot use of PES to reverse land degradation, and promote income-generating activities for rural farmers and to contribute to improved rural water quality. ICRAF provides technical assistance
Costa Rica: mainstreaming market-based mechanisms for environmental services	World Bank: 30 GEF: 10	(Under preparation.) Will ensure long-term sustainability of the PSA programme by developing new financing sources and improve the programme's efficiency
Venezuela: Canaima National Park Project	GEF: 11	(Under preparation.) Will use payments from HEP producers to support conservation of Canaima national park
Panama: Rural poverty and Natural Resource Management II	GEF: 6	(Under preparation.) Will use PES to improve biodiversity conservation and generate water services
Honduras, Biosphere Reserve Rio Platano	KfW and GTZ ² : 11.5	Shade-grown coffee, improved cattle pastures. Other agencies: Corporación Hondureña de Desarrollo Forestal
Colombia/Rio Magdalena Watershed	KfW ² : 28.1	Reforestation, protection of existing forests, sustainable forest management. Working with Federación Nacional de Cafeteros de Colombia
Ecuador/Cordillera Chongón-Colonche	KfW ² : 9.6	Reforestation, enrichment planting, shade-grown coffee and cocoa, improved pastures and communal forest control. Together with Fundación Natura
Ecuador/Biosphere Reserve Gran Sumaco	GTZ, KfW ² : 9.6	Shade-grown coffee and naranjilla, improved pasture, reforestation. Together with Ministry of Environment
Peru Jaén – San Ignacio Bagua	GTZ, KfW ² : 6.4	Shade-grown coffee and cocoa, reforestation. Together with Instituto Nacional de Desarrollo, and a local project in San Ignacio
Paraguay/central and eastern region	KfW, GTZ ² : 9.6	Soil conservation, reforestation, natural forest regeneration
Dominican Republic/Alto Rio Yaque del Norte Watershed	KfW, GTZ ² : 8.9	Reforestation, shade-grown coffee. Together with the Ministry of Agriculture and DED

1. World Bank financial assistance is in the form of loans and GEF, and German cooperation through grants.

2. Except for the Costa Rica project, none of the projects supported by German cooperation are explicitly called "PES", although they refer to payments to change land uses. In these cases, the PES-type component is integrated into a broader conservation or forestry programme. Sources: World Bank, Environmental Economics and Indicators website; Hartmann and Petersen (2004).

4.4.5 Final consumers (retail sales)

None of the ongoing payment initiatives for watershed services in our sample rely on retail-based trading to provide incentives to landholders, but there are some proposals. The aim is to tap into consumers' willingness to pay for environmentally friendly products associated with watershed protection. Although retail-based trading might not necessarily result in higher prices, it can be a strategy to expand market share (for example, a retail strategy from the brewery La Florida in Costa Rica is the promotion of "the environmental beer of Costa Rica"). This mechanism usually requires certification and labelling from a trusted (independent) group to generate consumer recognition and encourage willingness to pay. A proposal for organic agriculture in Bhoj, India, depends on the possibilities of farmers entering niche organic markets that will either guarantee a higher price or at least a special market for their produce.

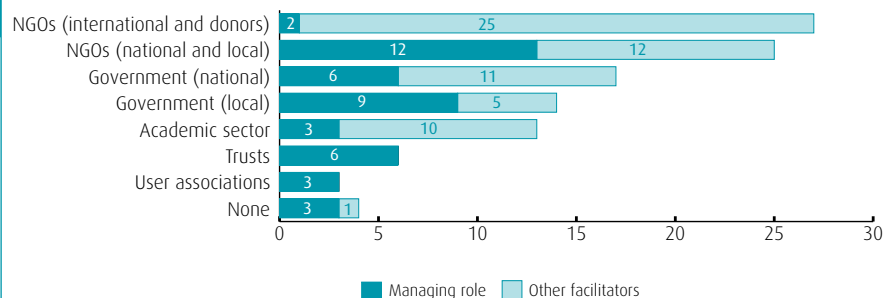
4.5 Linking supply and demand

In the introduction, we highlighted the public-good characteristics of watershed services, which means that there is little incentive for landholders to consider the downstream effects of their land-use decisions. How is it then, that supply of and demand for watershed services come to be linked? Although government intervention has enabled or directly brought about the introduction of PWS schemes in some cases, this is not a sufficient answer for several reasons. Several schemes have gone ahead without government intervention, whereas in some cases it has required active promotion by an NGO or international agency to get uptake of a government scheme. For example, in the Sumberjaya scheme, government made the legislative change, allowing farmers to get land tenure in exchange for undertaking certain land-management activities, but it was promotional and capacity-building activity by RUPES that enabled the scheme to gather momentum and get a much larger group of farmers on board. There are also situations where other government legislation works against the operation of PWS but schemes are still introduced. It is also necessary to ask what leads governments to make the legislative changes required to establish a PWS.

In reality, a wide range of entities, governmental and non-governmental, academic and financial, are involved in the genesis and subsequent operation of the schemes. Figure 6 shows that fewer than half of the local schemes (for which information is available) are managed by governments whereas most are managed by NGOs, user associations, trusts and academic institutions. Moreover, most of the schemes involve a range of other facilitators in other roles.

Figure 6

Facilitators and their roles in ongoing local schemes



n=40

Note: Excludes Lake Toba.

4.5.1 The role of legislative change

National schemes

In six cases, the national programmes have been accompanied by a legislative change, enabling payment or compensation for environmental services as in Costa Rica and Mexico, or creating obligations for water users to contribute to watershed management, as in the Philippines (Table 10). The other three schemes have been introduced without a separate law or decree on environmental services, as part of a more general forestry programme (Guatemala and Colombia) or in response to a specific problem of alien invasive species (Working for Water, South Africa). It is notable that in most of these cases the legislative or policy change is related to forestry either to recognise environmental services in the forestry law or to provide for forest incentives in national programmes. The role of agriculture and other ecosystems in providing watershed services has had relatively little recognition in the national schemes.

Local schemes

For local schemes, the situation is more varied. In Costa Rica, the recognition of environmental services in the Forestry Law set a framework for the introduction of subsequent local schemes. However, many local schemes have been able to proceed without changes in the law at national level, and in some cases without changes at the local level. Most local schemes set up without links to a national scheme usually require some specific changes to municipal legislation to allow the introduction of additional fees for water users, or the investment of water revenues or municipal tax revenues in watershed management (particularly if the areas where action is required fall outside the municipality's territory, for example PCJ), and the creation and management of an environmental fund (Box 4).

Table 10

Legislation underpinning national programmes for PWS

Scheme	Legislative change
China – Forest Ecological Compensation, Sloping Land Conversion	Forest Law (1998) and the Water Law (2002) formally recognise the importance of compensation for environmental service provision
Colombia – Plan Verde	Launched in 1999 as part of the National Forestry Development programme
Costa Rica – Payments for Environmental Services	Environmental services explicitly recognised in the Forestry Law No 7575 of 1996
El Salvador – Ecoservicios	Executive Decree 50 (draft) contains specific rules about environmental compensation
Guatemala – Direct Forestry Assistance Pilot programme	Forest conservation incentives are part of the National Forestry Incentives Programme, set up under the Forestry Law 1996 (rather than a separate law or decree)
Mexico – Payments for hydrological environmental services (PSAH)	Environmental services incorporated into the Federal Forestry Law
The Philippines – Watershed Rehabilitation Fund	Electric Power Industry Reform Act, 2001 stipulates that a levy on electricity sales must be paid to the financial benefit of the host communities
South Africa – Working for Water	Launched in 1995 as a programme administered by Department of Water Affairs and Forestry without the need for additional specific enabling legislation

Introducing a change in municipal legislation to accommodate PES can be time-consuming because of the need to negotiate with water users and farmers, and because of changes in government. In Tacuba, El Salvador, discussions on PWS began in 2002. Four years later, although water users were being charged, PWS was still not fully incorporated in a municipal regulation and landowners were not being paid, even though they had taken measures to protect the water source (Marin 2006).

In other cases, the schemes have gone ahead based on agreements between facilitating organisations and the main water users. For example, the scheme in Zapaliname, Mexico, which involves voluntary payments, does not appear to have involved any change in municipal legislation, but has evolved as a result of the national PSAH programme. One of the longest running schemes, in Cuenca, was introduced within existing regulations and without involving national government. The municipal water utility has been making a surcharge on the water bill for watershed management since 1984.

Municipal legislation on PWS

- The municipalities in the Piracicaba, Capivari, Jundiaí Consortium in Brazil, had to pass legislation to allow funds raised from a percentage of their water revenues to be invested in forest restoration projects managed by the Consortium in the whole of the watershed (Viana *et al.* 2002).
- In San Jeronimo, Guatemala, water users were invited by the municipal government to participate in discussion on a new municipal regulation on sustainable management of water to provide for PWS and regulate the use of water for irrigation and industry.
- Jesus de Otoro, Honduras: the local NGO Council for Administration of Water and Sanitation (JAPOE) began discussing the possibility of PWS with local farmers in the Cumes watershed. A municipal regulation in 2002 covered the creation and management of an environmental services fund with a specific reference to the micro-watershed of the Cumes River but with the flexibility to extend to other watersheds as necessary. The regulation also assigned responsibility for managing the fund to JAPOE.
- Pedro Moncayo, Ecuador: a municipal decree allocated a share of the water charges to a watershed management fund to implement the proposed payment scheme.

FONAG, in Ecuador, was created by an 80-year contract signed initially between The Nature Conservancy (TNC) and Quito Municipal water and sewage agency (EMAAP-Q), and later by Quito Electric Company (EEQ), both municipal companies. No legislative change was needed to set the scheme up. However, on three occasions in eight years, there have been changes in city leadership. TNC has had to invest effort in lobbying the new mayor each time to honour the contract. For this reason, steps are being taken to introduce municipal legislation to institutionalise FONAG and protect it from political changes (Krchnak 2007).

In some cases, introduction of PWS at the local level has been facilitated by changes in other legislation, not specifically related to payments. In particular, moves to decentralise responsibility for environmental management and water and sanitation to the municipal level have facilitated the introduction of PWS schemes. An example is the Los Negros scheme in Bolivia, where the municipality has started to contribute to the scheme.

Legislation conflicting with PWS

In some cases, legislative barriers can prevent PWS from proceeding to implementation. In the Mount Makiling Forest Reserve in the Philippines, negotiations for a PWS scheme have been under way since the late 1990s but without progress to implementation. The University of the Philippines in Los Baños, which manages the reserve, wants to introduce a watershed protection and conservation fee, which would be added on to water bills and channelled to a reserve trust fund. Progress has been delayed because of lack of clarity over the legal authority of the university to levy this new fee. The local government has a clear authority to levy the charge but

would also want to take over management of the reserve. For this reason, this option has not been pursued (Arocena-Francisco 2003).

In some cases, including those where legislative change is made specifically for PWS, a failure to address other areas of conflicting legislation and policy can reduce the scope and effectiveness of PWS. Some categories of water user such as irrigation farmers have often been given free or highly subsidised access to water, in many cases without extraction limits. Introducing a PWS in such contexts means that only a subset of the water users contribute and that the scheme is designed in isolation from water-resource allocation policy. This applies particularly to local schemes. In Pimampiro, Ecuador, the potential for scaling up the pilot scheme is quite limited because the major users, the irrigation farmers, are unwilling to contribute (Echavarría *et al.* 2004).

In a few cases, changes in policy or legislation after the PWS has been in operation may reduce its effectiveness. This has been observed in the case of the Cauca Valley, where irrigation users' associations contribute to watershed management through voluntary fees paid jointly with water use fees. Membership of the associations has declined and consequently there has been a drop in the funds collected. Although this partly reflects economic instability in Colombia, a major factor is the increase in the water use fees made by the regional environmental department which has affected willingness to make voluntary contributions. Until 2005, a 25% discount on water use fees was given to association members but this has now been deemed illegal, further reducing incentives for voluntary contributions (Blanco 2006).

4.5.2 Drivers of change

This diversity of legal and policy contexts in which PWS operate raises the question of what ultimately drives the introduction of PWS, whether through legislative change or without it. What motivates governments or other stakeholders to develop and promote a PWS scheme?

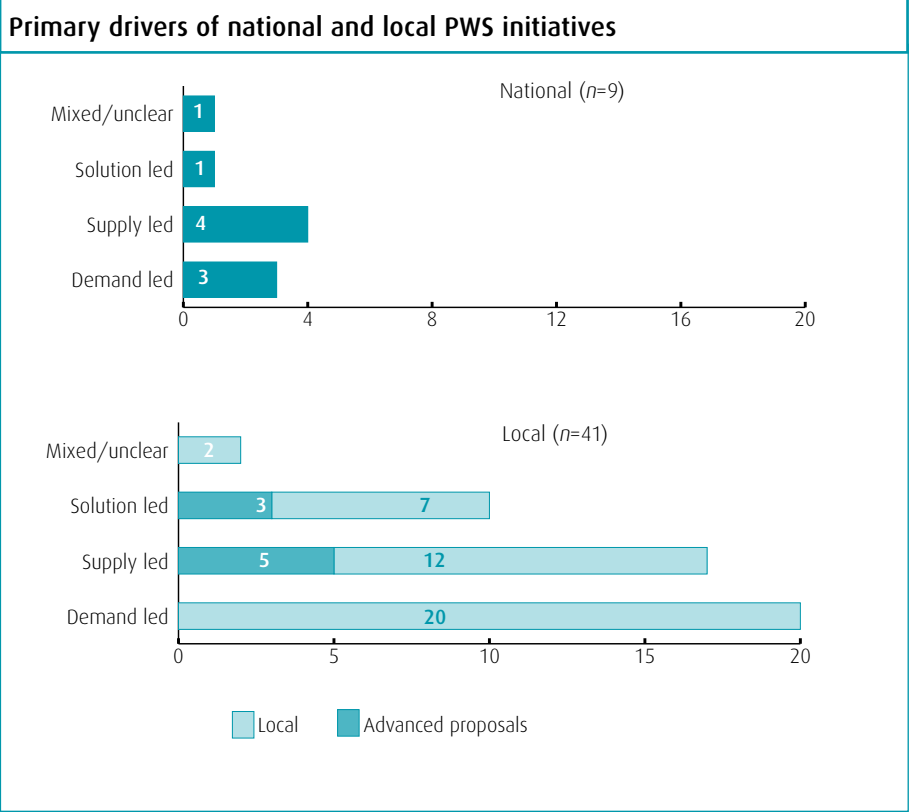
There are in theory two main problem situations leading to promotion of a payments watershed services scheme:

- *Demand led.* There is a problem downstream with water flow or quality, and it is believed that this is related to land-management practices upstream. Payments are seen as a way to give landholders an incentive to change their land-management practices.
- *Supply led.* There are threats to a protected area or natural ecosystems upstream and/or land and resource management is considered unsustainable. Payments from water users are perceived as possible sources of funds for the improvement and protection activities required.

A more recent driver is the promotion of PWS as a solution whereby an external organisation such as a donor organisation or an NGO (including IIED) seeks to identify situations where a PWS scheme might be feasible. These can be considered as solution led.

Determining the main driver for a payment scheme is complex as there is usually some element of more than one. Schemes that are led by water users may reflect considerable promotional efforts by organisations concerned about upstream conservation or land management. This is particularly likely for some of the local schemes in Costa Rica that are linked with the national programme. Supply-led schemes may target areas where there are known to be problems of water supply and quality. Similarly, a solutions-led approach would rarely involve introducing a PWS entirely from scratch. Usually the organisations concerned in choosing where to focus their efforts are looking to build on existing activities and initiatives. Figure 7 presents our judgement based on the information available on the nature of the main driver for each ongoing and proposed scheme.

Figure 7



Just under half of the initiatives can be considered primarily demand led. These include two of the national programmes, Forest Ecological Compensation and Sloping Land Conversion in China where the government has been responding to problems of floods, and of the local schemes, Jesus de Otoro, Honduras, where water users downstream were in conflict with coffee producers upstream about declining water quality.

Fifteen schemes can be considered supply led. They involve the intervention or facilitation of a government agency or a conservation or development organisation seeking to address a resource management problem upstream and seeing PWS as one possible means of achieving this. This applies to the national payment schemes in Costa Rica and in Mexico, both addressing the threat of deforestation, as well as the incipient scheme in Guatemala, where government interest in extending locally managed protected areas and restoring vegetation cover to deforested land is identified as a major driver underpinning the National Forestry Incentives programme. It also applies to several local schemes: for example Los Negros in Bolivia where Fundacion Natura was aiming to prevent further loss of cloud forest; Zapaliname in Mexico where the NGO ProFauna Mexico was interested in increasing the funds available to manage the Sierra de Zapaliname Reserve; and Cerro San Gil in Guatemala where The Nature Conservancy and local partner, FUNDAECO, purchased land in the upper watershed to consolidate the Cerro San Gil National Protected Area and facilitated an agreement with the municipality water utility.

Even the schemes involving cash payments from water users only (the Type D and E schemes in Table 3), have not all been driven primarily by water users. The FONAG scheme, in Ecuador, was promoted by TNC and a local environmental NGO, Fundación Antisana, which proposed it to the municipality of Quito as a way of financing the Condor Biosphere reserve, particularly the Cayambe Coca and Antisana nature reserves (Krchnak 2007).

Many of the international projects are primarily solution driven, in particular the RUPES suite of schemes in Asia, the Silvopastoral programme of the World Bank in Colombia, Costa Rica and Nicaragua, and the local schemes tested in India and Indonesia in the IIED project. In addition, the national programme in El Salvador, EcoServicios, is primarily aimed at creating a national system of PES as a sustainable funding mechanism for conservation.

4.5.3 The role of facilitating organisations

Several players of different types, including national or local government agencies, environmental NGOs, development NGOs and funding institutions, are involved in linking suppliers of watershed services with the service users to enable a payment scheme to develop and operate. They operate various stages of the process from initial stakeholder dialogue to design, implementation and operation of the PWS, and are involved in most PWS. There are very few schemes in our sample where the suppliers and the buyers make arrangements for payment without the help of a facilitator at some stage of the process, and they tend to involve special conditions (see 4.5).

The roles for facilitators are:

- *Between farmers and downstream users.* Their participation could be transitory. The dialogue will help to identify the environmental services expected by downstream users.
- *Programme design.* Feasibility studies, designing the payment mechanism, developing management plans and establishing monitoring systems to ensure the delivery of watershed services.
- *Support to suppliers.* This helps create the technical, social and institutional capacities to implement the land-management practices required by buyers.
- *Administration of the scheme.* Draw up contracts, collect and manage funds, transfer payments to suppliers, coordinate overall monitoring and technical capacity.
- *“Wholesale” managers.* In these cases, a facilitator will take the risk of the intermediation process by buying the environmental services (usually bundled) from landowners. They try to sell these services to different users by pooling demand from local and international sources. This type of intermediary in practice becomes a “first-stage” demand for environmental services. Because of the risk involved, the role of “wholesale” manager is usually taken by a government agency, particularly for national-level schemes.

The roles that facilitators play depend on the type of PWS scheme. Where prices are set administratively at the national level (see 4.6), facilitators are useful to help suppliers deal with local applications. For example, in the PSA scheme in Costa Rica, local organisations (many NGOs, but not all) such as FUNDECOR take on this role. Where prices are determined through negotiation (at the local level), facilitating organisations are needed to create a negotiation forum and to assist the weaker party (usually the suppliers) with the negotiating strategy.

In some cases one group can do several tasks (for example, Fundacion Natura in the Los Negros scheme, Bolivia, has been involved in dialogue brokering as well

as technical advice and scheme administration). Some facilitators can also have a transitory character, for example assisting during the initial stages of a scheme (facilitating dialogue or information) but withdrawing as the scheme gathers strength and other institutions or groups take ownership. In Pimampiro, Ecuador, the NGO CEDERENA helped the local municipality establish the scheme, and then withdrew once it was fully operational. However, it is still uncertain whether the municipality will be able to obtain the additional resources needed to manage the scheme.

No schemes have been identified in our sample where a facilitator operates as a market player, taking on risk by buying watershed services from landowners and selling them on to different users. This reflects the limited market-like nature of the schemes reviewed. The closest example is the Costa Rica national PES scheme, where FONAFIFO pools funds from different sources to pay the landholders and takes on risks associated with managing an investment portfolio/fund. However, it does not use the price mechanism to match up supply and demand and instead rations access to the scheme.

4.5.4 Types of facilitating organisation

In only one national programme (Ecoservicios, El Salvador) has a new institution been created to manage the programme. In all other cases, existing government institutions have been allocated this responsibility. In Mexico, responsibility for administering the PSAH scheme was assigned to CONAFOR, the government agency in charge of forests. Both Chinese national programmes and the Guatemala programme are facilitated by the forest departments in conjunction with local municipalities.

In local schemes, there is more diversity in the arrangements. In 14 cases the main administrator is national or local government. In 11 cases an NGO has taken on this function (seven of which are in Asia). Trusts have been created in six schemes, all of them in Central or South America. The academic sector is only involved in the administration of the Silvopastoral scheme in Colombia, Costa Rica and Nicaragua, reflecting the action-research nature of these schemes, however.

Other facilitation roles apart from management are mostly played by NGOs, international ones in particular, followed by government, national and local, and the academic sector. Such NGOs are usually environmental NGOs, promoting sustainable land use and/or forest conservation, for example Cederena in Pimampiro, Ecuador, Fundacion Natura in Los Negros, and the Mexican Fund for Nature Conservation and WWF in Zapaliname, Mexico.

Non-governmental organisations play a key role in the facilitation of PES schemes. Their experience and knowledge at the local level can help break down

communication barriers between different stakeholders. Personal intermediation by a (independent) promoter of PES can play an important role in motivating and informing landowners, leading to increased participation (for example, Fundecor and Codeforsa in Costa Rica). They have been able to provide continuity to counteract the high turnover of personnel in government agencies. They are also better connected with experiences from other countries and so are able to bring ideas and lessons from elsewhere. In South America, where decentralisation is proceeding fast, NGOs and international donors have been particularly important in supporting local governments in the creation of PES-type schemes. For example, the support provided by GTZ has been crucial in the creation of the Cuencas Andinas project in Colombia, Ecuador and Peru.

In general, facilitators play key roles and are nearly always needed in the design and operation of payments for environmental service schemes. They have a diversity of tasks, and therefore many of the PWS schemes involve partnerships between different types of organisation, government groups (like ministries of environment and water), non-governmental groups, academia and international interest groups. Although government entities play a very important role in addressing the public-good characteristics of watershed services, NGOs are important at the local level as they are flexible enough to respond quickly to local-level conditions, and strengthen the link between providers and users at the local level.

4.6 Payment mechanisms

The linking of supply and demand for watershed services finds its practical expression in the payment mechanism, whereby the agreed amount of payment goes from the users to the providers in return for the watershed services or proxy land-based activities agreed. There are four main issues related to payment mechanisms for watershed services:

1. How are payment levels determined?
2. How are payments transferred from buyers to sellers?
3. What is the unit (cash or in-kind) and timing (one-off, ongoing) of payments?
4. How is contract performance monitored and enforced?

4.6.1 How are payment levels determined?

There are three types of mechanism used for price determination in the schemes reviewed:

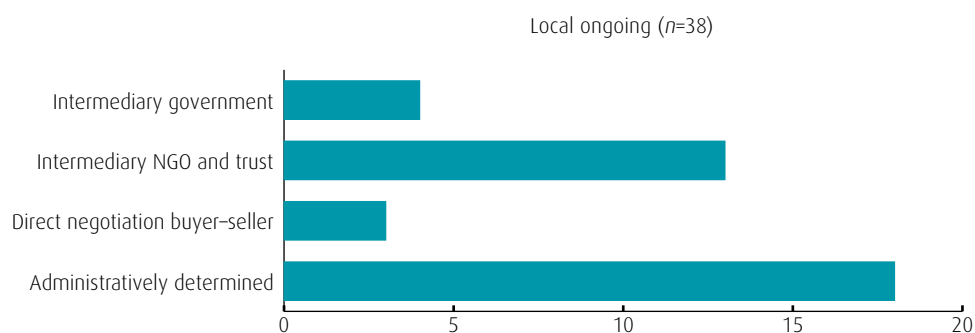
1. Administratively determined (non-negotiable) payments.
2. Direct negotiation between buyers and sellers.
3. Negotiation through an intermediary.

It is not unusual for schemes to have a combination of price discovery mechanisms. For example, in the national PSA programme in Costa Rica, although payment levels to providers are administratively set for the national programmes, payments made by water users are determined through negotiations with FONAFIFO, the government agency administering the scheme. Many of these national-level intermediaries work alongside local facilitators, who help to bridge the final gap with local farmers and water users.

More sophisticated methods for determining payment levels include auctions, but these were not used in any of the ongoing schemes reviewed, nor are they proposed in the advanced proposals. Differentiated payments based on opportunity cost of land, or quality of the environmental service provided obtained through auctions, have been proposed for the Costa Rican or the Mexican national programmes, but at the moment they still remain theoretical. In an auction system, farmers make bids specifying the payment level they would be willing to accept. In so doing, they reveal their opportunity cost, enabling the desired amount of land in different locations to be brought into a scheme at least cost. Auctions are more popular in developed countries such as the USA or Australia where controls are stricter. An example of auctions is the Conservation Reserve Program in the USA, which encourages agri-environmental objectives through “retiring” land from production using fixed contracts (Ferraro 2008).

Figure 8

Mechanisms for determining payment levels to suppliers in local schemes



Note: Excludes Lake Toba and San Jeronimo (no payments to landholders) and Morazan (no information). Some level of negotiation between buyers and sellers is still implicit in most mechanisms, even those administratively determined.

a. Administratively determined (non-negotiable) payments

In this type of approach, the authority administering the scheme determines the payment level, in some cases after conducting studies of opportunity costs for landholders or of water users' willingness to pay (see Box 5). Although there is some stakeholder consultation and lobbying by different interests, there is little negotiation directly with landholders or water users. If the number of applications from landholders exceeds the funds available at the fixed payment level, there is no adjustment of the payment level as in a market system. The allocation of funds to landholders is done a first-come first-served basis or the ability to meet certain criteria. This approach to determining payment levels has been used in most of the national-level PWS, where it is not practicable to conduct negotiations with all the landholders in the scheme. Local schemes have a wider range of mechanisms to determine prices, although administratively based decisions count for 40% of cases reviewed.

Box 5

Determining payment levels in Heredia, Costa Rica, and Los Negros, Bolivia

The Heredia PWS project in Costa Rica used a combination of opportunity cost to estimate "capture values", and substitutes costs to estimate the cost of protection and recovery of forest. These values suggested an upward revision of 7.59 colones per cubic metre as a water fee (*tarifa hídrica*). The national regulating body authorised an increase of 3.8 colones per cubic metre.

A 2003 survey in Los Negros, Bolivia, showed that 70% of downstream farmers would be willing to pay collectively approximately US\$12,500 – 19,700 per year, equivalent to a contribution of approximately 2% of average household income for each family (Robertson and Wunder 2005). It took some time to overcome mistrust, and by 2007 the municipality (in representation of downstream users) was covering part of the project costs ((Asquith and Vargas 2007).

All but one of the national schemes involving payments to landholders have administratively determined payment levels, leaving little scope for farmers to negotiate them. The exception is the incipient national Ecoservicios scheme in El Salvador, where there have been negotiations between government and local stakeholders but only in the context of a local pilot project.

The three national schemes involving payments from water users, have administratively determined transfers from electricity or water charges (for example Colombia, Box 6).

Several local schemes involving payments to landholders appear to have administratively determined payment levels with little prior negotiation. For example:

- Five local schemes in Costa Rica, which have simply adopted the payment levels of the national scheme with which they are linked (CNFL, Energía Global, ESPH, La Florida, Platanar).

Determining contributions from hydroelectricity producers in Colombia

The Plan Verde national government forestry programme in Colombia aims to increase forest cover and rehabilitate micro-watersheds. The programme is managed by Regional Environmental Management Corporations (Corporaciones Autonomas Regionales, CARs), which are decentralised bodies of the Colombian Ministry of Environment. Among other sources, the CARs are financed by transfers from the hydroelectric sector. A 3% share of the returns from electricity sales is directed to their budget for investment in environmental protection in general and of the watershed in particular. Half of the amount received (in 1994–2000 this amounted to US\$ 135 million) must be channelled to protection of watersheds where energy is generated, following the watershed management plans. However, it has been highlighted that a large portion of these funds is spent on administration costs and other activities not related to watershed investment (Quintero and Estrada 2003).

- The three silvopastoral pilot schemes in Colombia, Costa Rica and Nicaragua have payment levels determined on the basis of studies of costs of adopting alternative management practices.
- In Pimampiro, Ecuador, the municipality and the local NGO designing the project determined payment levels without any prior examination of opportunity cost. The formula was simple: available monthly funds collected from user fees divided by the total area they wanted to target. Payments were slightly adjusted by the degree of degradation. For example, primary forests and páramos get \$1 per hectare, whereas intervened landscapes receive less than that (Echavarría *et al.* 2004). Studies of opportunity costs conducted after the payment scheme had been implemented provide more formal support for the price levels set (Ordóñez and Puglla 2004).

b. Payments based on negotiation

Payment terms and levels can also be determined through negotiation either directly between buyer/water user and supplier or more commonly through an intermediary. Negotiations address contract details outlining land-management practices in exchange for agreed payments (cash or in-kind).

Direct negotiation. There are no examples of direct negotiation in national programmes and relatively few cases of direct negotiation in local schemes (four ongoing schemes and two advanced proposals). Direct negotiation is mostly used in situations when there are few stakeholders involved such as La Esperanza in Costa Rica and San Pedro del Norte, Nicaragua (Box 7).

Negotiation through intermediaries. Almost half of ongoing local schemes rely on negotiations through intermediaries (48%) for price discovery, almost equally distributed between NGOs, trusts and government entities (local and national). In Los Negros, Bolivia, negotiations between farmers and downstream users were facilitated by the NGO Fundacion Natura to establish the “exchange rate”

of beehives for forest, with final agreement on 10 hectares of primary forest, but also allowing for different amounts for intervened forests. Initially, most of the negotiations took place between the farmers and the intermediary, who in turn tried to raise trust with downstream users. Until now, downstream irrigation groups have been unwilling to commit, but the local municipality has agreed to contribute to the scheme on their behalf (Asquith and Vargas 2007).

Box 7

Negotiations and conflict resolution in San Pedro Norte, Nicaragua

In this scheme, the local municipality, supported by PASOLAC, entered negotiations with local farmers to introduce alternatives to deforestation and slash-and-burn agriculture (including stone ditches and barriers). At this pilot stage, five farmers, covering 18% of the critical area, receive approximately US\$25 per hectare per year. So far, promoters of the agreement are satisfied with the benefits received, both environmental (increase in availability of water in creeks and natural springs), and social (conflict resolution). This initiative has been proclaimed as a highly participative model, involving many local stakeholders (institutions and civil society). The municipality is currently trying to raise available funds to include five additional farmers located in the critical areas. Source: Pérez (2005); Velazquez-Pereira (2005).

4.6.2 Mechanisms for transferring and managing funds

As well as agreement on the amount of payment to transfer, there has to be a decision on how funds will be managed and transferred among stakeholders. These mechanisms vary according to their degree of complexity and in our sample include:

- a. Direct payments from buyer to seller eliminating the need for management of funds by an intermediary.
- b. Payments through intermediaries, with the implication that funds have to be managed by the intermediary (including trust funds).

a. Direct payments from buyer to seller

Service users can make direct transfers to the providers. The conditions are usually the same as for direct negotiation of the payment level, that is, few providers and usually one main downstream user. These conditions are found only in local schemes, and all national PWS schemes in our sample require some level of financial intermediation.

However, some local schemes involving administratively determined prices also have a simple transfer mechanism for the payments. A requirement in this case is that the user has the financial and technical capacity to administer payments. So far, there are only seven ongoing local schemes where payments go directly from the service user to the service provider. Two of these cases are hydroelectric companies (ICE and La Esperanza in Costa Rica), and the others are local water utilities (usually managed by the municipality): ESPH in Costa Rica, El Imposible in El Salvador, Campamento and Jesus de Otoro in Honduras, and Pimampiro in Ecuador. Such organisations have systems for collecting and managing funds from electricity and /or water consumers and this gives an important advantage. For example, the ESPH

in Costa Rica collects payments from end-users through a surcharge on the water bills. The money related to the surcharge is placed in a separate Environmental Fund. Payments are subsequently transferred from the fund directly to the farmers, without the need to go through an intermediary like FONAFIFO.

b. Payments through intermediaries (including trust funds)

In all other local schemes reviewed which involve payments to suppliers and for which there is information available (30), contributions are transferred through intermediaries. These manage the funds and make the payments. Their role is particularly important when the existing water user does not have the financial ability or willingness to manage the payments, or when there are several users. For example, the CNFL in Costa Rica relies on the national intermediary FONAFIFO to allocate payments to farmers rather than engaging in activities that are not core to its business objectives.

Environmental funds are emerging as an important type of intermediary in PWS. When payments come from different types of source at different scales of time (for example, annual lump sums, monthly payments from users or one-off grants from donors), it becomes necessary to establish a fund to pool the different sources of finance. Separate funds, with defined legal structure, are also preferred by donor agencies to ensure sustainability of funds.

The PWS schemes reviewed differ in their legal and financial structure (see Table 11). In terms of their legal structure, several schemes have been set up as trust funds with legal separation from the finances of the host organisation. Trust funds are separate accounting entities, with a designated trust fund manager, or executive coordinator). This ensures scope for financial planning without interference from the host organisation. In some cases (for example Cuenca) a multi-stakeholder committee decides on the use of the income.

Funds also differ in terms of their financial structures. In most cases, the funds receive periodic contributions from users and so disburse payments on a regular basis (either as cash payments, or supporting projects for watershed management like FONAG). For example, a trust fund created in the Mexican PSAH ensures that the payments could be maintained over five years. Other funds, like the endowment funds, invest their main capital and spend only the interests generated. For example, in the case of Quito, Ecuador, the fund was established by users' payments and left to capitalise for several years. The revenues generated by interest are used to fund watershed conservation activities. Revolving funds, on the other hand, imply a cyclical movement of cash flows out of the fund as loans are disbursed and back into the fund as loans are repaid. This provides a continuing source of money for specific activities. Examples of revolving funds include Fuquene in Colombia, and Cuenca in Ecuador.

Table 11

Schemes using (and proposing) trust funds to manage funding

Central America

San Pedro Norte, Nicaragua (ongoing). Seed capital obtained from PASOLAC (US\$12,000) and the same amount is expected from the municipality. The municipal government created, through a Municipal Ordinance, the Association of Water and Resource Management that is to take charge of PES contracts, water tariff collections and management of the fund. This association is recognised by the National Assembly.

Campamento, Honduras (ongoing). Fund for Environmental Services (FONSAM) was set in 2002 by the local water board. Uses seed fund from PASOLAC and annual contributions from the municipality (not clear how much) including funds collected from: fines, 50% of funds from licences, permits and concessions for sustainable management of natural resources, products and rents from the funds invested, any donations that the municipality receives and, in the future, revenues from the environmental users' fees.

Guatemala, Sierra de las Minas Water Fund (proposed), which will include representatives from the biggest user groups – industry, agriculture, hydroelectric plants and local authorities, as well as environmental organisations, such as Defensores de la Naturaleza.

Guatemala, MAGA (proposed). Creation of the Trust Fund Water and Forests for Peace, with representation from several government bodies and financed through allocation of public funds.

El Salvador, FONASA, Ecoservicios. FONASA will pool contributions from users and invest into a trust fund.

North America

National PSAH, Mexico (ongoing). Funds are channelled through the Mexican Forest Fund, an instrument created to finance forest conservation and restoration projects, by pooling funds from different sources. As such, the fund also supports other programmes managed by CONAFOR.

Fidecoagua, Mexico (ongoing). Fund for the Promotion, Preservation and Payment for Forest Environmental Services in the Mountain areas of Coatepec, Veracruz. FIDECOAGUA is the organisation responsible for engaging with the participants and managing the funds collected, through its technical committee.

South America

FONAG, Ecuador (ongoing). Created in 2000, to which water users in Quito (drinking water, agriculture, hydroelectric power (HEP), tourism, etc.) contribute with the aim of sponsoring watershed management projects.

Ambato, Ecuador (proposed): Thungurahua Páramo Management Fund. Contributions currently agreed are: from the council of Tungurahua Province: 5% of their budget; from the municipal water utility company: US\$ 30,000 annual. Under negotiation: secure regular contributions from the irrigation water boards; in the future, all users are to be charged a fee for páramo conservation. Fund to be constituted by an executive secretary, a technical advisor and a secretary. The sponsors and the indigenous movements will form part of the board. Payments made through community projects.

Asia

Makiling Reserve, the Philippines (proposed). The project proposes that a watershed protection and conservation fee be introduced as an addition to existing water charges. The revenue generated would be channelled through a new Reserve Trust Fund that is to be overseen by a multi-stakeholder management board.

Simpler arrangements are adopted in some cases because of political resistance to financial separation. In both the ESPH in Costa Rica and Pimampiro in Ecuador the watershed services fund is operated through simple earmarking of a share of the water bills. Wunder and Albán (2008) warn that keeping funds in a savings account rather than a fund with legal restrictions could potentially be a threat for the long-term viability of the schemes. Similarly, the National PES scheme in Costa Rica although originally intended to operate with funding from a Trust Fund has annual allocations from government central budget, making it vulnerable to changes in priorities. In China, the Forest Ecological Compensation programme was initially conceived as a separate fund using earmarked fees. However, owing to lack of political support, the programme is now funded through central budget.

4.6.3 Terms of payment

Payment can differ in unit (cash, including low rates and guarantees, or in-kind) and timing (periodic or one-off) (see Figure 9). Cash payments can be continuous or for a fixed period. Six of the eight national programmes that make payments to landholders use cash payments. Almost half of ongoing local schemes make continuous or fixed-period cash payments, most in Central America.

Payment structures for cash payments

Payment structures when cash payments are used are generally very simple with flat rates per hectare for different activities regardless of location. The national scheme in Costa Rica, for example, pays different rates for forest conservation, reforestation and agroforestry, but these rates apply over the whole country without any spatial differentiation to account for differences in forest type or quality or of the opportunity cost of land. Similarly, the three silvopastoral schemes involve payment according to a complex set of points for different land-use practices but without taking into account differences in the location (Pagiola *et al.* 2004).

Where there is spatial differentiation, the different categories are kept to a minimum. The national scheme in Mexico has two categories in its payment structure: cloud forest, which commands a higher payment, and all other forests (Muñoz-Piña *et al.* 2005). In Pimampiro, Ecuador, the payments vary according to the degree of intervention in the vegetation (conservation of primary forest commands double the payment for secondary forest) (Echavarría *et al.* 2003). In the Sloping Land Conversion Scheme in China, account is taken of differences in opportunity cost of converting agricultural land to forest. The in-kind payment of grain is set at 2,250 kg per hectare in the Yangtze River Basin where average yields are higher and at 1,500 kg per hectare in the Yellow River Basin (Xu *et al.* 2004). The national scheme in Costa Rica has been criticised for its lack of spatial differentiation in the payment structure (Rojas and Aylward 2003; Pagiola *et al.*

2005; Wünscher *et al.* 2008. Critics argue that linking the level of payment with the expected delivery of environmental services or with the opportunity costs of the land would enable more cost-effectiveness in the payment scheme. However, FONAFIFO has resisted these calls for differentiated payments on the grounds of increased transaction costs (Rodriguez, personal communication, 2007).

Other types of financial payment

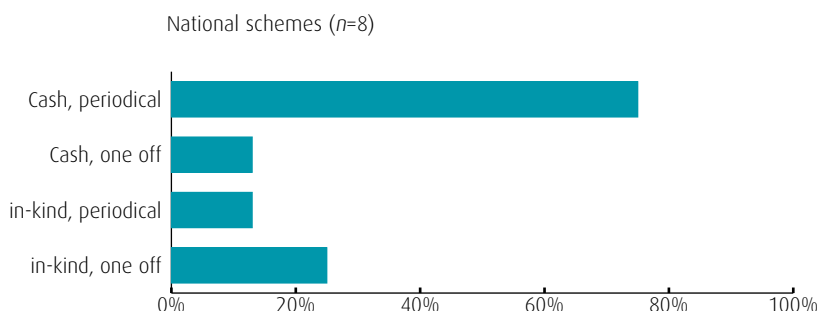
In a few schemes, rather than cash payments, soft loans or guarantees are offered to farmers. In Fuquene, Colombia, for example, farmers are able to access commercial loans to cover the costs of transition to organic agriculture because of a guarantee provided as part of the PWS scheme (Rubiano *et al.* 2006).

In-kind payments

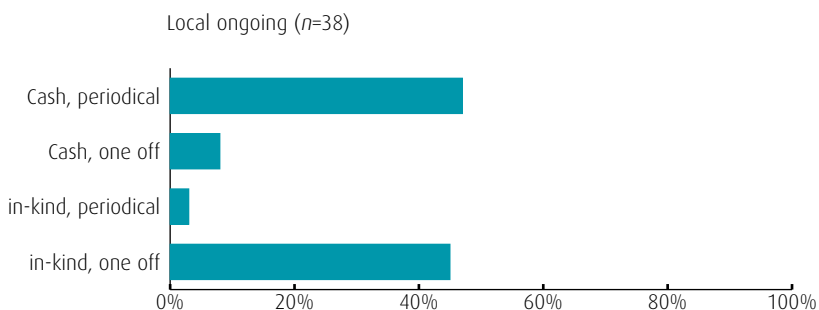
One-off in-kind benefits, including technical assistance and inputs, are being used as the sole form of payment in 15 of the ongoing local schemes, but are also commonly used in combination with cash payments. Only in one case are there periodic in-kind payments. The Los Negros scheme in Bolivia gives one artificial

Figure 9

Terms of payment to suppliers in national and local schemes



Note: Excludes Working for Water, South Africa.



Note: Excludes Lake Toba and San Jeronimo (no payments to landholders) and Morazan (no information).

beehive (and apiculture training) per year to each landowner who agrees to set aside 10 hectares of primary forest for conservation. Contracts are renewable on an annual basis (Robertson and Wunder 2005). The conditionality attached to the payment when using in-kind benefits is low, making the activities on the supply side little different from a conservation project.

In-kind transactions, including technical assistance and inputs, are being used in over 30% of ongoing local schemes, most of them located in Bolivia, Ecuador, Indonesia, India and China. Some examples of in-kind payments are presented in Table 12.

4.6.4 Monitoring and enforcement

Monitoring of contract performance

As 4.2 shows, delivery of hydrological services is measured (or expected) through land-based proxies. The information collected in this review suggests that most of the schemes in our sample that do monitoring of contract performance focus on visual inspection of land use, rather than monitoring the amount of environmental service produced. The Mexican PSAH and the Costa Rican PSA programmes, for example, monitor changes in forest cover. One exception is the experimental RiverCare scheme, which is being promoted by RUPES in Sumberjaya, Indonesia (Box 2). As RUPES is trying to promote payment according to outcome, i.e. reduction in sediment in the river, it is also conducting monitoring at various sites in the river and involving the community in these activities (Suyanto 2007). This is an experimental scheme with RUPES acting as a “stand-in buyer”. It remains to be seen whether it will be taken up by the local hydropower company and whether it will continue this monitoring approach.

Monitoring methods used depend on the scale of the scheme, and can go from very specific examination of compliance through site visits to more general examination based on satellite images. For national-level programmes, satellite images as used in the Mexican PSAH provide quick information about forest cover that can be verified by field technicians if necessary. In Costa Rica, each new contract is entered into a database that contains information about the property, landowner, total property size and area under payments, geographic information system (GIS) map, reference number, and inscription number in the land registry (this last one with online access to verify land ownership) in case of sale of the land while the contract is still valid. The database contains digital photos and a short video. An authorised forester, who is in turn also subject to external audits, is in charge of field monitoring. Some local schemes also use satellite images for monitoring, for example Fidecoagua, in Mexico.

Table 12

Examples of in-kind payments

Case	Status	Description
Brazil (PCJ)	Ongoing	Farmers living along riverbanks in targeted areas receive a reforestation plan (including approval of the relevant environmental authorities and technical assistance) and (native) tree seedlings; plantation and maintenance are responsibility of the landowner; there are no further incentives given after this initial phase
China (Meiji Jiang)	Ongoing	Orchard investors are able to lease land from small landowners through a village committee. The investors make significant profits in establishing the orchards, and they have obligations to conserve the hilly land and prevent soil erosion as a requirement to access the lease. The government can provide one-off subsidies to help with the soil and water conservation practices
Guatemala (Sierra de las Minas)	Advanced proposal	Improved land practices and conservation projects with farmers in buffer areas of the Sierra de las Minas National Park are financed through training and capacity building. The project aims at providing cash payments at some stage if enough funding is raised
Honduras (Campamento)	Ongoing	Technical assistance to farmers for improved agriculture methods (especially coffee), as well as community projects and installation of latrines to deal with human waste
India (Sukhomajri)	Ongoing	Upstream villages refrain from allowing their animals to graze on the watershed hills (to maintain vegetation cover for soil protection). As compensation, villages receive access other pasture areas, construction of rainwater collection dams that improved water supply to the village and allocation of water use rights to all households within the village (later replaced by water use fees)
Indonesia (Sumberjaya)	Ongoing	Improved land practices through community agroforestry in exchange for land tenure for 25 years, with a trial period of five years; plus multipurpose tree seedlings provided by the Forestry Service. RUPES is also testing an additional direct financial payment and/or in-kind payment from management of hydropower company and domestic water users
Pakistan (Mangla Dam)	Ongoing	Farmers living above the Mangle Dam receive technical assistance and other inputs for the construction of soil and water conservation structures upstream from the dam reservoirs. Farmers contribute the equivalent to 30% of labour maintenance costs
The Philippines (Mount Kanla-on)	Ongoing	Agroforestry activities with farmers living within Mount Kanla-on Park aiming at stabilisation of riverbanks and soil conservation measures to arrest soil erosion in the recharge area for a spring water plant. In-kind payments made through tree-saplings, two nurseries and reforestation with 100,000 fruit and timber trees. Farmers also receive technical assistance to adopt sustainable agroforestry practices such as SALT (multi-storey, rock walling and use of organic fertilisers)



A forested lakeside in Nicaragua

Monitoring is more difficult in more remote places, with limited access to satellite images and physical constraints for visual examination. This is one of the most difficult administration issues for Natura, the NGO managing the Los Negros scheme in Bolivia. Even annual visits can be difficult and expensive. Monitoring for compliance can be challenging for projects with the magnitude of the Chinese Sloping Land Conversion Programme. In this programme, monitoring is done by random inspections by officials from different levels of the government. In some cases, this leads to inefficiencies, with local governments planting on all steep slopes regardless of any target, or planting close to roads as “showcases” for visiting officials (Bennett 2008).

Enforcement and sanctions

Group or peer pressure is important for communally owned land, and where payments or rewards are distributed to the communities instead of to individual farmers (Ruhweza and Masiga 2007). The main examples of cash payments distributed in communally owned lands are found in the *ejidos* in Mexico, and in

indigenous lands in Costa Rica. In Costa Rica, the indigenous association applies for the payments, signs the contracts and is responsible for the activities (i.e. conservation or reforestation) agreed. Thus far, the national intermediary FONAFIFO has actively stayed out the process by which funds are distributed within the association, and will only intervene or sanction if the contract is breached. Contract compliance within the associations is managed following their own specific rules. Because an important proportion of the payments are channelled to social activities that benefit all, there is a strong interest in making sure that the contract is not breached (Arauz Montezuma 2002). At one stage in Costa Rica, FONAFIFO experimented using global contracts, under which a group of small farmers applied through one umbrella contract and distributed the payments internally. The system was not successful, as one individual could cause the breach of the contract even if the majority were complying. A new approach to reduce transaction costs is to use group technical support, but continuing with individual contracts for each farmer (Saenz, FONAFIFO, personal communication).

Some schemes apply sanctions in cases of contract violation. Where schemes involve periodic payments the most common sanction is to suspend payment temporarily or permanently. In Pimampiro, Ecuador, there are three potential sanctions for breaking the contract, depending on the infraction (Wunder and Albán, 2008):

- Taking out secondary products: suspension of payments for one month.
- Selective felling without permission: suspension of payments for three months.
- Clear-cutting: permanent exclusion from the programme, plus legal procedure (clear-cutting is illegal in this area), but this has not happened yet.

In the case of in-kind benefits, sanctions are more difficult to apply as such benefits are usually one-off. In the only example of periodic in-kind benefits in Los Negros, Bolivia, the beehive payment is given at the beginning of the contract period to the landowner who in return undertakes to conserve the agreed area of forest for a year. In this scheme, infractions would in theory demand the return of beehives. However, in practice the facilitating agency, NATURA, considers this dangerous for political reasons. The main sanction applied therefore is to block participation in the scheme the following year.

It remains a debate how much emphasis should be placed on monitoring and other methods to ensure transparency. Some practitioners such as Luis Gamez of ESPH feel that it would be better to allocate these funds directly into payments and accept some natural degree of non-compliance, without having to measure everything (Luis Gamez, ESPH, personal communication).

5 Socioeconomic impacts of the initiatives

This chapter examines the evidence on the social and economic impact of the payments for watershed services initiatives. There are several constraints involved in making such an analysis:

- Most initiatives are still recent so there is little information yet on impacts. Much of the information available is about estimated or predicted costs and benefits to different groups, rather than observed ex-post impacts.
- The information on both ex-ante and ex-post costs and benefits is often incomplete, emphasising benefits rather than costs, and focusing attention mainly on providers. Impacts on users receive less attention whereas impacts on other groups have rarely been studied.
- Studies or statements about impacts are sometimes misleading, as they do not take into account confounding factors sufficiently.
- Relatively few initiatives have been the subject of rigorous evaluations based on a field survey with local communities upstream and downstream.

This analysis tries to focus on the evidence from ex-post independent assessments of impacts (or if not strictly independent, involving at least rigorous, replicable research methods). Table 13 sets out the assessments identified in the course of this review and the initiatives they have targeted in each of three regions. These initiatives represent only a small percentage of the total ongoing and this highlights a major gap of information.

In addition to this list, there are several self-evaluations or documenting of lessons learnt written by coordinators or facilitators of the initiatives. The quality of the information on impacts in such reports varies considerably and is not always reliable. This information is used where nothing else is available but needs to be treated with caution.

Table 13

Impact case studies of ongoing initiatives

Initiative	Case study	Type of impact	Target groups	Research methods
Central America and Mexico				
Costa Rica				
National PES scheme Virilla watershed	Miranda <i>et al.</i> 2003	Livelihood impacts	Participants providers	Random stratified sample of 35 participants Small control group of 15 non-participants
National PES scheme	Ortiz Malavasi <i>et al.</i> 2003	Poverty impacts	Providers: forest protection only	100 telephone interviews: random sample not possible. Focus groups in four conservation regions. Collection and review of socioeconomic information
National PES scheme	Zbinden and Lee 2005	Poverty impacts – factors affecting participation in PES	Providers with contracts for conservation, reforestation and sustainable forest management (SFM) and non-participant	Personal interviews of 246 land- and forest-owning households in north lowlands where greatest intensity of PES contracts. Stratified sample of 71 conservation, 26 SFM and 36 reforestation plus 141 non-participants chosen through randomised pairing with participants.
National PES scheme	Muñoz-Calvo 2004	Poverty impacts	Participants of forest conservation in Osa Peninsula	Personal interviews with a small number of farmers in the Peninsula de Osa, in an area of high poverty levels
Heredia Public Service Company	Kosoy <i>et al.</i> 2005a Kosoy <i>et al.</i> 2005b	Economic impact and perceptions	Providers, potential providers, users	7 semi-structured interviews 111 questionnaires (all 10 providers)
Monteverde	Hope <i>et al.</i> 2005	Perceptions of PES	Non-participants	Structured interviews and focus groups
Guatemala				
Cerro San Gil/Las Escobas river basin	Kosoy <i>et al.</i> 2005a	Economic impact and perceptions	Providers, potential providers, intermediaries and users	15 interviews and 102 questionnaires
Honduras				
Jesus de Otoro	Kosoy <i>et al.</i> 2005a Kosoy <i>et al.</i> 2005b	Economic impact and perceptions	Providers, potential providers, intermediaries and users	18 interviews (3 out of 4 providers in total, 10 potential providers and 117 questionnaires)

Mexico				
National payment for hydrological services scheme (PSAH)	González Guillen 2004	Evaluation of the PSAH – economic, social and environmental impacts	Providers – successful applicants and rejected applicants	Stratified sample of beneficiaries (376) at three levels: region, land unit supported, and community members/landowners. Random sample of 39 rejected applicants. For Oaxaca state, parallel interviews with wives/partners of 18 beneficiaries in the main sample
Nicaragua				
San Pedro del Norte/Paso de los Caballos River Basin	Corbera <i>et al.</i> 2006	Economic and social impacts	Providers, potential providers, intermediaries and users	Eight semi-structured interviews and 65 questionnaires (inferred from total given for San Pedro and Cerro San Gil)
South America				
Bolivia				
Los Negros	Robertson and Wunder 2005	Environmental and livelihood impacts	Primarily providers	Semi-structured interviews with key informants: participants, donors, intermediaries, government officials
Colombia				
Bolo River Basin – Cauca Valley Corporation and Asobolo Users Association	Kosoy <i>et al.</i> 2005a	Economic impact and perceptions	Providers, potential providers, intermediaries users	Six semi-structured interviews, 100 questionnaires
Ecuador				
Pimampiro	Echavarría <i>et al.</i> 2004	Livelihood impacts Perceptions of water users	Providers and water users	Sample of 11 (out of 20) participants (providers). Sample of 36 water users
	Wunder and Albán 2005			Community workshops with providers and water users
Asia				
China				
Sloping Land Conversion Programme, China	Xu <i>et al.</i> 2004	Economic impacts	Participants and non-participants	Household survey – stratified random sample of 358 households in 3 provinces
	Uchida <i>et al.</i> 2004	Economic impacts	Participants	Household survey of 144 households in 2 provinces
Indonesia				
HKM – Sumberjaya Social forest – land-management contracts	Kerr, <i>et al.</i> (2005)	Access to the scheme and impacts on participating groups	Participating groups at various stages of the contract application process	Village level survey all 21 villages in Sumberjaya with protection forest group survey of all 29 groups formed to apply for land-management contracts

5.1 Key social and economic issues

In examining impacts, our concern is to address whether market mechanisms can both improve the delivery of environmental services, i.e. meet environmental objectives, and improve livelihoods, in particular for poor people. To address this question it is necessary to examine:

- The **characteristics of the people involved in the scheme as sellers** of environmental services. Are PWS schemes mainly confined to the rich or do they represent an opportunity for the rural poor?
- The **impact on the livelihoods of the participants involved as sellers** of environmental services. Are they better off as a result of the introduction of the PWS scheme in both financial and non-financial terms?
- The **impact on the downstream water users** that are supposed to be the beneficiaries of the improved environmental service provision – how do they benefit – and how do their contributions or payments match their benefits? Key to answering this question is assessing whether environmental services are actually improved as a result of the change in land management promoted upstream. However, it is also important to consider how the introduction of payments affects livelihoods of water users, particularly domestic users.
- The **impact on other groups** locally, nationally or at a global level. At a local level, people may be affected by changes in employment opportunities or restriction of access to formerly open-access natural resources. At a national level, second-round impacts on employment and prices may be significant particularly where market mechanisms are used on a large scale. These have rarely been studied, however. At the global level, the most significant impacts are environmental, given that watershed conservation often entails biodiversity conservation. These global environmental impacts are addressed in 6.2.

In examining the livelihood impacts of PWS it is important to consider the broader economic, social and political context. Whether PWS can help to alleviate poverty depends on the causes of poverty in any given situation. In many cases extreme poverty results from poor governance or structural inequities (for example as formerly under apartheid in South Africa, though the legacy lives on). Such poverty will not be substantially alleviated through PWS. In other cases, poverty is a result of more immediate circumstances, including limited opportunities to earn income and poor connectedness to markets. The development of PWS could have an impact in these cases (IIED 2005).

5.2 Who gets paid for delivering hydrological services?

This section reviews the evidence on the type of people who participate in PWS schemes as paid providers of environmental/watershed services. There are two aspects to this issue:

- Are farmers in the area targeted for the scheme poor relative to farmers in other areas?
- Within the area targeted, are the poorer/smaller farmers as well represented in suppliers as richer/larger farmers in the same area? A further aspect of this is the extent to which women participate as sellers of environmental services.

There is a practical constraint to the inclusion of poor people in PES initiatives because to benefit directly from sale of ecosystem services, people have to own or hold land. The distribution and ownership patterns of land are therefore critical for the poverty impact of PES programmes (Pagiola *et al.* 2005). The landless do not benefit directly from payments unless there is an attempt to recognise their informal access to resources. The case of Sukhomajri in India, where the landless were assigned water rights, is an example of how a scheme can be designed to enable the very poor to sell environmental services, but this is considered a special case and has proved hard to replicate (Kerr 2002).

The nature (private or communal) and size of landholding is also key. Figure 4 in 4.3 shows that most local and national payment initiatives involve private landowners. Groups that depend on communal land for their livelihoods (and most of whom are likely to be poorer than private landowners) are not well represented in the initiatives. Property sizes vary depending on the country, and the concept of small, medium or large land ownership is relative. For example, Central America is characterised by relatively small-sized properties.

Most of the schemes examined by the studies listed in Table 13 have not specifically targeted poor people. Rather, they have targeted the conservation of areas believed to be critical for water resources and hence most likely to deliver the service. In some cases, these areas are located closer to population centres, and are not necessarily inhabited by the poorer groups, who tend to be located in remote areas. Even if poor farmers live in these priority areas, they are usually scattered, and have significantly less access to information and capacity to administer a PWS project. As a result, there is variation between and within these schemes on the extent to which poor farmers are included in the schemes as suppliers. However, some of the newer schemes being developed such as the RUPES programme in Southeast Asia and Cuencas Andinas in South America are actively targeting poor farmers and communities living in uplands, although none of them is currently delivering payments.

5.2.1 Criteria for eligibility: national and local schemes

It is important to distinguish between small, local-level schemes where design criteria are determined locally, and national-level schemes with centralised eligibility criteria and priorities:

a. Local schemes

In small, local-level schemes, the evidence indicates that target areas sometimes involve small, poor farmers:

- In Jesus de Otoro initiative of Honduras, Kosoy *et al.* (2005) report that the providers of environmental services in the scheme are relatively poor peasants who rely largely on their lands for their livelihoods and are mainly subsistence farmers with some cash crops (coffee). This scheme works with 18 farmers, covering almost 80 hectares in a 3180-hectare watershed.
- In three small pilot schemes in El Salvador (Yamabal, Tacuba and Esteli), working with the regional NGO PASOLAC, farmers have an average property size of 2.5 hectares.

There are also examples, however, of schemes where the farmers involved are relatively well-off:

- The project of Los Negros in Bolivia works with 13 private landholders, with areas contracted for conservation set aside ranging between 3–390 hectares, and so far covering 1,100 hectares of cloud forest. Average annual income in the upstream community was roughly US\$1,000 in 2004 and it is fairly well-off compared with other rural areas in Bolivia (Robertson and Wunder 2005).

Within a target area it is not the poorest who are likely to benefit directly but the farmers with land, and particularly those with relatively large amounts of land. It is likely that those with small amounts of land and/or who depend solely on their farm for their livelihood are less able to set aside land for conservation. There is little empirical evidence but what is available appears to support this:

- In Pimampiro, Ecuador, the average property size in the scheme is 23 hectares: the eight non-participating families in the target area have less than 20 hectares. Wunder and Albán (2008) therefore conclude that small properties are slightly under-represented in the scheme. They argue that the smallest farmers tend to work their properties more intensively and therefore have less possibility to set aside land.
- In San Pedro del Norte, Nicaragua, Corbera *et al.* (2006) found that participants in the scheme have an average income including off-farm activities of US\$2,000 per year, whereas other farmers in the same area have a lower average income of US\$1,200 per year.

Much depends on the environmental service commodity that farmers are selling. Introducing improved management practices for agriculture or agroforestry may be more feasible for small farmers than forest conservation. Agroforestry systems integrated in management of environmental services are a viable option for many small farmers (see Rosa *et al.* 2003), as they provide short-term benefits in the form of crops and payments for environmental services, and long-term on-site benefits such as improved soil quality and timber.

b. National schemes

For national schemes, Costa Rica and Mexico provide contrasting experiences, reflecting to some extent differences in land and forest tenure regimes. In Costa Rica, most forestland is held privately, although often without formal land title. Mexico is notable for the high proportion of its forestland which is held as common property by *ejidos* and indigenous communities. The nature of the tenure pattern in Mexico means that forests held by *campesino* farmers are well represented in the target areas of the national PSAH scheme even though the criteria for selecting priority areas are primarily biophysical. Even within the broad group of *campesino* forests it appears that the poorest of these are relatively well represented. Of the PSAH payments in 2003 and 2004, 72% and 83% respectively went to forests associated with marginalised¹¹ population centres (Muñoz Piña *et al.* 2005). The authors conclude that PSAH is a scheme that benefits the poor, although targeting the poor was not an explicit criterion for the scheme.

For Costa Rica, the available evidence indicates that poor farmers are not well represented in the national scheme (at least until 2002, see Box 8). This applies to both the two issues mentioned above, i.e. the characteristics of the areas targeted and the relative participation of poor farmers within a targeted area. In Costa Rica until 2002, most of the PES contracted area was located in areas with a social development index of 40–70% – a relative index combining educational, health indicators with social indicators (number of single mother births) and electricity consumption where 0% is the poorest area and 100% the best in Costa Rica (Ortiz Malavasi *et al.* 2003). Several studies in different parts of the country have found that participants in the scheme are relatively well off. Ortiz Malavasi *et al.* (2003) conclude that of the participants opting for conservation contracts in the national PSA scheme only 15% are below the poverty line¹². These findings are consistent with those of Miranda *et al.* (2003) who surveyed the Virilla watershed, and Zbinden and Lee (2005) who focused on the northern region. However, Ortiz Malavasi *et al.* (2003) show how efforts made to broaden the participation in PES have had effects in the case of indigenous reserves. These accounted for 1.22% of contracts in 1998 but by 2001 had grown to 13.5%.

11. Based on an official indicator of marginalisation.

12. This survey was conducted over the telephone, and as such automatically eliminates those farmers without access to one, potentially the poorest of the group.

Studies of participation in Costa Rica's national PES scheme

Ortiz Malavasi *et al.* (2003) conclude that most of the participants opting for conservation contracts in the national PSA scheme are relatively well-off and only 15% are below the poverty line. Of those interviewed, 56% claimed to earn less than the poverty line but the authors of this study consider this statistic unreliable because of the tendency for interviewees to manipulate the answer. Based on other criteria, such as use of family labour, residence on the farm, size of farm, dependence on agriculture for income, and use of the PES for household expenses, they conclude that 15% of their sample could be considered near the poverty line (as their sample is of farmers with telephones it may not capture the poorest farmers in the national PES scheme). The results show that 81% of their sample had not lived on their farms in the past five years, demonstrating that the farm is only a minor source of income for them.

Zbinden and Lee (2005), based on a household survey conducted in 2002 among participants and non-participants in Costa Rica's PES scheme, found that participants in all three programmes of the PES scheme (conservation, SFM and reforestation) were better educated, had considerably larger farms and higher household income than non-participants. A higher percentage of non-participants (77%) lived on the farm than for the PES farms (21% in the case of conservation) and off-farm income was low relative to the PES participants.

Miranda *et al.* (2003) – A survey of participants in the PES in the Virilla watershed found that most were relatively well-off with an average income in the sample of US\$22,000 per year. They were also highly qualified, with more than half of the sample having their own profession, unconnected to the farm, as their main occupation.

Muñoz-Calvo (2004) – A study in Osa looked at the effect of the PSA programme in very low-income families in the Osa Province. The results indicate that farmers' main asset in the area is forest, and payments for conservation have helped raise many of the participants from poverty.

Gender representation

There has been very little attempt to assess the impact of PES initiatives on women or the extent to which they are represented as suppliers. Some analysis has been conducted for the national schemes in Costa Rica and Mexico:

- Over the first five years of the Costa Rican national scheme, women held only 11.1% of the contracts and 7.3% of the area enrolled (men held 41% of the contracts and 28.3% of the area enrolled) but their participation began to increase after 2000 as a result of promotional measures associated with the Ecomarkets project (Ortiz Malavasi *et al.* 2003).
- The rules of operation for the Mexican national scheme set out equality of opportunity to access the programme. However, only 16% of holders of land rights are women. Even in these cases, the rights may be exercised in practice by male members of their family so female participation in the national PWS scheme is very limited (González Guillen 2004). Women also have little involvement in community-governing institutions. A survey of successful and rejected applicants in *ejidos* and communities found that in 65% of cases there were no women community representatives. It was also found that only half of the women

landholders interviewed had knowledge of the payment scheme whereas nearly all of the men were aware of it.

In very local schemes, such as Pimampiro, Ecuador, an informal “social monitoring” can take place making sure that the payment is assigned to the person living and managing the property, regardless of the title. Using this system, project managers ensure that funds are allocated to the family household even in the case of divorce or separation (Robert Yaguache, CEDERENA, personal communication, 2001).

5.3 Impacts on livelihoods of service providers

A key question is whether service providers are better off as a result of the payment initiatives. Focusing the question on livelihoods recognises that financial benefits from the payments are only one aspect and that there are several non-financial aspects such as community empowerment that also need to be considered even if not readily quantifiable. It is also important to consider the various types of cost that payment schemes entail for participants.

Conclusions on the size or significance of costs and benefits depend heavily on the reference point of comparison, particularly where PWS is an alternative to other policy approaches for securing environmental services. Thus PWS schemes can be compared favourably with predecessor schemes that focused on land purchase or eviction. PWS provides a way of keeping people on their land and avoids some of the sensitivities associated with control of land by external interests. For example in the Cauca Valley, Colombia, the water users association started with land acquisition then moved to negotiating payments as an alternative. The local initiative, Fidecoagua in Coatepec, Mexico, followed a similar process. However, if the costs and benefits of these schemes are compared with the costs and benefits of the previous land-management practices, the conclusions are likely to be less favourable. Benefits may not be sufficient to compensate for opportunity and transaction costs.

5.3.1 Financial benefits

Three main approaches have been taken in the literature to assess financial benefits to service providers:

- Comparison of financial benefits (cash and in-kind payments) with household income or expenditure: this can be misleadingly positive in not taking account of the costs to service providers;
- Comparison with costs of providing the service: the transaction costs of accessing the scheme; the opportunity costs of foregone land uses and the costs of any new activities or practices required. The difficulty here is that average opportunity costs for a region may not be representative of the land enrolled in a payment

scheme. Land with high gradient, poor soils, difficult access will give lower returns and may be, as a result, the first to be offered a payment scheme. Another complicating factor is that alternative land uses are often restricted by regulation but with little enforcement in practice. In this situation, opportunity costs could be zero if the regulation can be upheld, but considerably higher if there is little probability of sanctions.

- Asking people directly for their opinions of the payment level. Surveys have approached this in different ways with some asking whether the payments are significant, others whether they are sufficient and others asking whether payments are fair. All have the problem that strategic bias on the part of respondents is hard to avoid.

One or more of these approaches have been applied to assess local schemes in Bolivia, Costa Rica, Ecuador and Honduras, and the national level schemes in China, Costa Rica and Mexico. There is considerable variation in results (summarised in Table 14), reflecting differences in socioeconomic contexts and land-use capability both within and between countries as well as the inherent drawbacks of the approaches. However, with one or two exceptions, the cash payments appear to be relatively insignificant and there is a view that they function more like supports or a bonus than a real incentive for land-use change (Ortiz Malavasi *et al.* 2003; Kosoy *et al.* 2005b). Box 9 highlights the variation in use and size of cash payment that can occur within a PWS scheme.

Box 9

Use and importance of cash payments in the Mexican PSAH scheme

A survey of the use of the payments made in 2003 (Alix-García, *et al.* 2005) found that payments varied from distributing 100% equally between all members, to the investing of all the money into public goods for the community, with many intermediate cases where the allocation included a combination of direct distribution of payments, payment for guarding the forest and fire prevention, and investment in local public goods. The survey shows that 18% of the *ejidos* decided to distribute all payments directly among *ejido* members, 22% invested the entirety in forest activities related to conservation, 18% allocated the full amount to public goods not related to forestry, whereas the remaining 43% adopted a combination of the three strategies

An evaluation of the Mexican PSAH scheme (González Guillen 2004) found that 80% of the members of *ejidos* and communities and 73% of the small, private landowners in their sample considered that the payments received were important or very important for their annual income. Where payments were shared out between community members rather than used for collective expenditure, the average amount distributed per member was 6,624 pesos (US\$596). In comparison, 60% of the *ejido* and community members indicated a monthly income less than US\$225. These authors point out though that their sample was primarily of larger forestland properties and that payments were more likely to be distributed between community members rather than used for collective expenditure when they were fairly significant. They cite, as a contrasting case, that of the community Santa Maria de Ocotan and Xocnostle in Durango state, which received US\$72,000 to share between 18,000 members, i.e. US\$4 each. In this case the payment was not shared out.

Table 14

Evidence on importance of cash payments

Approach	Scheme	Results	Source
Comparison with household income or expenditure	Important positive impact		
	Pimampiro, Ecuador	30% on average of household income. Used for school fees and healthcare	Echavarría <i>et al.</i> 2004
	PSAH Mexico	80% of members of <i>ejidos</i> and communities and 73% of small private landowners in the sample considered payments important for annual income	González Guillen <i>et al.</i> 2004
	Unimportant		
	National scheme, Costa Rica	For 9% of the sample of conservation contracts the payments represented more than 10% of income, for 67% of the sample less than 10%, and 13% thought had no effect on their income. Focus group discussions emphasised that the payment is considered like a bonus or form of enforced saving. However, in the Osa Peninsula, the payments were the main or second most important source of income	Ortiz Malavasi <i>et al.</i> 2003
	National scheme, Costa Rica	In Virilla watershed, average payments to the sample were 16% of household income	Miranda <i>et al.</i> 2003
	ESPH, Costa Rica	For 6 of the 10 providers, payments were less than 2% of gross income, for 3, less than 10%, and 21.8% for the remaining providers	Kosoy <i>et al.</i> 2005b
	Jesus de Otoro, Honduras	Payments were only 0.4, 0.6 and 1.2% of the 3 providers' gross household income	Kosoy <i>et al.</i> 2005b
Comparison with opportunity costs	San Pedro del Norte, Nicaragua	Payments to service providers are less than 10% of their annual income	Corbera <i>et al.</i> 2006
	Low percentage of opportunity costs		
	Los Negros, Bolivia	Payments were 2–10% of opportunity costs	Robertson and Wunder 2005
	ESPH, Costa Rica	Payments cover less than 2% of opportunity costs	Kosoy <i>et al.</i> 2005b
	Jesus del Otoro, Honduras	Payments cover less than 12% of opportunity costs	Kosoy <i>et al.</i> 2005b
	San Pedro del Norte, Nicaragua	Payments were 20% of average opportunity costs	Corbera <i>et al.</i> 2006

	Average fair payment level five times the actual payment level		
	Sloping Land Conversion Programme, China	Shortfall for 24% and 77% of sample households in Ningxia and Guizhou provinces	Uchida <i>et al.</i> 2004
		Shortfall for 7%, 40% and 22% of sample households in Shanxi, Gansu, and Sichuan provinces	Xu <i>et al.</i> 2004
Suppliers' opinion of payment levels	Payments considered to be below the fair level		
	Pimampiro, Ecuador	9 out of 11 landowners interviewed thought the fair payment level was higher than the actual level	Echavarría <i>et al.</i> 2004
	National scheme, Mexico	More than 50% of direct beneficiaries considered the payments to be low or insignificant. Average fair payment level over 50% higher for <i>ejidos</i> /communities and over 25% higher for small landowners than actual payment levels	González <i>et al.</i> 2005
	ESPH, Costa Rica	Fair payment level more than 3 times the average actual payment	Kosoy <i>et al.</i> 2005b
	Jesus del Otoro, Honduras	For 2 of the 4 providers, the fair level was more than double the actual amount. For another provider the fair level and the actual level were similar	Kosoy <i>et al.</i> 2005b
	San Pedro del Norte, Nicaragua	Average fair payment level 5 times the actual payment level	Corbera <i>et al.</i> 2006

5.3.2 Transaction costs

Most analysis of the costs incurred by participants has focused on opportunity cost as in Table 14 above. Participants also incur transaction costs of applying to join a scheme and fulfilling the ongoing procedural requirements. There has been very little quantification of transactions costs for participants but in some cases it is possible to conclude that they are significant in qualitative terms:

- In Costa Rica transactions costs for applying to the PES scheme have been high. Miranda *et al.* (2003) identified 11 separate requirements. More recently, requirements have been streamlined by linking FONAFIFO's database with those of other government agencies Pagiola (2008). Still, the average transaction cost for the farmer can be estimated by the fee that facilitators charge (12–18% of the payment).
- In Mexico, González Guillen (2004) found an average cost for successful applicants of 2,885 pesos (US\$260) for *ejidos* and communities and 2,345 pesos (US\$211) for small landowners. Costs for rejected applicants were similar (2,361 for *ejidos*

and communities and 3,696 for small landowners). On the basis of their sample results they estimated a total cost for all successful applicants of just under 1 million pesos (US\$89,000), or 0.35% of the total payment allocated for five years. This appears to be considerably lower than for Costa Rica although it is not clear what is included in the estimates of costs and the extent to which applicants' time is factored in.

5.3.3 Non-financial benefits

As financial payments are often considered to be insignificant, non-financial benefits must be part of the explanation why farmers participate and continue to participate in these schemes. Strengthening of property rights, capacity building, improvements in social organisation and in quality of life are the main benefits cited. For some of the initiatives, the impact assessment surveys have asked participants specifically about their perceptions of these non-financial benefits. In some cases, however, the main source of information is the observations of those running the scheme or involved as facilitators. In a few cases, the evidence is restricted to the observation that certain activities such as training and environmental education have accompanied the initiatives. Little is known about how participants and the local community perceive these. Non-financial costs for participants have rarely been documented.

Strengthening of property rights

A common theme of many case studies is the effect of PWS in strengthening property rights. This works in three different ways:

- **Strengthened property rights as the main payment offered.** This has been the approach in some schemes in Asia, in particular the HKm programme in Indonesia, which offers farmers long-term licences to use degraded protected state forestland for coffee production provided that they meet certain management conditions such as agroforestry, and soil and water conservation (Kerr *et al.* 2005). There has been little systematic analysis of the impact of this. Because this programme is recent, surveys have focused on farmers' perceptions and expectations of benefit.

In Sumberjaya, Kerr *et al.* (2005) found that applying for HKm land is believed to raise significantly the security of protection forestland compared with that of private land. Once the 25-year permit is in place, tenure on these lands will be considered almost as secure as private land. There are knock-on effects of the land permits, in particular reduction in forced bribes to local officials, but this cannot be attributed totally to the HKm programme: other local factors are also important. A high proportion of participants in group interviews expected the HKm to increase their income because of more intensive and diversified cultivation (fruit trees as well as coffee).

- **Strengthened property rights as a byproduct of the financial payment.** In situations where land rights/possession is usually demonstrated by clearing the forest, the PWS scheme strengthens the idea that forested land is being used and provides some protection against invasion. This applies to some small local level schemes such as Los Negros in Bolivia where entering into contracts for protecting land¹³ is perceived as a benefit by landholders, who feel that this strengthens their ownership claims (Robertson and Wunder 2005). It also applies to the Costa Rica national scheme. In their study of the Virilla watershed, Miranda *et al.* (2003) found that the PES programme increases tenure security by preventing invasion of land under PES conservation contracts.
- **Entering a PWS scheme guards against government expropriation.** Kosoy *et al.* (2005a) looked at PWS schemes in sites bordering large protected areas. As the payments are low relative to opportunity cost, they suggest that the threat of extending the protected area may coerce landholders into joining the scheme and collaborating.¹⁴

Capacity building

Training, technical assistance and other forms of capacity building are often provided in addition to, or in some cases instead of, financial payments. For example, in Pimampiro, Ecuador, farmers have received assistance for soil conservation, organic farming and forest management, helping them to increase productivity (Echavarría *et al.* 2004). In Los Negros, Bolivia, the facilitating NGO provided training in beekeeping to accompany the in-kind payment of beehives (see Table 9 for further examples). In San Pedro del Norte, Nicaragua, participants in the payment scheme acknowledged the benefits received in terms of technical assistance from PASOLAC, the facilitating NGO, for forest protection and regeneration activities and participation in other projects focused on improving agricultural production (Corbera *et al.* 2006).

Social organisation

Strengthening of social organisation may often be a specific component of a payment scheme, either because buyers need to deal with a small group of supplier representatives rather than numerous individuals to reduce transaction costs, or because promoters of payment schemes have understood the importance of this for community development and access to the schemes. These improvements in organisation can bring benefits for other aspects of community livelihoods, for example in marketing conventional cash crops.

13. Some participants in this scheme have asked for payments or compensations in the form of barbed wire, to fence off their properties and better enforce their tenure rights.

14. It is not clear in this report whether this statement is based on hard evidence or is conjecture.

- In Brantas, Indonesia, the observation of the NGO facilitating payment is that the scheme has contributed to the empowerment of the community, which as a result was able to negotiate better terms in their agreements with both the State Forestry Company and the extension services (IIED, December 2005).
- In Los Negros, Bolivia, the PES initiative has had positive effects in creating a Communal Forum in the upstream community to address problems and in building better relations with the downstream community. However, it has also heightened social tensions over land. Those who do not own land feel threatened by the process of land tenure approach of the intermediary NGO, which is acting in the absence of formal land titles (Robertson and Wunder 2005).

Quality of life and social image

In Costa Rica, discussion from focus groups concluded that the PES system has contributed to improved quality of life in rural areas but more for emotional and non-material reasons. One benefit cited is that loggers are looked down on in society and with PES they have passed from being loggers to conservers of the forest (Ortiz Malavasi *et al.* 2003, p.32). Kosoy *et al.* (2005a) draw a similar conclusion from their case studies in Colombia, Guatemala, Honduras and Costa Rica. In these, they found that payments were perceived as “supports” or “tips” for the adoption of good practices that upstream landholders are more or less socially and morally obliged to adhere to (“supports that reinforce a logic of social cooperation and moral obligations to Nature”).

5.4 Impacts on downstream service users/buyers

An important issue in evaluating the impacts on downstream users of water, and watershed services more generally, is whether the payments have the desired effect on environmental service provision. This ultimately affects whether a scheme is equitable or efficient in terms of the contributions demanded from or made on behalf of water users. This is discussed in depth in section 6.2 on environmental impacts of payment schemes.

Here we examine the evidence on the social and economic impacts of the payments on water users. The main questions are:

- *Ability to pay.* Imposing an additional charge on water may adversely affect the livelihoods of poor urban residents or of downstream small farmers as they may not be able to maintain their level of water use or may have to cut back on other necessities.
- *Equity.* Are some groups of water users not paying at all or not paying at a sufficiently high level?
- Are there ancillary benefits for downstream water users such as improvements in social capital?

5.4.1 Ability to pay

Section 4.3.3 mentioned that 15 local PWS schemes derive funding from either a surcharge on the standard water-user fee or a designated share of a negotiated increase in the water-user fee. To our knowledge, for five of these cases there have been studies conducted of the impact of user fees on domestic water users. These have mostly found that the payments are considered acceptable and have little impact on water use or access to water. However, they have also found that there is very little awareness among users of the payment schemes and of the motive for the surcharge.

- In Jesus de Otoro, Honduras, the increase in the water fee was only 0.02% of users' average income (Kosoy *et al.* 2005a). Only 43% of those interviewed were aware of the PWS scheme but once the scheme was explained to them, 72% agreed with the amount of the payment (Kosoy *et al.* 2005b).
- For Cerro San Gil, Guatemala, Kosoy *et al.* (2005a) found that the user fees of US\$0.2 per household per month charged to raise money for PWS represented only 0.04% of average household income.
- In Heredia (ESPH), Costa Rica, Kosoy *et al.* (2005a) found that the user fee represented only 0.01% of average household income. Only 21% of those interviewed were aware of the scheme. However, once the scheme was explained, 92% of those interviewed agreed with the amount of the payment (Kosoy *et al.* 2005b).
- In San Pedro del Norte, Nicaragua, 68% of water users surveyed were not aware of the PWS scheme and 78% responded that they had not been consulted about its implementation (Corbera *et al.* 2006).
- In Pimampiro, Ecuador, the municipality was able to introduce a surcharge of 20% to the water bill to cover the payments to forest owners without meeting any protest from water users. However, the introduction of the surcharge coincided with a major improvement in water distribution infrastructure and hence the regularity of supply (Echavarría *et al.* 2004). The municipality has not yet fully informed water users about the PWS and what the surcharge they are paying is used for (Wunder and Albán 2008).

Kosoy *et al.* (2005b) suggest that part of the explanation for the limited adverse impact on domestic water users is that the user charges set tend to be very low compared with estimated willingness to pay. Estimates prepared for the ESPH in Costa Rica showed downstream WTP considerably higher (more than three times) than the environmental charge added on to the water bill. A similar disparity applies to the Jesus de Otoro scheme in Honduras.



Family living from a managed forest in Costa Rica

In four other cases, there are built-in mechanisms to deal with the poorest water users. For example, the water utility in Cuenca levies a surcharge to cover watershed protection activities but this has little effect on the poorest users, as all customers receive a minimum, lifeline amount of water for free (Echavarría *et al.* 2004). Another approach used by two local schemes in Mexico, Fidecoagua and Zapaliname, is to make contributions voluntary so that poorer households are not forced to contribute. In the fourth of these cases, Estelí in Nicaragua, it was agreed that those who could not afford to pay could contribute their labour to watershed conservation activities (Ardón-Mejía and Barrantes 2003a).

The experience from these nine cases indicates that PWS schemes can be implemented without adverse impacts on the livelihoods of poor domestic water users. However, some of these schemes are also associated with low payments to providers, which do not fully compensate for opportunity cost and so may not be sustainable or effective in the longer term. In addition, concerns about ability to pay of domestic water users are a key constraint for the development and expansion of several schemes, for example Campamento, Honduras, and Tarija, Bolivia.

5.4.3 Equity

There are some cases, such as the Cauca Valley in Colombia, and some of the schemes involving private companies in Costa Rica, where a textbook model applies – that is to say, poor environmental service providers reside in the upper watershed and better-off buyers or users of services live in the lower part of the watershed. In such cases there would appear to be equity as well as efficiency grounds for a payment scheme.

In several cases, though, downstream water users are poorer than the upstream service providers. This raises the question whether it is fair to expect these users to make payments for environmental services and whether this could be a source of conflict. The answer to this is quite context-specific. In the ESPH case in Heredia, Costa Rica, the users surveyed have on average an annual income of US\$11,424 and the providers on average a gross income (on-farm and off-farm) of US\$59,000 (Kosoy *et al.* 2005b). However, as shown above, the same study finds that the impact of the payment on the users is minimal. Another case, El Imposible in El Salvador, where domestic water users are contributing through their water charge to the costs of management of a National Park, has been criticised for being inequitable. Poor rural communities are paying for environmental services generated in a national park and are unaware that part of their water charges are being used for this purpose (Rosa *et al.* 2003).

Even where the textbook model applies, the equity issues are not always straightforward. Kosoy *et al.* (2005a) argue that in the case of the Cauca Valley, Colombia, the introduction of PWS has served to change property rights and in effect has legitimised the abundant use of water by the sugar cane industry. Although the lowland sugar industries are making payments in kind to an indigenous community, they are legitimising their own water use rather than recognising the community's rights. This may be rather a criticism of water use pricing policy and the level of the PWS charge, particularly if it is well below willingness to pay and the opportunity cost for the providers. The payment may be enabling the industrial water users to continue to use water at a low price but this situation need not necessarily be

permanent. Kosoy *et al.* (2005a) apply the same argument to a bottled water company in Heredia, Costa Rica (presumably La Florida). However, it was the agreements with private companies on PWS which showed the potential willingness to pay for water and led the Costa Rican government to make substantial increases to water use charges through the Canon del Agua. The PES may have legitimised water use at low rates for the companies concerned in the short term, but in the longer term has precipitated a move to higher water-use charges.

Another problem that has been noted in some cases is that some users or groups of users, often the heaviest users of water, are not prepared to pay. This applies to Pimampiro, Ecuador, where the irrigation association is not contributing (Echavarría *et al.* 2004).

Ancillary benefits

Practitioners involved in operating the schemes have highlighted a range of spin-off benefits for the downstream communities such as raised environmental awareness and strengthening of social capital through creation of users associations, and resolution of conflicts with upstream users through creation of watershed institutions, but there is little independent assessment of this.

- Cauca valley, Colombia: the users association has promoted community training in income generating activities and environmental education.
- Cuenca, Ecuador: the creation of a multi-stakeholder committee that involves both users and “providers” encourages the feeling of ownership and provides a useful platform for discussing water issues (Echavarría *et al.* 2004).
- Jesus del Otoro, Honduras: the introduction of the PWS scheme helped to reduce upstream and downstream conflicts (Kosoy *et al.* 2005b).
- As part of the PWS scheme in San Pedro del Norte, Nicaragua, a local water committee was set up. According to Corbera *et al.* (2006), this has increased user awareness of their daily water restrictions and induced them to take a more active role in defining water quotas in each community sector. Even though there is limited user awareness of the PWS scheme, indirectly the scheme has empowered the local community to take control of the public water service, increasing its transparency and local participation (*ibid.*).
- In Kuhan, India, the downstream village development committee has undertaken spin-off activities such as a small micro-credit operation to supply agricultural and consumption credit to members (three so far), and a concerted attempt to expand irrigation water use (IIED 2005).

5.5 Costs and benefits for non-participants/other stakeholders

There is very little evidence on the nature and magnitude of socioeconomic impacts on non-participants in the payment schemes. Most studies have focused on impacts on participants or on the constraints to participation. The most cited impacts on non-participants relate to employment and access to natural resources.

5.5.1 Employment

At the local level

The available evidence at the local level in Costa Rica indicates a neutral or slightly positive effect of payment schemes. According to Ortiz Malavasi *et al.* (2003), payments for conservation are mostly neutral in terms of job creation but are likely to reduce jobs where land has agricultural potential. Eighty-one per cent of those interviewed indicated that they hire labour to carry out conservation-related work and 79% indicated that they use the PES primarily to maintain the farm and to pay labour. These results are consistent with the survey by Miranda *et al.* (2003) of the Virilla watershed in Costa Rica, which found that half of the respondents now hire additional occasional workers once a year for two to four weeks, as many as seven workers for some of the larger properties.

Other evidence is more anecdotal. For the Los Negros PES scheme in Bolivia, there are reports that several farmers have had to hire additional labour to help them manage their beehives, or enter into honey crop-sharing arrangements with landless people (IIED 2005).

At the national level

The Working for Water scheme in South Africa, which was set up with the dual purpose of protection water resources through controlling invasive alien plants and job creation, has had a positive effect on employment. In Costa Rica, Miranda *et al.* (2003) highlight, but without any attempt at quantification, the substantial creation of employment for forest professionals and technicians associated with the administration of the national PES scheme.

5.5.2 Access to natural resources

Spin-off benefits from payment mechanisms may create positive benefits for some people from among the poorest sections of a community. For example, poor people are now involved in increased non-timber forest products (NTFP) collection in arrangements struck with the forest service linked to farmers' conservation of water springs at the Brantas site in Indonesia (IIED 2005).

6 Environmental impacts of payments for watershed services

In this chapter, we examine the evidence on the environmental impact of PWS schemes. This covers their specific effects on watershed services downstream as well as other environmental impacts both downstream and upstream. To some extent, the downstream impacts on watershed services are a reflection of environmental impacts upstream as payments are directed at land-use changes. However, sometimes positive or desired environmental impacts upstream do not translate into positive or discernible impacts on watershed services. A report from an electronic workshop on PWS in watersheds in Latin America points out that the impact on water resources is uncertain and that the most noteworthy environmental impacts of PWS schemes have usually been in terms of forest conservation (illegal logging, conversion to agricultural and grazing lands, decrease of forest fires) and recovery of forest cover (FAO and REDLACH 2004). However, as we discuss towards the end of this chapter, sometimes the evidence of positive environmental impacts upstream is not clear either.

6.1 Challenges in assessing impact on watershed services

Before examining the evidence on the delivery of watershed services and other environmental impacts, it is important to set out some of the challenges involved. It is necessary to establish credible biophysical relationships between changes in land use and impacts on watershed services/water quality and quantity. This requires modelling of relationships, measurement of the baseline against which to examine impacts and subsequent monitoring of impact over a timeframe long enough and at a scale large enough for impacts to be discernible. It is also necessary to model the relationship between payments and changes in land use, i.e. to understand how payments affect landholder decision making. This means that other factors, mostly socioeconomic, that affect land-use patterns, need to be taken into account. It may be that the changes in land use observed owe more to the influence of other factors such as changing commodity prices than the introduction of a payment scheme.

During this review it was difficult, and many times impossible, to find strong scientific evidence of the impacts. There are few examples, if any, of PWS schemes that actually consistently measure and monitor the delivery of the watershed service. In most cases, the impacts reported are based on perceptions of local populations and those operating the schemes and/or quick measurements of what the impacts should be, rather than in-depth scientific evidence drawing from site measurements and modelling of relationships.

6.1.1 The scientific debate on land use and water linkages

Linkages between land use and water quality are well documented and there is some consensus in the literature (see Calder 2005). Water pollution could result from erosion (sheet, rill, gully and channel bank), industry and mining activities (especially where mercury or cyanide are used), domestic sources (including houses and farms), and agriculture (agrochemicals). Deforestation leads to higher erosion and sedimentation rates compared with natural intact forests, but well-managed land units can keep the production of sediments under relatively good control. For some types of pollution, like sediments, vegetation around streams and rivers in the riparian area can help as a filter, reducing the river load.

The links between land use and water quantity, in particular the impact of changes in forest cover, are more difficult to demonstrate (Bruinjeel 2005; Calder 2005). There is little evidence that precipitation is affected significantly by the existence of forests, except in very large basins like the Amazon. Even the effect of cloud forests on capturing horizontal precipitation might be smaller than initially thought. Because of their higher evaporation and transpiration rates, forests require more water, reducing the run-off (compared with shorter vegetation). An increase in forest cover is also more likely to decrease dry season flows. The effect of forests on regulation of flows is positive, but only for normal intensity storm events. For high-intensity storm events, forests have little regulating effect.

The impact of forest clearing on streamflow depends on the site characteristics (rainfall, etc.) and the degree of surface disturbance. If soil infiltration capacity after deforestation is maintained, most of the water yield will increase as baseflow (lowflows). However, if infiltration capacity is reduced by compaction, the longer-term effects could be insufficient for the replenishment of groundwater reserves during the rainy season and hence there will be a decline of dry season flows (Bruinjeel 2004).

The impact of reforestation is also site-specific and not always positive, particularly for water quantity. According to Van Noordwijk (2005), the land-use changes that would result in reductions of evapotranspiration (and thus increase total water yield) would be to stop planting evergreen trees (especially fast-growing ones). Planting fast-growing species that use large amounts of water could actually reduce the water flows. Hence plant removal instead of reforestation might actually be needed (as happens in South Africa). However, it is also argued that in degraded tropical areas, planting trees may improve soil biodiversity and in turn the structural properties of the soil, leading to reduced overland flow, particularly on steep slopes (Chappell and Bonell 2005).

The main issues related to forest and water linkages are set out in Box 10.

Forests and water linkages

Forests reduce annual flows of water. This result is obtained through the use of experiments based on observations¹⁵ and from theoretical reasons for increased evapotranspiration from forests (Calder 1999). In wet conditions, experiments show that forests, being aerodynamically rough, lose more water through evaporation than other short crops. In the uplands of the UK, experiments show that evaporation from mature conifer forest is two times higher than the evaporation from short crop (grassland). Additionally, because they have deeper roots, forests have greater access to soil water in dry conditions. Therefore, water losses from forests are higher in dry climates than other shorter crops. Experiments show that in Southern India, evaporation from eucalyptus forests is twice as much than from short crops (finger millet).

The regulation impact of forests on flows is unclear. The view that forests act as “sponges” soaking up water and releasing it gradually over dryer periods is widespread, although not supported by extensive evidence. In theory, forests have two opposing impacts on base-level flows: (1) natural forests tend to have higher infiltration, which will lead to higher soil water recharge and increased dry season flows; and (2) increased interception and increased dry period transpiration will increase soil moisture deficits and reduce dry season flows. However, instances of deforestation reducing water supplies also exist (Hamilton and King; 1983; Bosch and Hewlett 1982), although effects tend to be highly specific, and further research is needed.

Key factors that appear to influence the outcome are the type of tree species, the form of new land use and its associated management practices. In the case of cloud forests, evidence suggests that increased water yields from cloud interception (fog deposition on vegetation) offset higher rates of evapotranspiration, resulting in increased dry season flows (Bruijnzeel 2001). However, new research from Monteverde, Costa Rica, indicates that the added capture is relatively small compared with rough pastures (Bruijnzeel 2005). Where deforestation is associated with high soil compaction (for example roads, paths or grazing land), then runoff may rise by more than evapotranspiration falls, leading to lower water tables.

Forest might help reduce flood risks in regular-intensity events. The public perception of forests is that they have significant benefits in terms of reducing floods. In theory, through increased evapotranspiration and rainfall interception, forests may help to reduce flooding by removing a proportion of the storm rainfall and by allowing the build-up of soil moisture deficits. These effects would be expected to be most significant for small storms and least significant for the largest storms. On the other hand, forest management activities may increase floods through high impact harvesting, drainage practices, and road construction, resulting in increasing stream density and soil compaction during logging.

Some early hydrological studies – in the USA: Hewlett and Helvey (1970); in South Africa: Hewlett and Bosch (1984); in the UK: Kirby *et al.* (1991); Johnson (1995); and in New Zealand: Taylor and Pearce (1982) show little linkage between land use and storm flow. The recent evidence supporting a positive relationship suggests that this might only exist in smaller catchments and during small events – in the USA: La Marche and Lettenmair (2001); in the UK: Robinson and Dupeyrat (2003); and in India: Sikka *et al.* (2003). Even in smaller catchments, the extent to which forests soak up excess water during rainy periods depends on the forest type and management.

In larger catchments, flooding occurs sequentially in basins as the storm passes over, allowing for averaging out of flood waters. In prolonged and heavy storms even large catchments will

15. Including “natural lysimeters” transpiration studies looking at neutron probe soil moisture, micromet, plant physiology, tracing methods, interception studies, interception gauges, gamma ray attenuation, “wet” lysimeters and rainfall simulators.

generate floods, but this is likely to occur even where catchments are forested (Bruijnzeel and Bremmer 1989). Experiments conducted in the Himalayas (Hofer 1998, cited in Calder 2004) show no measurable effects (Ganga-Brahmaputra-Megha), presenting no increase in frequency or the magnitude of flooding over the last few decades.

Relation of forest and reduced erosion is not straightforward. Establishing clear relationships between forest cover and erosion is extremely difficult. It is generally believed that high infiltration rates associated with natural and mixed forests will reduce surface runoff and thus erosion. Moreover, by binding soils, tree roots reduce the susceptibility of soils to erosion, especially on steep slopes. Trees also help to reduce the impact of rain on soils, and thus the level of particle dislodgement. Plantation forests do not necessarily demonstrate these benefits, as roads, logging, drainage ditches can have effects on wind-throw and splash erosion (Calder 1999).

Evidence suggests that forests are less important than other factors, such as ground cover, soil composition, climate, raindrop size, terrain and slope steepness, in determining erosion rates. Forest use is also critical, with studies showing that different logging regimes and roading systems will produce varying levels of sheet erosion and that in Malaysia, for instance, selective logging may lead to more erosion vis-à-vis cocoa and oil palm production (Douglas *et al.* 1992). Forest plantations of certain species, such as *Tectona grandis* may cause severe erosion.

Less is known about gully erosion and landslides. In a study of erosion in Chiang Mai Province, Thailand, Forsyth (1998) suggested that gully erosion may be more important than sheet erosion in forested areas owing to the way tree trunks and roots shape water flows. Where this is true, deforestation may reduce erosion. Landslides tend to be associated with steep slopes, saturated soils and tectonic movements, and are made more likely by human activities, for example road building. Although shallow landslides may be prevented by deep root systems provided by trees, this is not the case with larger landslides (Bruijnzeel 1990).

Forests help reduce sedimentation, in some circumstances. Sediment delivery ratios depend on a range of site-specific factors, including: the size of catchments (larger basins having lower ratios because they have more obstacles for catching sediment), local geology, topology, stability of river banks, and the state of land use and the road network (Chomitz and Kumari 1998). Although changes in land use may have significant impacts on sediment delivery, this needs to be carefully compared with existing levels before land-use change. Very few empirical studies have taken account of all the relevant variables. Although it is believed that the more extensive root systems of forest help hold the soil more firmly in place and resist landslides better than clear-cut or heavily disturbed watersheds (Conservation Finance Guide), this tends to hold true mostly for shallow landslides. Large landslides are not necessarily correlated to previous existence of forest in the area.

Natural healthy ecosystems help in maintenance of aquatic habitats. The positive impact of forests on the health of aquatic populations in rivers, lakes and along coasts through controlling sedimentation, nutrient loading, water temperature and water turbidity is often highlighted (Calder, 2005). High sediment and nutrient loads are particularly damaging, causing eutrophication and the development of algae blooms that starve aquatic life of oxygen and sunlight. In the case of riverine aquatic life, riparian forests are thought to provide cover to maintain water temperatures, oxygen concentration, food and pools for spawning and juvenile development (Calder 2005).

Time lags can be considerable. Because of their nature, there can be significant time lags between changes in land practices and their impact on service delivery downstream. Changes in global climate can also affect delivery of the watershed service, limiting (or strengthening) the impact achieved from local land practices.

6.1.2 Predicting the impacts: understanding the environmental baseline

To assess environmental impacts it is necessary to understand the biophysical baseline. This involves a hypothetical evaluation of what would have happened without the PES scheme. It requires conducting or reviewing previous field experiments in the sites where the scheme will take place, and understanding which are the main biophysical processes pursued (i.e. the relationships between biophysical variables such as precipitation, soil compaction and infiltration). Very few schemes have actually developed their own hydrological baseline studies (the Bhoj scheme proposed in India is one of the exceptions) (Agarwal *et al.* 2007).

The generation of environmental benefits may not be significant if payments are directed to good practices (i.e. conservation) that would have happened anyway (*lack of additionality*) or if the project results in displacement of harmful activities to other places not receiving payments (*leakage*).

Hydrological baseline studies require information referring to rainfall from different gauge stations, climate, evaporation, soil moisture, unsaturated zone and recharge, streamflow, water quality, geomorphology and sediments. Hydrogeological baseline studies include one-off data sets (geology, digital terrain model, river-bed levels, borehole datum levels and locations, Ordnance Survey coverage and aquifer parameters) and time series monitoring requirements, such as groundwater levels and groundwater quality.

The WfW programme in South Africa is one of the very few schemes with strong hydrological evidence supporting its impacts. Conducting in-depth hydrological studies can be very expensive, and in many places long-term data do not exist or are not available to the public. Not surprisingly, many of the early ongoing payment schemes have gone ahead with relatively little scientific information about the hydrological baseline and the likely impacts of changing land use. Instead, they have relied heavily on perceptions of different stakeholders. In many cases, perceptions may only be weakly related to scientific evidence (Porrás and Miranda 2005), but they can become the basis for policy making (Jeanes *et al.* 2006; and see Box 11).

In Bolivia there are contrasting experiences in an ongoing scheme and a proposed scheme. The Los Negros scheme in Bolivia, where the downstream community blamed decreasing water levels on the clearing of cloud forest by the upstream farmers, went ahead with payments without in-depth examination of local data on forest-hydrology links (Robertson and Wunder 2005). However, the scheme administrators have since conducted a study to look at these relationships in more detail. For the proposed scheme in Tarija (one of eight advanced proposals in our

sample), hydrological modelling studies were conducted which concluded that deforestation (especially through uncontrolled burning) would have substantially negative effects on dry-season flows and would increase sediment run-off. This scheme, however, has not proceeded further with payments and is moving to a project-based strategy for watershed management (Robertson and Wunder 2005).

In some of the more recent initiatives, efforts are being made to conduct hydrological background studies. In the Valle de Bravo case in Mexico, a series of studies was commissioned to look in detail at water quality and quantity in rivers and dams. Moreover, the scheme provides equipment and training for local groups to carry out monitoring. The Cuencas Andinas programme of schemes in Colombia, Peru and Ecuador is developing a series of methodological steps, with emphasis on the use of optimisation models (like the Soil and Water Assessment Tool: SWAT) to analyse the biophysical variables, and estimate the potential environmental and economic impacts of the externalities (Estrada and Quintero 2004). In Fuquene, Colombia, for example, hydrological studies are being performed in the field to understand how different types of soil influence waterflow and sediment loads.

Box 11

Rapid hydrological appraisal tool from RUPES

The Rapid Hydrological Appraisal tool (Jeanes *et al.* 2006) tries to bring together knowledge of land linkages from computer-based landscape-hydrological simulation models with stakeholder perceptions of watershed functions. Using participatory rural appraisal techniques the tool explores stakeholders' perceptions on:

- the severity of the watershed problem in relation to land use;
- the positive contributions made by specific land-use practices that help reduce the problems; and
- the potential of payments or rewards for supporting positive actions upstream.

The appraisal is developed over a six month period, and has five steps:

- month 1: inception and reconnaissance of stakeholders and issues;
- months 2-4: baseline (desktop) data collection of existing literature and reports;
- months 3-4: baseline (fieldwork) data collection: spatial analysis, participatory landscape analysis, locals' and policy makers' ecological knowledge surveys;
- months 3-5: data processing into modelling and preparation of scenarios;
- month 6: communications and refinement of the findings.

This tool has been used in the proposal for payments for environmental services in Singkarak Lake Basin, Indonesia. The tool is, however, relatively new and there is no information about impacts to compare with initial baseline.

6.1.3 Achieving threshold levels for delivery of the service

Most local schemes are still at a pilot stage, with limited funds and only able to work with a few farmers or watershed providers. In these cases, it is not possible to achieve the significant threshold required for the sustained delivery of the watershed

services. Although these schemes are usually located in areas considered critical by the water user, their very small scale means that they are unlikely to generate any significant impact on the hydrological service. The main environmental benefit of these schemes will be indirect in terms of the learning experience they provide.

Examples of schemes having small scales include:

- Mount Kanla-on in the Philippines, which concentrates on reforesting 20 hectares and rehabilitating 80 hectares of forestland. The total area of the park is 24,557 hectares.
- The ESPH in Costa Rica covers 1,900 hectares and 21 farmers. The target area is approximately double that size.
- San Pedro Norte, Nicaragua. Target area for the scheme is 600 hectares. At the moment, the scheme covers only five farmers in 13 hectares.
- Jesus de Otoro, Honduras. Total upstream catchment area 3,180 hectares (some of it already protected, and almost half under forest cover). Current PES coverage approximately 75 hectares and 23 coffee producers located along the river.

An exception to this is where the agreed actions include measures to address point sources of pollution or construction of small check dams to retain soil. In Tacuba, El Salvador, one of the measures agreed with the local community was the relocation of a few houses to reduce the threat of domestic pollution to the headwaters (Marin 2006).

6.2 Reported impacts on watershed services

For only a few of the PWS schemes is there any indication that measurements are being made of changes in watershed services, i.e. water flows or quality. However, in most of these cases, either the period for data collection is very short or no thorough hydrological study exists to enable attribution of the observed changes to changes in land-use practices rather than other factors such as improvement of infrastructure.

It appears that in many of the cases measurement does not go beyond changes in land use. This applies not just to local schemes but also to national programmes. For example, in an evaluation of the Mexico PSAH, González Guillen (2004) points to the difficulty of determining whether the scheme is effectively protecting the capacity to provide hydrological environmental services, given the lack of monitoring in the priority watersheds. Local schemes in Costa Rica such as Energia Global, CNFL and Platanar confine their monitoring activities to examining land-management practices.

Some schemes report perceptions of participants or water users as evidence of impacts. Again, this raises issues of attribution as the changes observed may be real but may be due to other factors. Inferences about the impact on watershed services

have also been made from analysis of the types of land targeted and included in the schemes.

6.2.1 Evidence based on measurements of water quantity and quality

The most credible measurements of impacts on water quantity are from the South African Working for Water programme, which has taken a different approach to the popular one of “trees for water”. Ongoing for over a decade, the programme focuses on the removal of alien invasive plants that consume large quantities of water. The growth and rapid spreading of these trees and bushes has been shown to be responsible for stream flow reduction and other adverse impacts on aquatic ecosystems. The impacts of this programme on water flow have been estimated at 48–56 million cubic metres of additional water per annum (DWAF 2006).

Other schemes report changes in watershed services based on measurement but without sufficient consideration of other factors to enable credible attribution. Echavarría (2002) notes that in the Valle del Cauca scheme, Colombia, between 1988 and 1998 levels of the Desbaratado River did not present the extreme flooding incidents that occurred previously. There were also improvements in dry-season flows for the Nima and Amaime watersheds. But she acknowledges the limitations of these data, stating “without concrete figures, it is difficult to assess the actual hydrological impacts of the interventions to date” (Echavarría 2002).

In the San Pedro del Norte scheme in Nicaragua, it is reported that through the use of natural dikes, living fences and some rehabilitation of degraded forests, several seasonal water sources have become permanent in the past two years, and average water flows during the dry season have increased from 6 to over 12 cubic metres per day (Obando 2006; and see Figure 10), although the timeframe for data collection is relatively limited.

Changes in water quality have been measured in some cases. In Jesus de Otoro, Honduras, the water authority has been monitoring water quality since 1999 and has observed some improvement. However, the small scale of the pilot PWS scheme here makes it unlikely that it is the main reason for this improvement.

The Chinese Sloping Land Conversion Programme provides a contrasting experience. The sheer scale of the project, and the fact that it is not entirely voluntary, has resulted in the conversion of 9 million hectares of sloping land to forestland or tree plantations (the ultimate objective is the conversion of 17 million hectares). According to observations made by Sichuan Agricultural University in Tianquan County, cited in Changjin and Chen (2005), silt run-off from converted lands is already 22–24% less than from comparable farming lands.

Figure 10

Reported impacts on main water sources in San Pedro Norte, Nicaragua



Source: PASOLAC 2006.

6.2.2 Local perceptions of impacts

In many cases, the only information on the environmental impacts of the PWS schemes is based on local perceptions. These are mostly positive, as indicated by the examples in Box 12. Only one project has reported possible negative effects of forests on water flows. Salas (2004) describes how three years after tree planting in the Maasin watershed (the Philippines), there was a severe reduction in the water volume flowing from the main dam, leading to further discussions about the possible causes.

Box 12

Perceptions of impacts

"Where we have trees by the river, we see more and cleaner water," states Carbajal. "Many springs in the area had dried up a lot as farmers cut the forest around them. Now they are planting again and noticing that the springs give more water." Participants in the Silvopastoral Project, cited in Sheck (2006).

"When we organize group reforestation activities, more than 200 people show up, our only problem is providing transportation for everybody. They are aware that they are not going to plant trees, but to 'sow' water for the area." Staff of the Pedro Moncayo initiative (Ecuador), cited in Ecuador Virtual website (2005).

Some studies ask users whether they perceive changes in water service since a PWS scheme was introduced. Kosoy *et al.* (2005a) found that 64% of 100 users interviewed in Jesus de Otoro, Honduras, thought that water availability had improved during the two previous years, and 39% of 100 interviewed in Heredia, Costa Rica. However, in both cases, it is hard to see that any change could be attributed to the PWS schemes as there were so few landholders at the time receiving payments (four and ten, respectively).

This difficulty of attribution to PWS applies to other cases as well. In Campamento, Honduras, there was a perceived reduction in pollution from coffee-processing wastes. However, it was suggested that this had more to do with coffee prices and levels of activity, and that pollution would increase again as coffee prices recovered (Ardón-Mejía and Barrantes 2003b).

In Costa Rica, several hydropower companies involved in local schemes linked to the national programme (CNFL, Energia Global, Platanar) renewed their contracts after the first five years. This suggests that the hydroelectric companies perceive a positive impact from the actions taken even if they are not actively measuring water regimes. They are, however, changing their focus in the face of limited evidence on impact. CNFL stopped issuing new contracts for forest conservation in 2004 because of the lack of evidence and is now concentrating on investments in agro-conservation measures (A Saenz, FONAFIFO, personal communication, 2007). Energia Global has shifted its focus from water quantity to water quality (Ortiz Malavasi, personal communication, 2005). It is also possible that contract renewal has more to do with the impact on company reputation than reduction of erosion.

The case of Meijiang (China) illustrates the difficulties in drawing conclusions on the impact of land-management practices introduced by PWS when farmer perceptions vary and other factors such as extraction of river sand may be contributing to reduced sedimentation. According to Jin *et al.* (2005), farmers' perceptions of the programme are:

- Soil erosion increased in the first three years of orchard development (for building terraced strip, level ditch, bamboo ditch, and planting), but was expected to ease off afterwards.
- Environmental pollution is not perceived to be a problem, although developers have applied fertilisers and plenty of pesticides in orchards.
- There is no consensus on the impact of orchard development on water flow. Perceptions were almost equally divided among interviewees, half saying that water flow had increased and half that it had decreased.
- Lowering of riverbeds might be the result of increasing extraction of river sand rather than any reduction in soil erosion.



Payments for environmental services in Costa Rica have allowed farmers to forgo intensive agriculture and move towards a more holistic approach involving conservation, reforestation, and agroforestry

- Most farmer respondents believed that orchard development mitigated soil erosion and caused little pollution. Some of the quotes included: “There is no source of pollution”; “no pollution is visible”; “pesticide goes to the river and runs away, and so it does not pollute local drinking water”; “drinking water is taken from the local well, which is not polluted”.

6.2.3 Evidence based on characteristics of targeted land

Some evidence on the impact or rather lack of impact of PWS schemes comes from analysis of the characteristics of the land included in the scheme. These studies examine the extent to which the land in the scheme has the following characteristics:

- Located in watersheds important for human use of watershed services.
- Likely to affect watershed services for biophysical reasons: for example high slope.
- At risk of a change in land use, through, for example, forest clearing for agriculture.

The first characteristic has in many cases been a design feature of the schemes. Several the local schemes such as Pimampiro in Ecuador and Tacuba in El Salvador have targeted land surrounding the headwaters of the main source of water supply. The national programme in Mexico has proximity to an urban centre as one of its criteria for selection. The second and third characteristics have proved to be more problematic.

In the Sloping Land Conversion Programme in China there is evidence relating to the second characteristic. Xu *et al.* (2004), in a study of areas converted from agriculture to forestry in three provinces, found that 38% of the area converted in Gansu Province (and 10% in Shanxi and 11% in Sichuan) was low slope area and hence at little risk of causing erosion. Changes in forest cover in these areas are not likely to have had much impact on watershed downstream but may have had upstream environmental impacts on biodiversity and landscape.

There is more evidence relating to the third characteristic. It appears that in some schemes the land that has been entered into the PWS schemes was not at high risk of deforestation. In the case of national programmes, research in Costa Rica and Mexico calls into question the additionality they achieve. In the isolated Peninsula of Osa (Costa Rica), land under protection contracts corresponds mainly to forestland that may not be in direct danger of being converted because of its isolation and difficult access (Sierra and Russman 2006). Analysis by Sánchez-Azofeifa *et al.* (2007) found that there was no significant difference in the rate of deforestation in 1997–2000 between areas in the national PSA scheme and areas that were not. Likewise, in the Mexican national scheme (PSAH), much of the land being put under PSAH payments was not really at risk of being converted because of its low opportunity costs. A spatial model was used to identify areas at high, medium and low risk of further deforestation. In 2003, only 11% of the participating hectares in the scheme were classified as having high or very high deforestation risk but this increased to 28% in 2004 (Muñoz-Piña *et al.* 2005).

There is some evidence also from local schemes. In Los Negros, Bolivia, compensation covers only 2–10% of the opportunity costs for setting aside agricultural land. Farmers in the first year of the scheme were allowed to choose the areas they put into payments, usually located in steep slopes with less potential for agriculture and therefore in less risk of conversion (Robertson and Wunder 2005).

In these cases where there is limited additionality, the PWS schemes not only have little effect on watershed services but do not have much environmental effect upstream in terms of forest conservation.



7 Conclusions

In this review, we have surveyed the status of payments for watershed services in developing countries, highlighting the main trends in their evolution, and synthesising the available evidence on their environmental and social impacts. The ultimate aim has been to draw lessons from existing experience on how and to what extent PWS initiatives can be designed to be efficient, effective and equitable.

Our task has been complicated by the continuing diversity in the conceptualisation of payments for environmental services. Although our criteria for PWS are not as strict as others offered in the literature (see, for example, Wunder 2005), some schemes classified as such in earlier reviews did not meet our criteria and therefore have not been included in our review. Nevertheless, our sample of PWS is still rather diverse. In addition, notable adaptations made in the early schemes and the emergence of a new generation of PWS which set out to address some of the concerns about the earlier schemes also complicate the drawing of general conclusions.

7.1 The current state of the art of PWS schemes

There is considerable difference between the theory of payments for environmental services and the practice in the context of watershed services. Political realities and cultural resistance preventing increases in water charges and the need to keep down transaction costs have had a major influence on the design of the schemes. There is widespread use of administrative pricing, simple pricing structures that do not differentiate according to the characteristics of land, and allocation by first come first served. Only a few of the early ongoing schemes have been preceded by valuation studies to make the case for the efficiency of land-based approaches to provision of environmental services or to determine willingness to pay. In the few cases where a valuation has been done, the results have often not been used in that payment and levels for users have been set considerably lower.

There is also heavy reliance on government and donor funds, and only limited contribution from the water users and other downstream beneficiaries. In particular, the private sector has been slow to get involved. Many schemes involve reallocation or closer earmarking of government tax revenue rather than direct contributions from beneficiaries. Payments are being made on behalf of beneficiaries who are often unaware of the fact. The limited contribution from the private sector and the heavy dependence on donor funding raises concerns about the sustainability of the initiatives.

7.2 Impacts of PWS schemes: effectiveness, efficiency and equity

Demonstrating effective delivery of watershed services through PWS has proved elusive. This reflects the complex nature of the relationship between land use and water and the need to take into account factors such as type of species, land-management, topography and climate. For this reason, there is little firm evidence from ongoing schemes about the effectiveness of PWS in improving delivery of watershed services. The lack of targeting in some of the schemes also raises questions about their effectiveness in delivering improvements in land use that are truly additional.

Looking at the efficiency of PWS schemes requires, as a minimum, evidence that the net costs of land-based approaches including opportunity costs are lower than the costs of the conventional downstream measures needed to secure an equivalent increase in water flow, quality, flood control, etc. As there has been little reliable quantification of the effects of land-based measures on delivery of watershed services and only few ex-ante studies of costs, this evidence is lacking. The only indication that water users perceive some efficiency from the use of PWS is that some of the hydroelectric companies in Costa Rica renewed their five-year contracts. However, this could have more to do with public relations benefits than water-related benefits.

For the social impacts of PWS, the evidence so far does not indicate adverse impacts for those participating. However, the cash payments when used do not seem to be playing the intended role of providing a viable alternative to current land-use practices but instead more a partial support. This may reflect the difficulty the PWS schemes face in focusing payments on land with high opportunity cost or at high risk of conversion (or unsustainable practice). Conclusions on the size or significance of costs and benefits also depend heavily on the reference point of comparison as PWS schemes can be compared favourably with predecessor schemes that focused on land purchase or eviction. PWS provides a way of working with landholders and avoids some of the sensitivities associated with control of land by external interests.

A key question though is who participates as providers of watershed services. The evidence is that PWS schemes sometimes involve the participation of poor, small farmers but more by accident than design, at least for the earlier schemes. The second generation schemes are actively targeting the poorest groups but it is too early to judge their success.



Protection of cloud forests in the upper parts of the watershed improves the availability of water by trapping fog from passing clouds. This is a particularly useful service in the dry season when rainfall is scarce, and the value of hydroelectricity is higher

On the demand side, there is little sign that schemes are adversely affecting access to water for the urban poor. However, it is not clear that those paying through water use fees for PWS are getting value for money.

Overall, although there is considerable enthusiasm among donors, governments, NGOs and researchers for payments for watershed services, there is little evidence yet that the schemes are matching up to the high expectations placed on them. There is still a lack of evidence from developing country PWS schemes that investing in land-management measures upstream has advantages over other measures to address downstream water-related problems. There is also insufficient evidence that payments to landholders will be effective in changing their behaviour or will make significant improvements to their livelihoods.

7.3 Signs of change in PWS schemes

Since the previous IIED review of PWS schemes (*Silver Bullet or Fools' Gold?*) in 2002, there have been notable developments. Not only has there been a remarkable growth in the number of schemes and proposals, particularly in Latin America and Asia, but there have also been some changes in their characteristics. A second generation of schemes have emerged which have actively tried to incorporate lessons from the early schemes and to address concerns raised by the early reviews.

Programmes such as RUPES in Asia and Cuencas Andinas in South America have been set up with specific poverty reduction and livelihood improvement objectives. The newer schemes are also giving more attention to hydrological measurements and valuation studies. At the same time, some of the early schemes such as the national programme in Costa Rica have made a series of modifications to promote participation of small farmers and indigenous peoples and to respond to stakeholder concerns, or to improve analysis of hydrological linkages, as in the case of Los Negros, Bolivia.

There is now greater recognition of the complexities of the land use and water linkages, and hence the need for site-level measurement. There is also greater interest in the contribution of other types of land-use change such as agroforestry and organic agriculture. This is bringing other players into PWS on the supply side: farmers as opposed to owners of forestland, and broadening the range of the intermediaries and facilitating organisations – forest and conservation organisations have been joined by organisations promoting sustainable agriculture, agroforestry and community development. Some long-standing schemes in Costa Rica have shifted their focus from water quantity to water quality in the face of lack of evidence of the impact of forest conservation, and have increased the emphasis on agro-conservation measures.

The key question is whether this second generation of new schemes and adapted early schemes will be able to demonstrate better than the first generation that they can deliver improvements in watershed services efficiently and equitably.

7.4 Where next?

Payment schemes, if they are to be financially self-sustaining, whether through private or public money, need to be driven more by the water users and become an integral part of water resource management and allocation policy. For this to happen, better evidence is needed of the beneficial impacts of sustainable land-management practices on water flow and quality, and on the ability of payments to influence the behaviour of landholders. This can pave the way for enabling legislation that acknowledges and promotes land-based activities as means to provide watershed environmental services.

Better evidence of land management and delivery of watershed services, coupled with enabling legislation, may be effective in bringing in more private companies as buyers. However, judging by the current experience, PWS schemes are unlikely to be the route to major sources of new private money. It is necessary to understand why private water users have been reluctant to commit funds. It has sometimes stemmed from a view that they currently contribute funds through taxation or through water charges to finance, among other things, watershed management. This reluctance is likely to intensify as raw water charges are introduced more widely. Proponents of PWS therefore will increasingly need to make the case for earmarking tax revenue or water revenue rather than, or as well as, tapping private willingness to pay.

If dependence on public money is to continue, there needs to be a better case made that PWS has advantages in meeting public objectives over other approaches. There are increasing calls for better targeting in PWS schemes so that the areas with the highest potential impacts on delivery of watershed services participate. This means differentiated payments that reflect: (1) the risk of loss of watershed services; (2) the geographical location of the provider (i.e. riparian areas are more sensitive to sediment discharge); (3) the opportunity cost involved in switching activities. Explicit grading systems can be incorporated in evaluation of proposals, to help identify areas more valuable for environmental benefits, and where true modification of conduct would be achieved by the economic instrument. Hydrological maps can be overlapped with risk-prone areas, and socioeconomic studies can group farmers according to their location, willingness to engage and required compensation levels.

Targeting can also be used to achieve social objectives such as promoting the participation of certain vulnerable groups and preventing adverse social impacts. Some PWS schemes are adopting these approaches, often in response to donor concerns, to address poverty and contribute to the millennium development goals. Better understanding is needed of the effectiveness of such approaches and of the tradeoffs involved with the achievement of watershed service delivery and other environmental objectives.

It is also necessary to be realistic about what PWS can achieve in contexts where there are serious deficiencies in water infrastructure, or where water is provided free or at subsidised rates to certain groups, or where commercial agriculture is heavily subsidised. This underlines the importance of deploying PWS as one element in a water-resource management policy. PWS is likely to work best when it is coherent with water resource allocation and pricing policy.

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Appendix 1

Case Profile

Summary	
Maturity of the initiative	Proposal or ongoing scheme, dates, status with respect to <i>Silver Bullet or Fools' Gold?</i>
Driver	Unclear, government regulation, supply side, demand side
Supply	Categories: public government land, public communal land, private landowners, private reserves, local NGOs and trusts. Are small farmers involved? (Put information on the size of properties, etc.)
Demand/ Intermediary/ Facilitator	Categories include Government (national, local), corporate business, user associations, NGOs (national/local/international), trusts, research groups, universities. What role? (i.e. Independent donor, percentage charged over the payment, etc.). Is it a participant or a stakeholder?
Service	Water flow regulation, water quality maintenance, erosion and sedimentation control, land salinisation reduction/water table regulation, maintenance of aquatic habitats
Commodity	Improved management practices, reforestation for commercial plantations, conservation and protection of existing ecosystems, rehabilitation of degraded ecosystems for protection
Payment mechanism	What are the eligibility criteria/requirements for participating in the scheme, e.g. formal land title, minimum size of landholding, etc. Is it voluntary or compulsory? How do they avoid free-riding? What exit strategy can buyers use if they wish to stop buying the environmental service? Are its incentives aligned for a successful system, better environment, happy people, low transactions costs, etc.? Categories include direct negotiation, intermediary-based transactions (trust, government agency, NGO), pooled transaction, over-the-counter, clearing house transaction, auctions, internal trading retail-based market, (environmental) user fees
Type of payment	In-kind (describe, for example training; support to access loans, markets; beehives), cash, one-off, cash instalments (describe period and conditions)
Funds involved	Monetary values if available
Impacts (costs and benefits)	Are costs and benefits verified and perceived/expected? Try to relate the costs and benefits to the different stakeholder groups Economic costs and benefits (C&B): Includes the costs of institution building (for example, transaction costs). This should be a focus of this new review. How much (roughly) are they? It might be worth trying to obtain indicator (number of people involved, since when did the proposal begin, etc.). Who is paying for setting-up costs? For how long? Who will pay for them after? Is the initiative likely to be self-sustainable?

	Environmental C&B. Describe the physical characteristics of the upstream area and why is it important to protect (this is already on the demand point of view); environmental impacts other than on the environmental service being considered, proportion of the whole watershed under the scheme? Scientific evidence? Has each case made studies? Have trade-offs been considered? What types of land-use activities were taking place there before the system? Have these activities stopped or are they taking place somewhere else? (leakages) (see also monitoring) Social C&B. Describe the socioeconomic characteristics of the upstream area – main land uses, livelihood strategies, stakeholder groups, size and distribution of landholdings, income groupings, etc.; impact of the payments on the family's income. Impacts on vulnerable groups: impacts for current welfare flows (economic, social, environmental), impacts on assets (physical, financial, human, social, environmental capitals), impacts on security (for example property rights), livelihood, financial, etc.), impacts for empowerment
Legislation issues	Preconditions for market establishment (and operation), for example legislation, institutional capacity, mechanisms for ensuring local participation, the development of partnerships, government support, educational programmes, finance, etc. Country-wide regulations? Local initiative? Existing laws for water and land use? Overlapping and contradicting laws. How is the initiative dealing with this? There might not be much information about this, but it will provide useful insights for ongoing initiatives that have to deal with water being controlled by many authorities
Monitoring	What has been the degree of/likelihood of compliance so far, and what factors have influenced it? What is the mechanism for monitoring and performance assessment? Are the payments directly contingent on ES provision (for example, on water quality) or rather on the land use that is supposed to produce the ES (for example, on conservation of native vegetation)? Time/frequency of monitoring. Monitor: external or internal? Certification schemes? Establishment of baseline. Biophysical monitoring? Leakages? How are different fluctuations and risks, which ES providers traditionally have little/no control over, being dealt with (for example, drought, fire, external intruders' actions)?
Main constraints (problems)	Main obstacles faced in market establishment and how these have been overcome. Obstacles to market development can be split between demand side (for example, low willingness to pay, lack of information) and supply-side factors (for example, insecure property rights, lack of finance, political risk, inadequate legal framework)
Main policy lessons	Is sustainable joint production with other forest goods and services possible? Impacts for current welfare flows (economic, social, environmental), impacts on assets (physical, financial, human, social, environmental capitals), impacts on security (for example, property rights, livelihood, financial, etc.), impacts for empowerment
Other information	Contracts, references, links

Appendix 2

List and status of cases reviewed

Number	Country	Name of initiative	Status (2006)
Africa			
1	Kenya	Western Kenya Integrated Ecosystem Project	Proposal
2	Malawi	Electricity company watershed protection contracts	Uncertain
3	Malawi	Water boards-watershed protection contracts	Uncertain
4	Malawi	Water boards-protected area contracts	Uncertain
5	South Africa	Stream-flow reduction licences (PES component)	Abandoned proposal
6	South Africa	Maluti Drakensburgh	Proposal
7	South Africa	Sabie-Sand catchment	Proposal
8	South Africa	Selati River	Proposal
9	South Africa	Working for water	Ongoing
10	South Africa	Working for wetlands	Borderline
11	Tanzania	Uluguru Mountains (WWF/CARE/IIED)	Proposal
12	Uganda	Brewery and wetlands in Lake Victoria	Borderline
13	Zimbabwe	Integrated catchment management in dryland areas	Abandoned proposal
Asia			
14	China	Meijiang	Ongoing
15	China	Forest Ecological Compensation programme	Ongoing
16	China	Sloping Land Conversion programme	Ongoing
17	China	Guangdong Province	Uncertain
18	China	Jiangxi Province	Uncertain
19	China	Shiangxi Province	Uncertain
20	China	Hebei Province	Uncertain
21	China	Northwest	Uncertain
22	India	Sukhomajri	Ongoing
23	India	Bhodi	Proposal (advanced)
24	India	Bhoj wetlands	Proposal (advanced)
25	India	Arvari	Borderline
26	India	Myrada	Borderline
27	India	Kuhan	Ongoing
28	India	HM (Inter-state watershed protection contracts)	Uncertain
29	Indonesia	Setulang (RUPES/CIFOR)	Proposal
30	Indonesia	Segara, West Lombok IIED)	Abandoned
31	Indonesia	Singkarak Lake (RUPES)	Proposal (advanced)
32	Indonesia	Lake Toba	Ongoing
33	Indonesia	Sumberjaya (with RUPES)	Ongoing
34	Indonesia	Brantas	Ongoing
35	Indonesia	Cidanau	Ongoing
36	Indonesia	Ranget Spring, West Lombok (WWF)	Proposal
37	Indonesia	Halimun (WWF/RUPES)	Proposal
38	Indonesia	Kapuas Basin, West Kalimantan (WWF/CARE/IIED)	Proposal

39	Nepal	Kulekhani	Ongoing
40	Pakistan	Mangla-Dam (national programme)	Ongoing
41	The Philippines	Makiling	Proposal (advanced)
42	The Philippines	Bakun (RUPES)	Proposal
43	The Philippines	Kalahan (RUPES)	Proposal
44	The Philippines	Sibuyan island (RUPES/WWF/CARE/IIED)	Proposal
45	The Philippines	Maasin	Ongoing
46	The Philippines	Mount Kanla-on	Ongoing
47	The Philippines	Watershed Rehabilitation Fund	Ongoing
48	The Philippines	Mount Isarog (WWF/CARE/IIED)	Proposal
49	The Philippines	North Sierra Madre (WWF/RUPES)	Proposal
50	Vietnam	Government watershed management contracts	Uncertain

Central America and Caribbean

51	Costa Rica	ICE-Arenal Watershed Fund	Abandoned proposal
52	Costa Rica	San Jose Watershed Fund	Abandoned proposal
53	Costa Rica	Del Oro	Abandoned
54	Costa Rica	La Esperanza	Ongoing
55	Costa Rica	Platanar	Ongoing
56	Costa Rica	Energia Global	Ongoing
57	Costa Rica	ESPH	Ongoing
58	Costa Rica	CNFL	Ongoing
59	Costa Rica	ICE	Ongoing
60	Costa Rica	La Florida	Ongoing
61	Costa Rica	Silvopastoral/ RISEMP	Ongoing
62	Costa Rica	PSA national	Ongoing
63	Dominican Republic	Procaryn	Proposal
64	El Salvador	El Imposible	Ongoing
65	El Salvador	Pasolac (Morazan)	Ongoing
66	El Salvador	Pasolac (Tacuba)	Ongoing
67	El Salvador	Ecoservicios (national programme). Includes two pilot sites in Jaltepeque-Jiquilisco and Coatepeque	Ongoing
68	Guatemala	Sierra de las Minas	Proposal (advanced)
69	Guatemala	Cerro San Gil	Ongoing
70	Guatemala	MAGA National	Ongoing
71	Guatemala	San Jerónimo (GTZ)	Ongoing
72	Honduras	Campamento (Pasolac)	Ongoing
73	Honduras	Jesus de Otoro (Pasolac)	Ongoing
74	Honduras	El Escondido	Proposal
75	Honduras	Rio Platano (GTZ)	Proposal
76	Jamaica	Buff Bay	Proposal
77	Jamaica	Watershed protection contracts and fees	Uncertain
78	Mexico	Fidecoagua	Ongoing
79	Mexico	Valle de Bravo	Ongoing
80	Mexico	Zapalinamé	Ongoing
81	Mexico	National PSAH	Ongoing
82	Nicaragua	Estelí (El Regadio) Pasolac	Ongoing
83	Nicaragua	San Pedro Norte (Pasolac)	Ongoing
84	Nicaragua	Silvopastoral/ RISEMP	Ongoing

85	Panama	Chagres (Panama Watershed Canal)	Abandoned proposal
86	Panama	Filo del tallo	Uncertain
87	St Lucia	Talvern Watershed	Proposal

South America

88	Bolivia	Bermejo (international with Argentina)	Abandoned proposal
89	Bolivia	ICO	Borderline
90	Bolivia	Los Negros	Ongoing
91	Bolivia	Tarija	Proposal (advanced)
92	Bolivia	San Pedro (GTZ)	Proposal
93	Bolivia	Sucre (GTZ)	Proposal
94	Bolivia	Watershed management programme (GTZ)	Proposal
95	Bolivia	Comarapa Municipality	Proposal
96	Bolivia	Prometa (HEP)	Proposal
97	Bolivia	Vallegrande municipality	Proposal
98	Brazil	Proambiente (GTZ)	Proposal
99	Brazil	PCJ	Ongoing
100	Brazil	São João Watershed (WWF)	Proposal
101	Chile	Water share trading and PES	Abandoned proposal
102	Colombia	Afluentes del Cauca	Proposal
103	Colombia	La Miel	Proposal
104	Colombia	Campoalegre	Borderline
105	Colombia	Valle del Cauca	Ongoing
106	Colombia	Fuquene (C Andinas)	Ongoing
107	Colombia	Silvopastoril/ RISEMP	Ongoing
108	Colombia	Plan Verde	Ongoing
109	Ecuador	EcoFondo Podocarpus National Park	Proposal
110	Ecuador	Rio el Angel (Cuenca Andinas)	Proposal
111	Ecuador	Ambato (C Andinas)	Proposal (advanced)
112	Ecuador	Shutan Bajo	Borderline
113	Ecuador	Cuenca	Ongoing
114	Ecuador	FONAG	Ongoing
115	Ecuador	Pedro Moncayo	Ongoing
116	Ecuador	Pimampiro	Ongoing
117	Ecuador	Arenillas	Proposal
118	Ecuador	Cotacachi, Imbabura	Proposal
119	Peru	Alto Mayo (Cuenca Andinas)	Proposal (advanced)
120	Peru	Arequipa (Cuenca Andinas/GTZ)	Proposal
121	Peru	Jequetepeque (Cuenca Andinas/WWF/CARE/IIED)	Proposal
122	Peru	Piura (Cuenca Andinas)	Proposal
123	Venezuela	Partnerships for National Parks	Proposal

Appendix 3

Glossary of terms

"First generation" schemes	Initial round of market for watershed services schemes. Most of them are local and relatively isolated pilot schemes characterised by a "learning by doing" approach". Most of the schemes reported in the initial <i>Silver Bullet or Fools' Gold?</i> publication fall in this category
"Second generation" schemes	Schemes are slowly beginning to take into account existing experiences and lessons from other projects. Stronger emphasis is placed on the design of baseline studies, monitoring and information sharing. Many of these schemes are subsidised by donors and tend to be part of larger regional projects such as Cuencas Andinas or the Silvopastoral Project
Abandoned schemes	These schemes have been abandoned, either as a whole, or the payment for environmental service component has been dropped for lack of support or leadership
Administratively determined pricing mechanisms	An authority can determine payment levels externally. In these cases, bargaining power by landowners is limited, although they can still voice their willingness to accept by choosing not to join. This potentially can send signals back to the authority to adjust their payment levels. This type of payments is mostly used in national-level strategies
Advanced proposal	Proposed schemes for which baseline studies have been conducted, stakeholder negotiation meetings have been held but no payments are actually taking place yet
Direct negotiation between sellers and buyers	These mechanisms involve detailed contracts outlining best management practices, land purchase agreements and conservation easements. Direct negotiations are mostly used in situations when there are few stakeholders involved and/or capable watershed programme already exists; direct negotiation will be easier and faster. It usually involves detailed contracts setting out best management practices, or land purchase agreements. However, payments are generally part of larger projects, and they are the result of (usually) a long bargaining process
Ecosystem or environmental services	The benefits that people derive from natural ecosystems, in contrast with man-made structures that could be substitutes Benefits can be direct as provisioning services (i.e. food and water) or regulating services (i.e. control of floods and erosion, water purification, land degradation, desiccation, soil salinisation, etc.); ; or indirect through providing supporting services for the functioning of ecosystem processes (i.e. nutrient cycling; soil creation) Ecosystems also provide people with non-material benefits such as aesthetic pleasure, recreational opportunities, and spiritual and cultural sustenance (MEA 2005)

Internal trading	Transactions within an organisation, for example intra-governmental payments
Market	Markets are defined as voluntary transactions between buyers and sellers, where the price is set on the basis of supply and demand
Maturity of the scheme	The maturity of the scheme refers to its status. They could be “ongoing”, proposals, borderline schemes, abandoned, or uncertain
National or local government budget allocations.	National level projects, like the PSA in Costa Rica or the PSAH in Mexico, have annual government budgets allocated for payments for environmental services. In Costa Rica the main source is the 3.5% of collections from a 15% tax on fuels. In Mexico it is approximately US\$20–30 million per year
Negotiations through intermediary.	As the number and distribution of stakeholders increase, so does the need for an intermediary. They are used to control transaction costs and risks, and are most frequently set up and run by NGOs, community organisations and government agencies. In some cases, independent trust funds are created. Intermediaries are vital in national schemes such as the PSA in Costa Rica and the PSAH in Mexico, and the final contribution from downstream users will reflect their capacity to negotiate on behalf of upstream farmers
Ongoing schemes/ initiatives	These are initiatives in which payments are being made from the users (direct and indirect), or to the suppliers, or both
Pooled transactions	Pooled transactions control transaction costs by spreading risks among several buyers. They are also used to share the costs of a large transaction as often required in the watershed markets
Preliminary proposals	Proposals for payment schemes which have been announced but for which there is limited information available or little background work completed
Regulatory mechanisms	Some markets for watershed services are based on externally imposed requirements, especially in developed countries where environmental regulations are stricter. Market-based strategies are used to help companies reach environmental targets while reducing costs of compliance
Retail-based trades	Where payments for watershed protection are attached to existing consumer purchases, for example Salmon-Safe agricultural produce. Normally associated with certification and labelling schemes that generate consumer recognition and willingness to pay
Uncertain schemes	It was not possible to obtain sufficient information proving that the scheme had been abandoned or was still ongoing. Some schemes may have evolved into another local or national programme (such as the Chinese regional schemes reported in 2002), but we have not been able to confirm this
User fees	Funding of payments for watershed services through a special fee charged to domestic or agricultural water users

Watershed	The term watershed refers to the geographic boundaries of a particular water body, its ecosystem and the land that drains to it. It also includes groundwater aquifers that discharge to and receive discharge from streams, wetlands, ponds and lakes. Large watersheds are sometimes referred to as river basins. It is sometimes referred to as “catchment”
Watershed ecosystem services	These are the ecosystem services provided by fresh water and the hydrologic cycle (MEA 2005). Services include: Provisioning: water (quantity and quality) for consumptive user, water for non-consumptive user (hydroelectricity, transport), aquatic organisms for food and medicines Regulating: maintenance of water quality (natural filtration and water treatment), buffering of flood flows, erosion control through water/land interactions and flood control infrastructure Cultural: recreation, tourism, existence values Supporting: role in nutrient cycling (floodplain fertility), primary production, predator/prey relationships and ecosystems resilience These services can be tracked geographically using a watershed as an analysis unit

Appendix 4

Supporting information for Figures 2 to 9

Figure 2 supporting information Summary of watershed services demanded

Scheme	Water quantity	Water quality	Bundled services
Ongoing national	South Africa – Working for Water China – Forest Ecological Compensation and Sloping Land Conversion programmes Philippines – Watershed Rehabilitation Fund Mexico – PSAH Costa Rica – PSA El Salvador – Ecoservicios	China – Forest Ecological Compensation and Sloping Land Conversion programmes Philippines – Watershed Rehabilitation Fund Mexico – PSAH Costa Rica – PSA El Salvador – Ecoservicios	Costa Rica – PSA El Salvador – Ecoservicios Guatemala – MAGA Colombia – Plan Verde Mexico – PSAH
Ongoing local	India – Kuhan India – Sukhomajri Indonesia – Sumberjaya (with RUPES) Nepal – Kulekhani Philippines – Maasin Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – La Esperanza Costa Rica – Platanar El Salvador – El Imposible El Salvador – Morazan Guatemala – San Jerónimo (GTZ) Honduras – Campamento (Pasolac) Honduras – Jesus de Otorá (Pasolac) Nicaragua – Estelí Bolivia – Los Negros Colombia – Valle del Cauca Ecuador – Cuenca Ecuador – FONAG Ecuador – Pimampiro	India – Sukhomajri Indonesia – Brantas Indonesia – Cidanau Indonesia – Lake Toba Indonesia – Sumberjaya Nepal – Kulekhani Pakistan – Mangla dam (national programme) Philippines – Maasin Philippines – Mt Kanla-on Mexico – Fidecoagua Mexico – Valle de Bravo Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – ICE Costa Rica – La Esperanza Costa Rica – La Florida Costa Rica – Platanar Costa Rica – Silvopastoral RISEMP El Salvador – El Imposible El Salvador – Pasolac (Tacuba) Guatemala – San Jerónimo (GTZ) Honduras – Campamento (Pasolac) Honduras – Jesus de Otorá (Pasolac) Nicaragua – Silvopastoral RISEMP Bolivia – Los Negros Brazil – PCJ Colombia – Fuquene (C Andinas) Colombia – Silvopastoral RISEMP Ecuador – FONAG	China – Meijiang Mexico – Zapalinamé Costa Rica – Silvopastoral RISEMP El Salvador – El Imposible Guatemala – Cerro San Gil Nicaragua – San Pedro Norte (Pasolac) Nicaragua – Silvopastoral RISEMP Brazil – PCJ Colombia – Silvopastoral/ Regional Integrated Silvopastoral Ecosystem Management Project RISEMP Ecuador – Pedro Moncayo
Advanced proposals	India – Bhodi Indonesia – Singkarak Lake (RUPES) Philippines – Makiling Guatemala – Sierra de las Minas Bolivia – Tarija Ecuador – Ambato (C Andinas) Peru – Alto Mayo (Cuenas Andinas)	India – Bhodi India – Bhoj wetlands Philippines – Makiling Guatemala – Sierra de las Minas Bolivia – Tarija Peru – Alto Mayo (Cuenas Andinas)	Indonesia – Singkarak Lake (RUPES)

Figure 3 supporting information

Land-based proxy commodities for watershed services

Scheme	Management	Reforestation	Conservation	Restoration
Ongoing national	South Africa – Working for Water Philippines – Watershed Rehabilitation Fund El Salvador – Ecoservicios (national programme) Colombia – Plan Verde	China – Forest Ecological Compensation and Sloping Land Conversion programmes Mexico – National PSAH Costa Rica – PSA National Guatemala – MAGA National Colombia – Plan Verde	Mexico – National PSAH Costa Rica – PSA National Guatemala – MAGA National	China – Forest Ecological Compensation and Sloping Land Conversion programmes El Salvador – Ecoservicios (national programme) Colombia – Plan Verde
Ongoing local	China – Meijiang India – Sukhomajri Indonesia – Brantas Indonesia – Cidanau Indonesia – Sumberjaya (with RUPES) Pakistan – Mangla dam (national programme) Philippines – Maasin Philippines – Mt Kanla-on Mexico – Valle de Bravo Mexico – Zapalinamé Costa Rica – ICE Costa Rica – Silvopastoral RISEMP El Salvador – Morazan El Salvador – Pasolac (Tacuba) Guatemala – Cerro San Gil Guatemala – San Jerónimo (GTZ) Honduras – Campamento (Pasolac) Honduras – Jesus de Otoro (Pasolac) Nicaragua – Estelí Nicaragua – San Pedro Norte (Pasolac) Nicaragua – Silvopastoral RISEMP Colombia – Fuquene (C Andinas) Colombia – Silvopastoral RISEMP Colombia – Valle del Cauca Ecuador – FONAG Ecuador – Pedro Moncayo Ecuador – Pimampiro	Philippines – Maasin Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – ICE Costa Rica – Platanar Mexico – Fidecoagua Guatemala – San Jerónimo (GTZ) Honduras – Jesus de Otoro (Pasolac) Colombia – Valle del Cauca Ecuador – Pedro Moncayo	India – Kuhan India – Sukhomajri Indonesia – Brantas Indonesia – Cidanau Nepal – Kulekhani Philippines – Mt Kanla-on Mexico – Fidecoagua Mexico – Valle de Bravo Mexico – Zapalinamé Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – ICE Costa Rica – La Esperanza Costa Rica – La Florida Costa Rica – Platanar El Salvador – El Imposible Guatemala – Cerro San Gil Guatemala – San Jerónimo (GTZ) Bolivia – Los Negros Colombia – Valle del Cauca Ecuador – Cuenca Ecuador – FONAG Ecuador – Pimampiro	Indonesia – Lake Toba Philippines – Maasin Brazil – PCJ
Advanced proposals	India – Bhodi India – Bhoj wetlands Indonesia – Singkarak Lake (RUPES) Philippines – Makiling Guatemala – Sierra de las Minas Ecuador – Ambato (C Andinas) Peru – Alto Mayo (Cuenas Andinas)	Bolivia – Tarija	Bolivia – Tarija	Indonesia – Singkarak Lake (RUPES)

Figure 4 supporting information

Participants in markets for watershed services: payment recipients

Scheme	Private landowners	Private reserves	Informal occupiers of public land	Communal land	Park administration
Ongoing national	China – Forest Ecological Compensation and Sloping Land Conversion programmes Philippines – Watershed Rehabilitation Fund Mexico – PSAH Costa Rica – PSA El Salvador – Ecoservicios Guatemala – MAGA Colombia – Plan Verde	Costa Rica – PSA	Mexico – National PSAH Costa Rica – PSA National Guatemala – MAGA National	Mexico PSAH Costa Rica – PSA	
Ongoing local	China – Meijiang India – Sukhomajri India – Kuhan Indonesia – Brantas Indonesia – Cidanau Pakistan – Mangla dam Mexico – Fidecoagua Mexico – Valle de Bravo Mexico – Zapalinamé Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – ICE Costa Rica – La Florida Costa Rica – Platanar Costa Rica – Silvopastoral RISEMP Honduras – Campamento (Pasolac) Honduras – Jesus de Otoro (Pasolac) Nicaragua Esteli (Pasolac) Nicaragua – San Pedro Norte (Pasolac) Nicaragua – Silvopastoral RISEMP Bolivia – Los Negros Brazil – PCJ Colombia – Fuquene (C Andinas) Colombia – Silvopastoral RISEMP Colombia – Valle del Cauca Ecuador – Cuenca Ecuador – FONAG Ecuador – Pedro Moncayo Ecuador – Pimampiro	Costa Rica – La Esperanza	Indonesia – Sumberjaya (with RUPES) Philippines – Maasin Philippines – Mt Kanla-on	India – Sukhomajri India – Kuhan Nepal – Kulekhani Mexico – Zapaliname El Salvador – Tacuba Ecuador - FONAG	El Salvador – El Imposible Guatemala – Cerro San Gil Ecuador – Cuenca

Figure 5 supporting information Sources of funding for national and local schemes

Scheme	Domestic water fees: reallocation or surcharge	Agricultural water user fees	Reallocation of municipal budget	Reallocation of company budgets/statutory industry contributions	Reallocation of national budgets	Donors
Ongoing national		Colombia – Plan Verde	South Africa – Working for Water	Philippines – Watershed Rehabilitation Fund Costa Rica – PSA Colombia – Plan Verde	South Africa – Working for Water China – Forest Ecological Compensation and Sloping Land Conversion programmes Mexico – PSAH Costa Rica – PSA El Salvador – Ecoservicios Guatemala – MAGA Colombia – Plan Verde	South Africa – Working for Water Mexico – PSAH Costa Rica – PSA El Salvador – Ecoservicios Colombia – Plan Verde
Ongoing local	Philippines – Maasin Mexico – Fidecoagua Mexico – Zapalinamé Costa Rica – ESPH El Salvador – El Imposible El Salvador – Pasolac (Morazan) El Salvador – Pasolac (Tacuba) Guatemala – Cerro San Gil Guatemala – San Jeronimo Honduras – Jesus de Otoro (Pasolac) Nicaragua – Estelí (Pasolac) Nicaragua – San Pedro Norte (Pasolac) Brazil – PCJ Ecuador – Cuenca Ecuador – FONAG Ecuador – Pedro Moncayo Ecuador – Pimampiro	India – Kuhan India – Sukhomajri Brazil – PCJ Colombia – Valle del Cauca Ecuador – FONAG	Nepal – Kulekhani Mexico – Fidecoagua Mexico – Valle de Bravo Honduras – Campamento (Pasolac) Nicaragua – San Pedro Norte (Pasolac) Bolivia – Los Negros	Indonesia – Brantas Indonesia – Cidanau Indonesia – Lake Toba Philippines – Mt Kanla-on Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ICE Costa Rica – La Esperanza Costa Rica – La Florida Costa Rica – Platanar Brazil – PCJ Ecuador – Cuenca Ecuador – FONAG	China – Meijiang Indonesia – Sumberjaya (with RUPES) Pakistan – Mangla dam (national programme) Philippines – Maasin Mexico – Fidecoagua Mexico – Zapalinamé	India – Sukhomajri Philippines – Maasin Mexico – Valle de Bravo Costa Rica – Silvopastoral RISEMP El Salvador – Pasolac (Morazan) El Salvador – Pasolac (Tacuba) Guatemala – San Jerónimo (GTZ) Honduras – Campamento (Pasolac) Honduras – Jesus de Otoro (Pasolac) Nicaragua – San Pedro Norte (Pasolac) Nicaragua – Silvopastoral RISEMP Bolivia – Los Negros Colombia – Fuquene (C Andinas) Colombia – Silvopastoral RISEMP Ecuador – FONAG

Figure 6 supporting information

Facilitators and their roles in ongoing local schemes

Managing Intermediaries

International NGOs and donors	NGOs (national and local)	Government (national)	Government (local)	Academic sector	Trusts	User associations	None
Indonesia – Sumberjaya	India – Sukhomajri India – Kuhan Indonesia – Brantas Indonesia – Cidanau Indonesia – Sumberjaya Philippines – Maasin Philippines – Mt Kanla-on Mexico – Zapalinamé El Salvador – Morazan Guatemala – Cerro San Gil Honduras – Jesús de Otoro Nicaragua – Esteli Bolivia – Los Negros	Pakistan – Mangla Dam Philippines – Maasin Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – La Florida Costa Rica – Platanar	China – Meijang (village committee) Indonesia – Sumberjaya Nepal – Kulekhani Pakistan – Mangla Dam El Salvador – El Imposible El Salvador – Tacuba Nicaragua – San Pedro Norte Colombia – Fuquene Ecuador – Pimampiro	Costa Rica – Silvopastoral RISEMP Nicaragua – Silvopastoral RISEMP Colombia – Silvopastoral RISEMP	Mexico – Fidecoagua Mexico – Valle de Bravo Guatemala – San Jeronimo Brazil – PCJ Ecuador – Cuenca Ecuador – FONAG	Honduras – Campamento Colombia – Valle del Cauca Ecuador – Pedro Moncayo	Costa Rica – ESPH Costa Rica – ICE Costa Rica – La Esperanza

Other Facilitators

International NGOs and donors	NGOs (national and local)	Government (national)	Government (local)	Academic sector	None	Uncertain
India – Sukhomajri India – Kuhan Indonesia – Brantas Indonesia – Cidanau Indonesia – Sumberjaya Nepal – Kulekhani Philippines – Maasin Philippines – Mt Kanla-On Mexico – Valle de Bravo Mexico – Zapalinamé Costa Rica – Silvopastoral RISEMP El Salvador – Morazan El Salvador – Tacuba Guatemala – Cerro San Gil Guatemala – San Jeronimo Honduras – Campamento Honduras – Jesús de Otoro Nicaragua – San Pedro Norte Nicaragua – Estelí Nicaragua– Silvopastoral RISEMP Bolivia – Los Negros Colombia – Fuquene Colombia – Silvopastoral RISEMP Ecuador – FONAG Ecuador – Pedro Moncayo Ecuador – Pimampiro	India – Kuhan Indonesia – Brantas Indonesia – Cidanau Nepal – Kulekhani Mexico – Zapalinamé Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – La Florida Costa Rica – Platanar Guatemala – San Jeronimo Ecuador – Pedro Moncayo Ecuador – Pimampiro	India – Sukhomajri Indonesia – Sumberjaya Philippines – Mt Kanla-On Mexico – Fidecoagua Mexico – Valle de Bravo Mexico – Zapalinamé Costa Rica – ESPH Costa Rica – ICE Costa Rica – Silvopastoral RISEMP Nicaragua – Silvopastoral RISEMP Colombia – Silvopastoral RISEMP	China – Meijang (township and county government) India – Kuhan Guatemala – San Jeronimo Colombia – Valle del Cauca Ecuador - FONAG	India – Sukhomajri India – Kuhan Indonesia – Brantas Indonesia – Cidanau Indonesia – Sumberjaya Mexico – Valle de Bravo Costa Rica – Silvopastoral RISEMP Nicaragua– Silvopastoral RISEMP Brazil – PCJ Colombia – Silvopastoral RISEMP	Costa Rica – La Esperanza	Pakistan – Mangla Dam Costa Rica – El Imposible Ecuador – Cuenca

Figure 7 supporting information Drivers of PWS initiatives

Scheme	Demand led/ Downstream water use	Supply led/ Upstream water use	Solution led	Mixed/unclear
Ongoing national	South Africa – Working for Water China – Forest Ecological Compensation and Sloping Land Conversion programmes	Costa Rica – PSA Guatemala – MAGA Colombia – Plan Verde Mexico – PSAH	El Salvador – Ecoservicios	Philippines – Watershed Rehabilitation Fund
Ongoing local	China – Meijiang India – Sukhomajri Pakistan – Mangla dam (national programme) Philippines – Maasin Philippines – Mt Kanla-on Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – ICE Costa Rica – La Esperanza Costa Rica – La Florida Costa Rica – Platanar El Salvador – El Imposible Honduras – Jesus de Otoro (Pasolac) Nicaragua – San Pedro Norte (Pasolac) Brazil – PCJ Colombia – Valle del Cauca Ecuador – Cuenca Ecuador – Pedro Moncayo Mexico – Fidecoagua	El Salvador – Pasolac (Chalatenango) El Salvador – Pasolac (Morazan) El Salvador – Pasolac (Tacuba) Guatemala – Cerro San Gil Honduras – Campamento (Pasolac) Bolivia – Los Negros Colombia – Fuquene (C Andinas) Ecuador – FONAG Ecuador – Pimampiro Mexico – Valle de Bravo Mexico – Zapalinamé	India – Kuhan Indonesia – Brantas Indonesia – Cidanau Nepal – Kulekhani Costa Rica – Silvopastoral RISEMP Nicaragua – Silvopastoral RISEMP Colombia – Silvopastoral RISEMP	Indonesia – Lake Toba Indonesia – Sumberjaya (with RUPES) Guatemala – San Jerónimo (GTZ)
Advanced proposals		Philippines – Makiling Guatemala – Sierra de las Minas Bolivia – Tarija Ecuador – Ambato (C Andinas) Peru – Alto Mayo (Cuenas Andinas)	India – Bhodi India – Bhoj wetlands Indonesia – Singkarak Lake (RUPES)	

Figure 8 supporting information

Mechanisms for determining payment levels to suppliers in local schemes

Scheme	Administratively determined	Direct negotiation buyer-seller	Intermediary NGO and trust	Intermediary government
Ongoing national	South Africa – Working for Water China – Forest Ecological Compensation and Sloping Land Conversion programmes Philippines – Watershed Rehabilitation Fund Costa Rica – PSA Guatemala – MAGA Colombia – Plan Verde Mexico – PSAH			El Salvador – Ecoservicios
Ongoing local	China – Meijiang Indonesia – Sumberjaya (with RUPES) Pakistan – Mangla dam (national programme) Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – La Florida Costa Rica – Platanar Costa Rica – Silvopastoral RISEMP Nicaragua – Silvopastoral RISEMP Brazil – PCJ Colombia – Fuquene (C Andinas) Colombia – Silvopastoral RISEMP Colombia – Valle del Cauca Ecuador – Cuenca Ecuador – FONAG Ecuador – Pedro Moncayo Ecuador – Pimampiro	Costa Rica – ICE Costa Rica – La Esperanza Nicaragua – San Pedro Norte (Pasolac)	India – Kuhan India – Sukhomajri Indonesia – Brantas Indonesia – Cidanau Nepal – Kulekhani Philippines – Mt Kanla-on Honduras – Campamento (Pasolac) Honduras – Jesus de Otoro (Pasolac) Bolivia – Los Negros Mexico – Fidecoagua Mexico – Valle de Bravo Mexico – Zapalinamé	Philippines – Maasin El Salvador – El Imposible El Salvador – Pasolac (Tacuba) Guatemala – Cerro San Gil
Advanced proposals		India – Bhodi Philippines – Makiling	Indonesia – Singkarak Lake (RUPES) Guatemala – Sierra de las Minas Bolivia – Tarija Ecuador – Ambato (C Andinas)	India – Bhoj wetlands Peru – Alto Mayo (Cuenas Andinas)

Figure 9 supporting information

Terms of payment to suppliers in national and local schemes

Scheme	In-kind, one-off	In-kind, periodical	Cash one-off	Cash periodical
Ongoing national	Philippines – Watershed Rehabilitation Fund Colombia – Plan Verde	China – Sloping Land Conversion	China – Sloping Land Conversion	China – Forest Ecological Compensation and Sloping Land Conversion programmes Mexico – PSAH Costa Rica – PSA National El Salvador – Ecoservicios Guatemala – MAGA
Ongoing local	China – Meijiang Indonesia – Sumberjaya (with RUPES) Nepal – Kulekhani Pakistan – Mangla dam (national programme) Philippines – Mt Kanla-on Mexico – Valle de Bravo El Salvador – Pasolac (Tacuba) Honduras – Campamento (Pasolac) Brazil – PCJ Colombia – Fuquene (C Andinas) Colombia – Valle del Cauca Ecuador – Cuenca Ecuador – FONAG Ecuador – Pedro Moncayo	Bolivia – Los Negros	India – Kuhan Indonesia – Brantas Philippines – Maasin	India – Sukhomajri Indonesia – Cidanau Mexico – Fidecoagua Mexico – Zapalinamé Costa Rica – CNFL Costa Rica – Energia Global Costa Rica – ESPH Costa Rica – ICE Costa Rica – La Esperanza Costa Rica – La Florida Costa Rica – Platanar Costa Rica – Silvopastoral RISEMP El Salvador – El Imposible Guatemala – Cerro San Gil Honduras – Jesus de Otoro (Pasolac) Nicaragua – San Pedro Norte (Pasolac) Nicaragua – Silvopastoral RISEMP Colombia – Silvopastoral RISEMP Ecuador – Pimampiro
Advanced proposals	India – Bhoj wetlands Indonesia – Singkarak Lake (RUPES) Guatemala – Sierra de las Minas Bolivia – Tarija Ecuador – Ambato (C Andinas)		India – Bhodi	Philippines – Makiling Peru – Alto Mayo (Cuenas Andinas)

Natural Resource Issues

If poverty is to be reduced and livelihoods improved, significant shifts in policies, institutions and markets will be required to encourage sustainable natural resource management. How to go about this is a major challenge facing governments and civil society groups. Much guidance is available for farming, forestry and fisheries, but in reality livelihoods depend upon many forms of natural capital and are not amenable to sectoral interventions. This series of reports aims to present material on key cross-cutting themes of significance to many natural resource sectors, including water, soil, biodiversity, carbon and climate.

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A growing international debate calls for downstream beneficiaries of wise upstream land and water use to dig into their pockets and pay. The International Institute for Environment and Development (IIED) stimulated the debate several years ago with a ground-breaking review of the scene (Landell-Mills and Porras. 2002. *Silver Bullet or Fools' Gold?*). Now we have gone further – with this in-depth international review and analysis of all accessible ongoing initiatives and advanced proposals for market mechanisms for watershed services. This report highlights the main trends in the evolution of these proposals and initiatives, synthesising the available evidence on their environmental and social impacts and drawing lessons for the design of future schemes.

Free online case study resources can be downloaded from the website that accompanies this study: www.watershedmarkets.org

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