

## Understanding the Social and Ecological Outcomes of PES Projects: A Review and an Analysis

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### Abstract

Market-based approaches to environmental management, such as payments for ecosystem services (PES), have attracted unprecedented attention during the past decade. In this article, we review 26 case studies on PES from 11 countries in Asia and Latin America to help improve the understanding of the factors affecting PES schemes at the local level. We assess outcomes of the PES interventions in relation to four outcomes: equity, participation, livelihood, and environmental sustainability. Although we consider economic efficiency of these schemes to be crucial for informing policy debates, assessing it was not under the scope of this review. Our analysis shows the importance of property rights and tenure security, transaction costs, household and community characteristics, effective communication about the intervention, and the availability of PES-related information with regard to the sustainability of ecosystem service markets. The review suggests that PES schemes could target improvements in more than one outcome dimension. Focusing on the above five areas can lead to the continued provision of ecosystem services and improvements of the well-being of local inhabitants.

**Keywords:** ecosystem services, markets, payments for ecosystem services, equity, participation, livelihood, environmental sustainability

### INTRODUCTION

Decision makers and researchers have examined a range of strategies to combine the twin goals of sustainable development: conservation of natural processes and improvement of human welfare, broadly speaking. For example, integrated conservation and development projects (ICDPs) aimed at conserving biodiversity and supporting rural livelihoods throughout much of the mid- to late-1980s (Hughes and Flintan 2001; Flintan 2003). But according to many observers, ICDPs failed to achieve their ecosystem conservation goals because they did not take into account

the complexity of socio-ecological systems, especially the interdependence between resources and peoples. Others have identified additional reasons for the failure to achieve the social goals of ICDPs: increasing market demands, growing population pressures, lack of alignment of social and private incentives, and so forth (Barrett and Arcese 1995, 1998; Gunatilake 1998; Brown 2003; Wells et al. 2004).

New conservation strategies, seeking to address some of the reasons for the failures of ICDPs, have gradually emerged in the past decade. These new strategies seek to use market-based incentives to provide direct encouragement to stewards of ecosystem services for conservation and through direct payments, also address issues of human well-being. One of the most popular market-based instruments is payments for ecosystem services (PES). Although there are many definitions of PES, they are rooted in the argument that direct economic incentives for landowners are more effective than indirect means of financing or command-and-control regulations for better stewardship of resources (Ferraro and Kiss 2002), and that the incentives help internalise the ecological externalities associated with the production of ecosystem services. Wunder

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(2005: 24) defines PES as, “a voluntary transaction where a well-defined environmental service or a land-use likely to serve that service is being “bought” by a (minimum of one) environmental service (ES) buyer from an ES provider and the ES buyer does so if and only if the ES provider over time secures the conditional provision of that service.” The concept has attracted remarkable attention because natural and human-managed ecosystems generate environmental externalities (costs or benefits resulting from the actions of producers or consumers that are not reflected in the price at which exchange takes place) and internalising these externalities through incentive-based mechanisms can encourage individuals to take into account the effects of their actions on others and thereby lead to more efficient outcomes.

The Millennium Ecosystem Assessment (MA) made significant progress in outlining how valuable specific ecosystem services are to human society. It defines ecosystem services as the benefits people obtain from ecosystems. These services include, “*provisioning services* such as food, water, timber, and fiber; *regulating services* that affect climate, floods, disease, wastes, and water quality; *cultural services* that provide recreational, aesthetic, and spiritual benefits; and *supporting services* such as soil formation, photosynthesis, and nutrient cycling” (MA 2005). Building on MA work, The Economics of Ecosystem and Biodiversity Initiative (TEEB 2009) also emphasised on the value of ecosystem services to the economy, society, and individuals, and demonstrated how we can practically take into account the value of these services in policy decisions to promote sustainable development and well-being of societies.

PES projects have tended to cover all four types of ecosystem services: provisioning (water, food, etc.), regulating (e.g., biodiversity-related functions that contribute to provisioning, cultural, and regulatory functions such as disease control and climate regulation), cultural (recreational and educational benefits), and supporting (e.g., soil formation and watershed protection). Generally speaking, watershed management-related benefits (supporting services) include soil erosion control, rainwater storage, and regulation of downstream water flow due to the maintenance of forest cover in the upper reaches of a watershed. These services depend on land-use activities of those who are living in the uplands. The beneficiaries are downstream users (local peoples, water consumers, and hydropower companies, among others). Biodiversity conservation (regulating services) can provide a number of benefits to local communities as well as global stakeholders in the form of improved productivity of ecosystems for provisioning services such as food and fibre, and other services such as pest and disease control functions, insurance against extreme events, and stocks of genetic and chemical information. Beneficiaries of biodiversity-related functions include biotechnology companies as well as local tourism industries and both current and future generations. Further, non-use value is an important component which is derived simply from the satisfaction of knowing that some feature of biodiversity continues to exist and that a resource will be

passed on to descendants to maintain the opportunity for them to enjoy it in the future. Recreation based on landscape beauty is an example of cultural ecosystem services provided by natural ecosystems—also a benefit for tourism and recreational industries and for informal recreation and non-use values. Carbon sequestration refers to the capture and storage of carbon so as to reduce terrestrial emissions. Forests and undisturbed habitats play an important role in absorbing carbon through photosynthesis and storing carbon in plant biomass (e.g., trunks, branches, foliage, and roots) and soils (Houghton et al. 1991; Sedjo and Solomon 1991). Farmers can contribute to carbon sequestration by maintaining trees on their farmland and through land-use regimes that reduce disturbance of soils and existing vegetation.

Use of market-based instruments for promoting ecosystem services can enable access to diverse sources of funding and make conservation a more competitive land-use paradigm (Asquith et al. 2008). But few empirical studies have systematically examined the factors influencing landowners’ decisions to participate (*cf* Zbinden and Lee 2005; Pagiola et al. 2008) in PES projects. Zbinden and Lee (2005) identify a number of household and community characteristics that influence landowners’ decisions to participate in Costa Rica’s PES schemes. Other researchers have discussed the enabling national and international level conditions for PES schemes to become a success (Leimona and Lee 2008). And a few researchers have also highlighted the importance of political willingness on the part of national and local governments to develop enabling policies in support of environmental service markets (Huang and Upadhaya 2007). Yet, it remains unclear how and to what extent various socio-economic and institutional factors influence the adoption of PES schemes. More work is necessary to examine carefully the conditions that can help enhance synergies between environmental conservation and poverty reduction goals of PES projects (Grieg-Gran et al. 2005; Pagiola et al. 2005). A systematic examination of existing case studies of PES projects can help produce theoretically informed generalisations about the conditions under which local landowners are willing to participate in PES schemes.

This article analyses existing empirical work on PES and synthesises the findings in these studies with regard to factors affecting the adoption and sustainability of PES schemes. We review 26 case studies from Asia and Latin America on the four conventional areas in which PES projects have been implemented: biodiversity conservation, watershed services, landscape beauty, and carbon sequestration. Because the studies use different methods, differ in their specific approaches, and use different sets of variables to explain outcomes, it is difficult to use a most similar systems research design which is also the basis of experimental research where differences in observed outcomes are viewed as being the result of differences in specific causal factors. Our review may instead be viewed as an approximation of a ‘most similar systems’ research design (López 1992). The emphasis here is on identifying similarities across different cases, and examining how generalisable

research findings may be because of the consequential nature of the same explanatory factors despite case differences.

The findings demonstrate the importance of property rights and tenure security for the adoption and effective functioning of environmental service markets. As PES schemes require a significant initial investment for land-use modification decisions, schemes that manage to clarify and strengthen property rights—both formal and informal—are an important stimulus for the adoption of PES schemes. Mobilising community strength through collective action, effective communication, enhanced access to information and credit services, and ensuring gender equality in PES design also appear as critical factors in reducing transaction costs and facilitating adoption of PES projects. The role of intermediary organisations including non-governmental organisations (NGOs) is apparent in many cases, particularly for raising awareness among stakeholders. Political willingness and support from the local government turns out to be crucial for mobilising local resources and helping build stakeholder support for broad-based acceptance and interest in PES. Our review suggests that PES schemes should target positive synergies across social and ecological goals through intervention in the above areas.

The ensuing discussion first provides the background of the case studies. The next section presents a synthesis of the findings of case studies. This is followed by a section which briefly discusses the outcome of PES schemes. The last section presents the key conclusions of the review.

## BACKGROUND OF THE CASE STUDIES

We selected 26 case studies for our review and comparison across different regions and foci of the projects. In our selection, we paid particular attention to cases that met the criteria of attending to multiple outcomes, implemented provision of direct payments to participants, used market-based instruments, and identified buyers and sellers of the anticipated ecosystem services. We also considered that payments in PES schemes are conditional on performance and the schemes are often targeted. We should also note that potential payments under a PES scheme for the continued or increased supply of environmental services include not just direct cash payments. Payments can comprise options such as the recognition of indigenous or local rights to local resources or tenure security, wages for services rendered, health and education infrastructure for local inhabitants, improved delivery of services such as education, skills training, and mechanisms to reduce vulnerability of poorer households through enhanced social safety nets, among others.

Table 1 summarises the basic characteristics of and activities undertaken by the selected PES projects to build the basis for the ensuing discussion related to the key preliminary lessons about the development and adoption of markets for ecosystem services. The case studies were selected from a large pool of articles returned from generic Google keyword searches (e.g., payments for ecosystem services, environmental services,

market-based instruments for ecosystem management, adoption of PES schemes, etc.). Geographic selection criteria were first applied to exclude papers that were not set in developing countries. A second set of criteria eliminated all case studies that did not highlight one of these eight factors influencing the adoption of PES schemes. This left a moderate pool of case studies that were relevant to our geographic focus and facilitated analysis of the factors affecting PES schemes at the local level. Further, we followed a consistent set of criteria to select the case studies. These criteria included the diversity of incentive-based mechanisms under practice, characteristics of PES schemes and their status (planned, active or completed), the focus of these schemes in terms of equity, livelihood, and environmental sustainability, geographic distribution, and knowledge gaps that could be filled by the case study. The keyword searches and selection of case studies were completed in 2009. Case studies that did not have information on at least three quarters of identified variables (see below) were not included for coding of the information in them. The table also describes the stakeholders and nature of the payments currently in practice under these schemes (Table 1).

## DISCUSSION

Among the most important findings of the review is the distribution of the outcomes. The evidence in Table 3 suggests that most of the reviewed PES projects had low to medium equity and livelihood outcomes, but they scored better on environmental and ecological sustainability outcomes. At one level this is not a surprising finding—after all, the schemes in question are designed with a view to enhancing environmental outcomes first, and livelihoods or equity outcomes typically as a co-benefit of the implemented scheme. But the limited social gains also points to the potential problem in PES schemes in general, in that they do not have adequate long or medium term social sustainability, and could therefore also fail to sustain their environmental gains in the longer run. This finding is also relevant in the context of the increasingly prominent conversation of PES projects related to reducing emissions from deforestation and forest degradation (REDD+).

More specifically, evidence from the reviewed case studies suggests that a number of factors have substantial implications for the adoption of and participation in PES schemes, and the impact of these schemes on livelihoods and the effectiveness of ecosystem services protection. We organise the findings into seven broad categories: 1) property rights and tenure security; 2) government policy; 3) equity; 4) transaction costs; 5) household and community characteristics; 6) information and communication; and 7) congruence between bio-physical processes and administrative boundaries. Based on the extent to which the discussion in the selected case studies emphasises these factors, we assign them scores of low (L), moderate (M), and high (H) (see Table 2). In choosing the score of L, M, or H, we attended to the extent to which the study author(s) of the case studies discussed the factor(s) in the methods, discussion, and policy recommendation sections of the study. The scores

**Table 1**  
*Description of case studies from Asia and Latin America in different areas of payments for ecosystem services*

Case studies	PES areas/activities	Author(s)
<b>Philippines</b>	<b>Watershed conservation</b>	Arocena-Francisco 2003
Makling Forest Reserve (MFR) Stakeholders: University of Philippines, National Park Authority, local governments, NGOs, EU, USAID, GEF, communities	Activities: reforestation, adoption of agro-forestry practices, cash incentives, training for sustainable land-use practices Nature of payment: in-kind incentives such as tenure security, paid labour for plantation activities, scholarships for high school students, training on sustainable land-use options	
Maasin watershed Stakeholders: University of Philippines, National Park Authority, local governments, NGOs, EU, USAID, GEF, communities	Activities: watershed rehabilitation, reforestation, assisted natural regeneration, timber stand improvement, rattan and bamboo enhancement Nature of payment: free tree seedlings for reforestation, rattan, and bamboo management	
Northern Sierra Madre Natural Park (NSMNP) Stakeholders: University of Philippines, National Park Authority, local governments, NGOs, EU, USAID, GEF, communities	Activities: community forestry, regeneration, nursery establishment Nature of payment: training on community-based forest management, tenure security	
Mount Kanlaon Natural Park Stakeholders: University of Philippines, National Park Authority, local governments, NGOs, EU, USAID, GEF, communities	Activities: community forestry Nature of payment: community-based tenure, direct cash funding for non-destructive livelihood project	Arifin 2005
<b>Indonesia</b>	<b>Watershed conservation, biodiversity conservation, and carbon sequestration</b>	
Sumber Jaya Stakeholders: central government, local communities, local coffee growers	Activities: coffee-based agro-forestry, enhancement of land tenure security, community forestry Nature of payment: rights to local people to coffee-based agroforestry on public land, incentives through community-based forest management	
Bungo watershed Stakeholders: Rubber Development Project, local communities	Activities: rubber agro-forestry, tenure security measures Nature of payment: support to rubber-based agroforestry	
Lake Singkarak Stakeholders: Ministry of Environment, local communities	Activities: forest carbon projects, afforestation, and reforestation Nature of payment: direct payment for carbon sequestration activities at the farm level	
<b>Vietnam</b>	<b>Forest management and watershed conservation, landscape beauty and eco-tourism, marine protected area management</b>	
Country-wide programme on sustainable forest management Stakeholders: Ministry of Environment, local communities	Activities: special forests, protection forests, production forests Nature of payment: rights to harvest forest products from production forests, incentives from tourism-related activities in special forests, households receive 75% of the forest products from production forests, households receive 2% of annual harvest from agro-forestry	The and Ngoc 2006
Tri An watershed* Stakeholders: DANIDA, water supply companies, WWF, communities	Activities: watershed management, drinking water supply, water pollution control Nature of payment: communities receive payment from water supply companies and upstream groups who are polluting the river	Hoang et al. 2008
Bash Ma National Park* Stakeholders: Department of Forest, Forestry University, Research Institute, communities	Activities: biodiversity conservation, buffer zone management, conservation trust funds Nature of payment: establishment a trust fund for community level environment and development activities through selling 60,000–80,000 carbon credits under Certified Emission Reductions (CERs) of UNFCCC	
Cap Phong Carbon Sequestration Project	Activities: carbon sequestration, fodder tree planting, and improved cattle grazing Nature of payment: -	

**Table 1**  
**Contd...**

Nha Trang Bay Marine Protected Area (MPA) Stakeholders: MPA Authority, village communities, government	Activities: marine protected area management, waste management, eco-tourism  Nature of payment: communities receive 10–15% of the income generated from park entrance fee (USD 2,000/village)	
<b>Nepal</b>	<b>Watershed management</b>	Upadhaya 2005
Kulekhani watershed Stakeholders: hydropower company, district governments, communities	Activities: community forestry, revenue sharing with a hydropower company, land-use improvement  Nature of payment: district governments receive 38% of the revenue from the hydropower company; district governments share this fund with local communities for community development activities	
<b>China</b>	<b>Watershed management</b>	Zhang and Mol 2008
Sloping Land Conversion Program, Ningxia Stakeholders: central government, local communities	Activities: establishment of ecologically valuable forests, planting of economic forests and grasslands, plantation forestry, grain subsidy as compensation payment  Nature of payment: households receive an annual grain subsidy of 1,500–2,250 kg/year for conservation of a hectare of land under Sloping Land Conversion Program, cash payment of CNY 300/ha/year for these eligible land uses	
<b>India</b>	<b>Watershed management</b>	Agarwal et al. 2007
Kuhan watershed Stakeholders: local communities, project authority	Activities: institution building, micro-watershed management, supply of drinking water, erosion control  Nature of payment: payments from watershed protection beneficiaries to service providers have been attempted but payment system is still not in place	
Suan watershed Stakeholders: local communities, project authority	Activities: upstream land management, enhancement of summer flow of the stream, fire control, erosion control, grassland conservation  Nature of payment: no payment has been taking place but payments from watershed protection beneficiaries to service providers have been attempted	
Bhoj wetlands Stakeholders: local communities, project authority	Activities: pollution control, solid waste management, agriculture run-off control, water quality management  Nature of payment: no direct payment has been taking place but payments from watershed protection beneficiaries to service providers have been attempted	
<b>Central America</b>	<b>Watershed conservation</b>	Kosoy et al. 2007
Jesus de Otor, Honduras Stakeholders: Council for Administration of Water and Sewage Disposal (JAPOE), Program for Sustainable Agriculture in Hillsides of Central America (PASOLAC), local communities	Activities: sustainable agriculture, agro-forestry, irrigation ditches and terraces, organic agriculture, recycling of coffee pulp, reforestation, management of water from coffee processing  Nature of payment: direct payment to participating landowners for construction of live fence, irrigation, and ditches and terraces, adoption of agroforestry, organic agriculture, recycling of coffee pulp	
Heredia, Costa Rica Stakeholders: local communities, project authority	Activities: forest fire prevention, restriction in timber harvesting, hunting and cattle ranching, reforestation and forest conservation  Nature of payment: direct payment for landowners for water quality improvement through watershed protection activities (0.008 USD/cu. m of water)	
Paso de Los Caballos watershed, Nicaragua Stakeholders: upstream landowners, downstream users, project authority	Activities: forest conservation, forest fire prevention, restriction of timber extraction, organic farming, restrictions on livestock raising  Nature of payment: direct payment for watershed conservation (USD 26/ha/year)	

Contd...

**Table 1**  
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<b>Bolivia</b>	<b>Bird habitat protection and watershed management</b>	Asquith et al. 2008
Bird habitat and watershed protection Stakeholders: local NGOs, US Fish and Wildlife Service, downstream irrigators, municipality, upstream landowners	Activities: conservation of upstream forests, bee keeping and apiculture training, distribution of fruit tree seedlings  Nature of payment: artificial beehives for bee keeping, training on sustainable agriculture, provision of barbed wire fencing, and distribution of free fruit tree seedlings	
<b>Nicaragua</b>	<b>Pasture management and biodiversity conservation</b>	Pagiola et al. 2008
Silvopastoral project Stakeholders: local communities (pastoralists), project authority	Activities: high density tree and shrub plantation, restriction of cattle grazing, stall feeding, plantation of fast-growing trees and shrubs  Nature of payment: direct payment for silvopastoral system (USD 75 per incremental Environmental Service Index point/year)	
<b>Meso-America</b>	<b>Carbon sequestration</b>	Corbera et al. 2007
Las Escobas River Basin, Guatemala Stakeholders: government, Fundación Para El Ecodesarrollo y la Conservación (FUNDAECO), local hydroelectricity company, local communities	Activities: forest conservation, reduction in soil erosion and sediment load  Nature of payment: FUNDACEO, an NGO, receives USD 17.86/ha/year to improve the management of the river basin. PES funds come from the increase in water tariff of USD 0.20/month.	
Paso de Los Caballos River Basin, Nicaragua Stakeholders: local NGO (PASOLAC), upstream and downstream landowners, regional civil organisations	Activities: reforestation in upstream watershed, establishment of water committees, organic agriculture, fire control, agro-forestry  Nature of payment: Households contribute USD 0.31/month to improve the water quality and landowners receive USD 26/ha/year for improving the watershed	
The Fondo Bioclimatico Carbon Project (FBC), Mexico Stakeholders: Tetra Park, International Automobile Federation, World Bank, local communities	Activity: reforestation  Nature of payment: 66.6% of the amount generated from the carbon sequestration project was allocated directly to farmers.	
Bravo Carbon Project, Belize Stakeholders: Conservation Management Authority (RBCMA), local NGO, The Nature Conservancy, Winrock International, Consortium of US and Canadian energy utilities, local communities	Activities: sustainable forest management, forest-based carbon sequestration project  Nature of payment: usufruct rights to local people to harvest forest products for subsistence purpose, paid labour	

NGOs=Non-governmental organizations; EU=European union; USAID=United states of international development; GEF=Global environment facility; DANIDA=Danish International Development Agency.

\*PES schemes which are at their initial stage.

\*\*No rewarding system has been started yet but a foundation for setting up contributions to catchment protection in the near future has been established. We dropped three case studies, one from India and two cases from Vietnam as we could not find out any outcomes after reviewing these case studies.

were assigned through subjective judgement by analysing the outcome-specific performance of the PES scheme under consideration. For example, a high level of environmental performance was recorded in situations where the PES scheme helped improve the provisioning of environmental services (ES) either through specific land-use modifications to produce desired ES or reforestation, preservation of forests threatened by clearing, and soil erosion control. A moderate level of outcome was noted where there was some kind of improvement but a minimal level of conservation activity. A low level of performance towards watershed protection and forest conservation was recorded in those groups where participants were aware of the degradation of the watershed, but where no visible and effective interventions to alter the situation existed. Similarly, the high level of livelihood impact was recorded in situations where the PES scheme improved the livelihood security through the diversification of household

income. While categorising the equity outcome, we assessed the case studies with specific relevance to Corbera et al.'s (2007) proposed three elements of equity: equity in access (participation); equity in decision-making (fairness); and equity in outcome (distribution). Although several of the reviewed case studies are still at an early stage of implementation, and some of the findings from these studies are more suggestive than conclusive, the analysis we present through the review can still be useful as relevant insights for the design of the next generation of PES schemes.

### Tenure security

Importance of tenure security—from identifying service suppliers to determining beneficiaries and encouraging farmers to invest in land conservation decisions—emerges as an important stimulus for the development of ecosystem services

**Table 2**  
**Factors affecting the adoption of and participation in PES schemes**

Case study	Factors affecting participation				
	Tenure security	Role of government and NGOs	Transaction costs	Household and community characteristics	Information and communication
<b>Philippines</b>					
Makling Forest Reserve (MFR)	High	High	High	Medium	Medium
Maasin watershed	High	High	High	Medium	High
Northern Sierra Madre Natural Park (NSMNP)	High	High	Medium	Medium	Medium
Mount Kanlaon Natural Park	High	Medium	Medium	Medium	High
<b>Indonesia</b>					
Sumber Jaya	High	High	High	Medium	Medium
Bungo watershed	High	High	Medium	Medium	Medium
Lake Singkarak	Medium	High	Medium	Medium	Medium
<b>Nepal</b>					
Kulekhani watershed	High	High	High	Medium	High
<b>China</b>					
Sloping Land Conversion Program	High	Medium	High	High	High
<b>Vietnam</b>					
Tri An watershed*	Medium	High	Medium	Medium	Medium
Bash Ma National Park*	Medium	High	Medium	Medium	Medium
Cap Phong Caron Sequestration Project	Medium	High	Medium	Medium	Medium
Nha Trang Bay Marine Protected Area (MPA)	Medium	Medium	Medium	Medium	Medium
Sustainable Forest Management	High	Medium	High	High	Medium
<b>India</b>					
Kuhan watershed	High	Medium	High	High	High
Suan watershed	High	Medium	High	Medium	High
Bhoj wetlands**	High	Medium	Medium	Medium	High
<b>Central America</b>					
Jesus de Otor, Honduras	High	High	Medium	Medium	High
Heredia, Costa Rica	High	Medium	Medium	Medium	High
Paso de Los Caballos watershed, Nicaragua	High	High	Medium	Medium	High
<b>Bolivia</b>					
Bird habitat and watershed protection	Medium	High	Medium	Medium	High
<b>Nicaragua</b>					
Silvopastoral project	High	Medium	High	High	Medium
<b>Meso-America</b>					
Las Escobas River Basin, Guatemala	High	High	Medium	Medium	Low
Paso de Los Caballos River Basin, Nicaragua	High	High	Medium	Medium	High
The Fondo Bioclimatico Carbon Project (FBC), Mexico	High	High	High	High	High
Bravo Carbon Project, Belize	High	High	Medium	Medium	Low

\*PES schemes which are in their initial stage;

\*\*No rewarding system has been executed yet but a foundation for setting up contributions to catchment protection in the near future has been established;

PES=Payments for ecosystem services; FBC= Fondo bioclimatico carbon

markets in most case studies. Some of the reviewed case studies highlighted that tenure security can be available to landowners through both private and community tenure institutions.

For instance, even with temporary written rules (which provide some sense of tenure security), communities in the Sumber Jaya province of Indonesia were willing to maintain watershed service provision for downstream users. Even informal recognition of the rights of a local community—e.g., to declare as village common land areas where agricultural activities have been absent for more than ten years—facilitated

the adoption of PES schemes. The Bungo case study from Indonesia (Arifin 2005) shows the importance of congruence between locally crafted and state rules in helping promote the efficacy of conservation efforts. Analogously, locally practiced land-use norms such as *tanah batin* (lands assigned for upland paddies where a number of ritual activities can be performed), and *nagari* (a complex social system of governing land use) turned out to be instrumental in Singkarak for executing a carbon sequestration project. Common property approaches govern land use, fishing, and forest uses broadly in West Sumatra. Such

**Table 3**  
**Outcomes of PES in the case studies**

Case study	PES outcomes			
	Equity	Participation	Livelihoods	Ecosystem sustainability
<b>Philippines</b>				
Makling Forest Reserve (MFR)	Low	Moderate	Low	Moderate
Maasin watershed	Moderate	Low	Moderate	High
Northern Sierra Madre Natural Park (NSMNP)	Low	Moderate	Moderate	High
Mount Kanlaon Natural Park	Moderate	Moderate	Low	High
<b>Indonesia</b>				
Sumber Jaya	Moderate	High	Moderate	Low
Bungo watershed	Low	Moderate	Moderate	Moderate
Lake Singkarak	Low	Low	Low	Moderate
<b>Nepal</b>				
Kulekhani watershed	Moderate	High	Moderate	High
<b>China</b>				
Sloping Land Conversion Program	Low	Low	Low	Moderate
<b>Vietnam</b>				
Cap phong carbon sequestration project	Moderate	Moderate	Moderate	High
Nha Trang Bay Marine Protected Area (MPA)	Low	High	Low	Moderate
Sustainable Forest Management	Low	Low	Moderate	Moderate
<b>India</b>				
Kuhan watershed	Moderate	High	Moderate	Moderate
Suan watershed	Low	Low	Low	Low
<b>Central America</b>				
Jesus de Otor, Honduras	Moderate	High	Low	High
Heredia, Costa Rica	Moderate	Moderate	Low	Low
Paso de Los Caballos watershed, Nicaragua	Moderate	Low	Low	High
<b>Bolivia</b>				
Bird habitat and watershed protection	Moderate	Low	Low	Low
<b>Nicaragua</b>				
Silvopastoral project	Moderate	High	Moderate	High
<b>Meso-America</b>				
Las Escobas River Basin, Guatemala	Low	Low	Moderate	Low
Paso de Los Caballos River Basin, Nicaragua	Low	Moderate	Moderate	High
The Fondo Bioclimatico Carbon Project (FBC), Mexico	Moderate	Low	Low	Moderate
Bravo Carbon Project, Belize	Low	Low	Moderate	High

\*PES schemes which are in their initial stage.

\*\*No rewarding system has been started yet but a foundation for setting up contributions to catchment protection in the near future has been established.

We dropped three case studies, one from India and two cases from Vietnam, as we could not find out any outcomes after reviewing them.

institutions also facilitated the adoption of PES schemes.

The importance of tenure security also comes across strongly in the case study of the Kulekhani watershed in Nepal. This case demonstrates that the implementation of the PES scheme was possible due to the policy of community-based forestry adopted by the Nepal government through the enactment of the Forest Act, 1993. In contrast, the lack of private ownership of land was identified as a factor responsible for the relative lack of success in adopting a PES scheme in Vietnam. The case study from People's Republic of China (PRC) highlights the difficulties PES projects encounter when they do not attend to socio-economic and institutional issues (Zhang and Mol 2008). Specifically, institutional factors such as land rentals, tenure security, and inadequate social capital development emerged as key constraints limiting the success of the Sloping Land Conversion Program (SLCP). In particular, weak and incomplete property rights emerge as the major constraints

on the sustainability of the SLCP as tenure security influences the land related investment decisions. Our finding about the importance of social capital is also supported in recent studies which emphasise on better training to local households and strengthening the levels of general trust that may directly enhance people's willingness to provide contributions to public goods in relation to the SLCP (Grosjean and Kontoleon 2009; Tu et al. 2011).

The Central America case study (Kosoy et al. 2007) also demonstrates that property rights and institutions are crucial to the successful adoption of PES schemes. In addition, it shows how PES projects can be a useful tool to reduce conflicts between upstream and downstream users if property rights are strengthened because such strengthening reduces uncertainties over how to share benefits. Indeed, property rights issues also emerged as needing substantial focus in PES project design as illustrated by the Bolivian case study (Asquith et al. 2008).



In this case, fears among upstream landowners that the PES scheme was an effort by the government to appropriate their land meant that there was more limited participation and adoption of the project among landowners.

The above discussion of property rights and tenure security is also relevant to the work on informal institutions as key to understanding rural development outcomes (Scoones 1998; Mehta et al. 1999). The importance of informal institutions is consistent with the outcomes of PES schemes in Indonesia. For example, in Sumber Jaya, two informal institutions, *gotong-royong* (labour sharing for common property), and *arisan* (capital sharing among community members) greatly facilitated the adoption of local PES schemes. This was also the case in Bungo where *peleline* (labour sharing for private land) and *berselang* (labour sharing for paddy planting and harvesting) systems were instrumental in uniting local communities for the carbon sequestration project. These informal institutions helped increase local participation and adoption of conservation measures and also reduced transaction costs.

We should also recognise that in some of the reviewed cases, PES schemes can help strengthen existing land rights (e.g., temporary land rights established through frontier activities). In the Bungo watershed in Indonesia, institutions supporting biodiversity services were strengthened when users acquired land-use rights for forest frontier activities. Their activities included the planting of cash crops such as rubber, cinnamon, and other tree crops. Planting these cash crops facilitated the adoption of PES schemes, which in turn, provided a basis for farmers to claim permanent land rights in the areas where PES schemes were functional. The importance of secure land rights is also highlighted in previous studies because insecure rights lead to short planning horizons, which may prevent poorer households from investing in land management decisions (Holden et al. 1998).

### Economic incentives and technology

Profitability of adoption, even with modification of existing land-uses is an important concern for the poor and small landholders. Adoption of PES schemes will definitely be low if payments are insufficient to meet costs associated with socially and environmentally acceptable land-use practices. The basic PES equation is that if  $TC+WTA>WTP$  then PES schemes (or market incentives-based approaches) are unsuitable and regulation is better; and that if  $TC+WTA<WTP$  then PES schemes are suitable: TC stands for 'transaction costs'; WTA for 'willingness to accept (payment)', and WTP for 'willingness to pay.' Low adaptation of PES schemes could happen as a result of a mismatch between the net value of the current payment and net costs for adopting the new technology (e.g., land-use practices) and forgone income from existing land uses. PES schemes must be able to meet the opportunity costs of land if the sustainability conditions are to be satisfied. Adequate socio-economic incentives for local people help change farmers' behaviour towards more

environmentally friendly activities even if this form of land use provides few benefits in the short run. The PRC case study emphasised the role of off-farm activities in order to divert people from traditional agricultural practices, but that alone might not bring the desired outcome unless it is supported by capacity building measures (e.g., education and skill building) of participating households.

Technology adoption can be low when returns are risky and insurance and other financial markets are imperfect (Giné and Yang 2009). Scholars have highlighted income and debt as factors influencing household decisions related to adoption or participation in PES schemes (Sureshwaran et al. 1996). Because access to credit is limited in most rural areas in developing countries, micro-credit programmes can support poorer households' participation in PES schemes. The Vietnam case study found a strong correlation between household debt and adoption of PES as the probability of adoption was negatively correlated with the amount of outstanding household loans. Most land-use modifications in PES require upfront investments which could be a barrier for participation. Moreover, it became clear that debt burdens may force households to early-harvest plantation forests, and this could undermine the optimal level of watershed services. Micro-credit facilities for potential farmers may encourage the adoption of PES in such situations. The Nicaragua silvopastoral project also confirmed that access to credit enhanced the intensity of participation in situations where higher investments are needed to ensure increases in environmental services. Support for PES should therefore include credit service and technical advice for enhancing the provisioning of environmental services.

### Role of governmental and non-governmental organisations

The role of national governments is highly consequential in creating the necessary legal framework for PES schemes. With the presence of governmental agencies, property rights can be clearly assigned and enforced (Huberman and Leippraud 2006). A number of the reviewed case studies show in addition that government support for PES schemes is often facilitated by dynamic leaders at local and national levels, because they can act as champions for innovative approaches to land management. For example, political willingness and support from the local government was a key factor in the Maasin watershed in the Philippines, where the provincial governor and the mayor of relevant municipalities were champions of PES, thereby motivating local stakeholders and mobilising finance for conservation efforts. Indeed, in the Northern Sierra Madre Natural Park (NSMNP) watershed in the Philippines the local government contributed directly to the PES scheme (Arocena-Francisco 2003). This support was crucial not only to consolidate local efforts related to PES, but also instrumental in designing acceptable watershed protection fees so that the beneficiaries would pay. Although government entities did not assume the role of suppliers and buyers of relevant ecosystem services, landowner

participation in PES was enhanced through enabling policy support, and financial and technical assistance.

The Indonesian case also shows the importance of enabling policies and government support. The recognition by the government of local rights to organise into community-based organisations helped build trust and a sense of guardianship among villagers in Sumber Jaya (Arifin 2005). The Vietnamese case study on carbon sequestration discusses the role of government support for clear mechanisms that generate community-wide benefits, provide policy assistance and build capacity, and help enforce contracts between buyers and sellers (Hoang et al. 2008).

The role of intermediary organisations is vital to link service producers and buyers and reduce transaction costs. The intermediary organisation such as an NGO brings together diverse constituencies to increase public involvement, design new initiatives, strengthen local institutions, and achieve tangible results. Past evidence has shown that awareness of environmental services and willingness to pay for them can be increased through the concerted efforts of environmental NGOs (Leimona and Lee 2008). The role of NGOs was similarly apparent in many of the reviewed cases, especially to raise awareness among stakeholders. Thus, in the Maasin watershed of Philippines, NGOs helped in organisational build-up, community mobilisation, data collection, conflict resolution, and execution of environmental activities compatible with the PES scheme. In the Kulekhani watershed in Nepal, the presence of credible civil society organisations such as community forestry user groups boosted the adoption of PES schemes through community mobilisation, advocacy, and raising awareness. The presence of the Reward Upland Poor of Asia for the Environment Services They Provide (RUPES) programme—an initiative of World Agroforestry Center which conducts targeted action research to examine and explore the ecosystem service markets in the region—was vital in identifying the conditions for incentivising service providers. Finally, intermediary organisations also played a key motivating role in the Bolivia case studies, especially for building trust and confidence in PES schemes (Asquith et al. 2008).

### **Equity and livelihoods**

Most of the reviewed studies emphasised the adoption of a proactive approach for a more equitable distribution of entitlements and benefits. Clear and transparent benefit sharing systems with a strong equity component had to be a part of the design of payment schemes and relevant institutions for triggering participation and enhancing the welfare of those affected by PES projects. The Bolivia case study and the Nha Trang Bay Marine Protected Area (MPA) study in Vietnam showed the importance of addressing equity concerns. In the Bolivian case, the PES project produced negative impacts on the poor because the scheme did not deliberately target the landless and the poor. The formalisation of property rights through the PES project had the potential to undermine traditional resource

access enjoyed by poorer households. Project implementers addressed this issue by providing employment opportunities to some of the landless households in the area covered by the project. The Nha Trang Bay MPA case study in Vietnam highlighted the importance of equity in allocating funds to legitimate stakeholders. The revenue generated by the changes in the user fee was allocated to support a number of community development activities in which villages were fully involved in the planning, development, and implementation of each activity. This sort of inclusive and participatory approach in terms of the allocation of the funds and participation of each stakeholder in the identification of the potential areas of intervention facilitated the successful adaptation of the PES scheme.

The case study of the silvopastoral project in Nicaragua (Pagiola et al. 2008) also reveals a number of factors that have implications relevant to equity and livelihoods. In this study, farm size was positively associated with the intensity of participation, implying economies of scale that larger farm size might provide. Male-headed households had higher intensity of participation than female-headed households. Another finding of the study was about the level of poverty and intensity of participation. Although the participation of the extremely poor was very low, poor households had consistently higher intensity of participation. Further, participation of poorer households was not only limited to simpler and less expensive silvopastoral options but also in more advanced forms of land uses which often required higher up front investments. The study, however, warned that it would be unrealistic to assume that all poorer households will always be able to participate more.

The Kuan and Suan case studies from India also show the importance of broad participation by different social groups, especially women. The recognition of women-headed households in the implementation of the PES watershed conservation programme promoted intense consultations in Kuan and led to a timely and needed agreement. This was not the case of Suan where the objective of shifting grazing pressure from the catchment resulted in failure because of the inability of organisational managers to consider the needs of different local stakeholders. A variety of factors contributed to this, including lack of consideration to an alternate grazing site, lack of clear consensus about the labour sharing arrangement for catchment protection, and no contribution from the downstream users.

### **Transaction costs**

Transaction costs in PES schemes refer to costs associated with the negotiation and enforcement of PES contracts. Negotiation costs include time and effort in organising and connecting buyers and sellers, assessment of current land uses and land-use practices, establishment and design of contracts, preparation of relevant documents, and the costs of making implementation of various project related decisions. The transaction costs of monitoring and enforcement include costs of certification,

and the monitoring of contractual obligations of buyers and sellers (Swallow et al. 2005; Adhikari and Lovett 2006). The transaction costs such as costs of gathering information, enforcing rules, and monitoring of agreed decisions would incur at various stages of the development and implementation of PES schemes in addition to the costs of production or service delivery costs.

The review suggests that high transaction costs are a barrier to participation because they make market exchanges more costly. For instance, transaction costs—estimated as USD 55/household with annual income of USD 1,035 (i.e., 6%) in the Sumber Jaya area of Indonesia—are high enough to be an obstacle to participation. In Vietnam (The and Ngoc 2006), the total annual transaction cost per contract in the study sites was about USD 35: a substantial amount for poor smallholders (e.g., usually farms supporting a single family with a subsistence farming). More strikingly, transaction costs per hectare of forest enrolled in the PES scheme was USD 20 (about VND 570,000) because of the fact that PES schemes involve a number of negotiations which have cost implications. This amount is two times higher than the payments received by households for a hectare of forest under the PES scheme. The fragmentation of plantation forests owned by households (usually two ha/per household scattered in many different places) meant high transaction costs related to negotiations, monitoring, and enforcement. Similarly, the silvopastoral project in Nicaragua also had high transaction costs that larger landholders were more able to bear. Although the case studies were not always clear about it, there were two main categories of transaction costs: recurrent (annual) and start-up costs. These costs can affect the extent of market transactions in case of ecosystem services and, therefore, influence the adoption and effectiveness of conservation efforts.

Collective action for PES projects is envisaged as an efficient solution for the provisioning of environmental services such as biodiversity conservation and watershed protection. Swallow et al. (2005) support this view, suggesting that community-based approaches help reduce transaction costs. The authors of the reviewed cases note a number of local mechanisms through which participants aim to reduce transaction costs. Among them, a collective contracting approach, in which a group of farmers enter into a PES contract collectively to reduce the costs of transaction, appears an attractive option. In Sumber Jaya in Indonesia, five farmer organisations were recognised by the government under its community-based forest management programme. These organisations were crucial in adopting conservation values in local land-use decisions. Indeed, the cases from Indonesia, Philippines, and China all reinforce the notion that collective action for PES projects is central to lower transaction costs. Acting collectively helps farmers to coordinate the provision of ecosystem services that have a larger geographic scope, such as biodiversity conservation and watershed protection. Collective choice rules crafted by local communities can also increase compliance with management decisions.

The reviewed studies also show an association between social capital, transaction costs, and PES outcomes. For instance, the absence of community-level institutions led to reduced success of the SLCP in the PRC. The absence of strong community-based organisations also meant weak social networks and lack of community capacity to spread risks by pooling resources during natural disasters and economic hardships.

The Ningxia case study also shows the importance of social capital for PES schemes. In this case, farmer participation was facilitated by community strength, institutionalised access to information, and efforts to reduce inefficiencies in the functioning of government institutions. Building local institutional capacity for implementing programme activities, enhancing their competence to influence decision-making, and rationalising local tenure systems were also important in inducing improved environmental services and conservation outcomes.

### **Household and community characteristics**

The review also identifies a number of socio-economic factors at the local level as having significant relevance in the adoption of PES schemes. In the Vietnam case studies, household characteristics such as education, income, labour, and skills and technical capacity help determine participation in the PES schemes. Technical capacity of individual farmers and family labour availability are additional influences on participation of households in land-use modification and technology adoption decisions (Thatcher et al. 1997). Availability of family labour, size of landholding, and education are all positively associated with the adoption of PES schemes.

Another finding of the review is that PES schemes are likely to be more viable in contexts where participants are socio-economically better off and land holdings are well structured. This is consistent with previous arguments that PES schemes are likely to be more functional where land users are well organised (Mayrand and Paquin 2004). This is due to the fact that the decision-making procedure becomes more complicated and costly with increasing group size since the required time and effort appear to be rapidly increasing functions of the size of the group.

The case studies also highlighted the importance of several contextual factors. First, the location of the watershed (proximity between the locations of service generation and service consumption) appears to be a 'push factor', for creating demand for environmental services. This is exemplified by the case of the Maasin watershed where the forest watershed is in close proximity to the city. Due to this proximity, any negative changes in the provision of watershed services (especially quality and quantity of drinking water supply) could be immediately felt by the local population. Moreover, it is also easier to organise the beneficiaries who live in proximity to each other. Another contextual factor was the levels of community preparedness for undertaking PES schemes. For example, communities that already have good social infrastructure such as mature community organisations

in place are more likely to succeed in implementing PES schemes than communities without them. The Honduras case study also supported the notion of the contextual significance. For instance, efforts to annex upstream lands into protected areas in Jesus de Otoro and Heredia had motivated landowners to participate with a fear that they might lose rights to their land if they refused to participate.

The Bolivian study emphasised the importance of flexibility and the need for a 'fit' between the design of PES schemes and local conditions. It specifically recommends that PES schemes should be flexible to accommodate changing local circumstances and demands of landowners. For example, farmers were in favour of in-kind payment over cash initially but later other in-kind payments were added in terms of technical assistance and capacity building to make the PES scheme more flexible. Second, the scheme adopted a dual-service PES approach that aimed to capture the multiple benefits simultaneously (e.g., carbon sequestration, biodiversity, watershed protection, and pollination services through the same conservation activity) and make the conservation programme more profitable. The high level of participation of poorer households in the silvopastoral project in Nicaragua was actually facilitated by the provision of multiple options within the PES programme. Households were free to choose one of many land-use modification options that suited their needs and circumstance. This suggested that PES schemes that offer multiple land-use choices would have a higher chance of adoption by farmers.

Finally, the case studies from India found that local technologies are more acceptable to landowners when it comes to changes in land-use practices. Such local solutions also create a win-win situation and help provide direct benefits for the upstream community and watershed service benefits for downstream users. For example, a bamboo plantation in Kuhan resulted in higher grass yields while maintaining grass cover during the monsoon. Further, locally mobilised resources (both cash and kind) and legitimate reasons for farmers to participate were more effective than motivation from external funding. Since there was rapid silting up of the reservoir that provides the water for the village, farmers realised that they would need to take quick and serious action if they wanted to preserve the dam.

### **Information and communication**

There is consensus in the 23 studies (only 23 of the 26 studies were considered for a discussion of outcomes because of missing information) that participation in environmental service markets can be realised and enhanced through effective information dissemination. Through different dialogue and consultative processes, households and communities can be motivated to participate. The key purpose for consultation with strategic stakeholders would be raising awareness on PES as well as facilitating stakeholders' buy-in regarding the PES concept. Advocacy, through media mobilisation, could also facilitate the awareness-raising

process and meet the demand for increased information on the subject. It is therefore important to galvanise proposed PES schemes with awareness-raising efforts that illustrate how PES options contribute to mobilising local resources, poverty reduction, and environmental improvement. In the Maasin watershed, approximately 70 information centres provided information on watershed management and also supported environmental movements. In the Kanlaon area, efforts directed towards educating people, exchange of information, and better communication were crucial for the project. The watershed management council of Mount Kanlaon Natural Park (MKNP) was a strong player which facilitated the adoption of a watershed management strategy through incorporating conservation education into its programme activities.

This review finds that PES design should be influenced by well-informed technical studies. Quite often, there is a great degree of uncertainty as well as disconnect between conservation activities undertaken and associated ecological outcomes. Willingness to pay for environmental services often increases if there is an established link between the upstream land-use practices and their corresponding effects on downstream environmental outcomes. The Nepal case study shows the importance of a good technical study to increase the downstream beneficiaries' confidence in the scheme. The Vietnam case study also puts emphasis on carefully designed cost-benefit analysis of watershed degradation to convince both buyers and sellers. The India case study underscores the importance of credible scientific information to assess problems, find areas of intervention, and build consensus among stakeholders to modify land-use practices and design the payment systems. These favourable conditions were achieved through an 'action-learning' approach. For example, the project established a good partnership between different organisations, with different sets of skills and operating at different scales. Further, the project invested considerable amount of efforts in mobilising and motivating the local communities towards the implementation of the schemes. These kinds of efforts were supplemented by a strong capacity building and training component. Moreover, effective communication strategies were in place in order to raise awareness and maintain support for the concept. Finally, since there was limited experience in such topics, the project teams adopted a sort of flexible and responsive approach to accommodate stakeholders' concerns in the project.

Well-informed hydrological and economic valuation studies are instrumental for PES schemes. An effort to put monetary value on environmental services is not straightforward because of the difficulty of measuring public goods and assigning a proper value to them (e.g., value of wetlands such as flood control and pollution reduction), but careful choice of valuation methods with insights from local use of resources could help design viable markets for environmental services. The Bolivia case study emphasises that PES schemes should be informed by a reliable baseline study. It shows that adjustments in compensation packages could be possible and that it can be

done effectively without resistance of local landowners as long as there is a convincing argument to motivate the local service providers.

### Bio-physical aspect and spatial coverage

Writings on PES emphasise that strategic spatial targeting will have positive implications for environmental benefits and the sustainability of environmental service markets. Environmental services of watersheds are usually more visible at a larger geographical coverage—e.g., supply of drinking water, habitat for plants and animals, areas of natural beauty, and water bodies for recreation and relaxation. This however will have implications on programme effectiveness. For example, the two relatively small watersheds [Maasin and Makling Forest Reserve (MFR)] were operating effectively when compared to the larger watershed of NSMNP in the Philippines. Some of these case studies also ascertain that this could be addressed through cooperative action and developing PES schemes within the framework of community-based resource management. The Vietnam case also validates the importance of the size of the resource system, as the area of forest plantation was positively associated with the adoption of PES programmes. Further, the importance of maintaining quality of environmental services appeared strongly in the case of Bach Ma National Park in order to attract large numbers of visitors to help generate park revenues for sustaining conservation activities as well as the reward mechanism.

The Kuhan case study from India emphasised the congruence between the spatial scale of bio-physical processes and administrative boundaries. In Kuhan, the catchment area is within the same administrative unit (i.e., *panchayat*). This coincidence of administrative and bio-physical boundaries made it possible for buyers and sellers to reach an agreement more easily through the meditating efforts of the *panchayat*. But in Bhoj, a similar match was missing.

In addition, the case study from India also emphasised the temporal match between bio-physical processes and decisions-making time horizons. In Kuhan, a realistic time frame (in this case, an eight-year agreement) was negotiated to halt grazing in the catchment which resulted in less grazing pressure. In Bhoj, the focus was on switching to organic agriculture from high external input practices for reducing water pollution. Although switching to organic farming is something that would have been achieved within a shorter time horizon, reducing pollution and increasing the quantity of water in the lake would require a longer time frame to reflect the impacts on the lake

water. Therefore, project interventions could not effectively take place in Bhoj due to the mismatch in spatial and temporal decision-making process.

### OUTCOMES OF PES SCHEMES

In this section, we examine the four different outcomes of PES projects reviewed in our analysis. Because of missing information in some cases, we are able to include only 23 of the 26 studies for a discussion of outcomes.

The four outcome variables are *equity*, *participation*, *livelihoods*, and *environmental sustainability*. Fisher (1989) argues that equity involves getting a ‘fair share’ not necessarily an ‘equal share’ and that the definition of the ‘fair share’ varies. In the context of participatory forest management, Malla and Fisher (1987) present three different scenarios against which the notion of equity can be assessed: 1) the rich get more and the poor are absolutely worse off; 2) the rich get more in absolute terms but the poor are a bit better off; and 3) both rich and poor get proportionally the same. Most conceptions of ‘equity’ are likely closer to the latter two scenarios.

The livelihood outcome dimension aims to capture the extent to which a PES scheme contributes to improved livelihoods of participants in the aggregate. Gender and equity considerations are interlinked with issues around public participation in PES programmes and livelihood benefits to PES participants. One of the most basic and effective mechanisms for promoting equity is to incorporate a community-led public participation process. A large body of knowledge argues that a community-based management regime limits the access to resources by local and non-local actors through crafting management institutions, addresses both environmental and socio-economic goals, and deals with the subtractability issue to ensure for equity, social responsibility, and conflict resolution in resource management (Berkes 2006). Environmental sustainability refers to whether or not these PES schemes are able to protect and enhance the provision of environmental services in the given landscape.

We evaluated each outcome variable using a qualitative scale similar to that for the seven categorical variables related to features of PES projects (e.g., low, moderate, and high). While evaluating these outcomes, we carefully examined the discussions in the case studies with regard to these four variables and inferred an appropriate ranking for the variable in question (Table 3).

Table 4 presents the descriptive information on outcomes of PES schemes. Fifty % of the cases revealed low level of equity while the remaining 50% showed moderate level of equity

**Table 4**  
**Descriptive statistics of PES outcomes**

Outcome	No. of cases	Frequency			Percentage			Mean*
		Low	Medium	High	Low	Medium	High	
Equity	23	11	12	-	47.83	52.17	-	1.52
Participation	23	7	10	6	30.43	43.48	26.09	1.83
Livelihood	23	11	12	-	47.83	52.17	-	1.52
Environmental sustainability	23	5	8	10	21.74	34.78	43.48	2.17

\*Mean value; 1=Low; 2=Medium; 3=High

outcomes; none of the case studies scored a 'high' in terms of the equity in these schemes' outcomes. This observation supports findings from the earlier case studies that emphasised scrutinising ecosystem service markets from the equity and poverty-reduction standpoint (Corbera et al. 2007). Out of 23 cases, about 30% demonstrated low level of participation. Only 26% of the case studies were found to achieve higher outcome in terms of participation. In terms of supporting local livelihood, 48% of the cases demonstrated low livelihood support with the remaining 52% appearing to have a moderate livelihood outcome.

In terms of environmental sustainability, about 43 % of the schemes reported to have higher level of impacts on protection of ecosystem services such as regulation of hydrological flows, biodiversity conservation, and carbon sequestration. The mean value for environmental sustainability outcome is higher (2.17) compared to the other three outcomes of interest. This is perhaps not a surprising finding as the main emphasis in market-based approaches to ecosystem services such as PES is generally on environmental sustainability. But this emphasis on ecosystem services and sustainability relative to local livelihoods and equity also suggests that PES projects have some way to traverse before they provide substantial benefits to local communities, raise livelihoods, and reduce inequalities.

## CONCLUSIONS

Although market-based instruments to promote ecosystem services are a relatively new phenomenon, they have emerged as strong candidates for addressing problems of ecological externalities, incentive incompatibility, information asymmetries, and provisioning of local public goods. Over the past decade, large sums of money have been invested in PES schemes in the developing world for improved carbon sequestration, watershed protection, and biodiversity conservation through voluntary initiatives of the private sector, pilot activities of financing agencies, and applied research programmes (UNEP/LSE 2005). But in spite of the growing interest in PES and a mounting body of evidence related to PES, there are still major gaps between the predictions made by theorists of PES and the outcomes that PES projects generate. This gap between theory and practice makes it particularly important to understand how a host of different contextual factors affect PES outcomes. This review article has drawn on available case study literature on PES at the regional and national levels to compare how different factors affect landowners' participation in PES schemes, and examined the different outcomes associated with reviewed projects.

A key finding of the review is the low to medium scores of most of the reviewed PES projects on social outcomes such as livelihoods and equity. Although we do not have a representative sample, the cases included in the review constitute some of the more prominent and well-studied examples of PES, precisely the ones where one would expect to find the best outcomes to have occurred. If the finding is more broadly applicable, it

would be important for managers of PES programmes to attend better to the longer term social sustainability of their projects.

Although designing PES schemes is complex and simple prescriptions or blueprints are unlikely to lead to optimally designed projects, the review highlights a few critically important conditions for successful PES projects by examining the information on institutional, socio-economic, bio-physical, and contextual factors available in the case studies. The first of these concerns the security of property rights. PES projects are likely to be more successful when secure property and tenure rights to land and forest resources are with landowners and communities. In addition, enabling policies that promote community-based approaches to natural resource management also seem to be associated with successful PES efforts.

Inclusiveness, transparency, and support for capacity building are also important for effective PES projects. Training and capacity building and access to information raise awareness of market-based approaches among stakeholders and provide better knowledge about impacts of changes in land-use practices of ecosystem service producers; greater inclusiveness and transparency help improve programme effectiveness, strengthen links between producers and beneficiaries, and reduce enforcement costs; and finally, involving women and broad consultations can improve buy-in for PES projects.

Credible intermediary organisations turn out to play an important role in PES projects as well, and their support has been important to the success of a number of cases. Adoption of PES is higher in cases where NGOs and civil society organisations are involved because such organisations can build trust between buyers and sellers.

PES schemes, in comparison to other approaches, are one of the best market-based instruments for achieving environmental outcomes. In terms of achieving equity and livelihood goals, the analysis revealed a mixed result. Although trade-offs between efficiency and equity in PES schemes are a kind of political decision, it is possible to combine environmental management and poverty reduction goals. Similar to findings of other studies (see Engel et al. 2008), participation of households in these schemes is still modest, particularly of the poorer ones. Since social outcomes of these schemes depend on many elements such as characteristics of poor landholders and their land, characteristics of the costs and benefits of providing ecosystem services, and the political feasibility of various policy options (Jack et al. 2008), these factors need to be considered in order to achieve both environmental and social development goals. Promoting synergies between poverty reduction and environmental conservation goals can help achieve both equity and sustainability.

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