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Payments for environmental services – A solution for biodiversity conservation?

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Abstract

Direct payments for environmental services (PES) are increasingly becoming subject of national development strategies and of actions promoted by large networks of non-governmental conservation organizations as means to finance biodiversity conservation. They arose also partly in response to the criticism against the efficiency of traditional approaches to conservation. Based on a literature review, the objective of this note is to assemble lessons learned from PES schemes in general and for biodiversity conservation in particular. Specifically, this note synthesizes the conceptual approach and current experiences of PES, and assesses the tool with respect to its economic, social and environmental impact to thus contribute to the debate on the perspective of environmental service markets for biodiversity conservation. It concludes that PES cannot be considered as panacea for biodiversity conservation, but that they can present a promising tool notably to internalize indirect use values derived from ecosystems, such as water filtration functions of wetlands or storm protection functions of mangroves, that provide benefits to human beings outside the ecosystem and for which the traditional set of environmental policy instruments had long been deficient.

Résumé

Les paiements directs pour les services environnementaux (PSE) sont de plus en plus utilisés dans les politiques de coopération des États et dans les actions de grands réseaux d'ONG écologistes pour financer la conservation de la biodiversité. Cet outil est notamment apparu comme une réponse au manque d'efficacité des approches traditionnelles de la conservation. A partir d'une recherche bibliographique, ce papier présente le concept de PSE et évalue l'impact économique, social et environnemental des expériences existantes, notamment dans le domaine de la biodiversité. Il contribue ainsi à la réflexion sur la création de marchés de services environnementaux. Il conclut que si les PSE ne peuvent pas être considérés comme une solution universelle pour conserver la biodiversité, en revanche ils peuvent offrir un outil efficace, notamment pour internaliser des valeurs d'usages indirectes des écosystèmes. Il en est ainsi par exemple de la filtration de l'eau dans les zones humides ou de la protection des tempêtes qu'offrent les mangroves – des retombées positives hors des écosystèmes que les outils traditionnels de politique environnementales ne traitaient pas.

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Introduction

Although environmental services (ES) are essential for human wellbeing and all life on earth, they deteriorate at an alarming rate: according to the Millennium Ecosystem Assessment (2005), nearly two-thirds of the world's environmental services are currently under threat. Environmental services are hereby understood as the benefits humans obtain from ecosystems including carbon sequestration, biodiversity conservation or watershed protection. This perception differs from the OECD employment of the term which refers to wastewater management services, solid-waste management services, sanitation and similar services and other environmental services (OECD 2005).

In recent years, the recognition of environmental services and their value has led to efforts to internalize environmental services through direct payments for environmental services (PES). From an economic perspective, the loss of ES is explained by the fact that most of these services present externalities or public goods to which, as long as provided for free, their owners will not give much attention when making land use decisions. The idea of PES consists therefore of external ES beneficiaries making direct, contractual and conditional payments to local landholders and users in return for adopting practices that secure ecosystem conservation and restoration and thus the provision of ES (Wunder 2005). In this way land users are expected to receive a direct incentive to include ES in their land use decisions, ideally resulting in more socially optimal land uses than would occur in the absence of such payments.

The concept of PES has experienced growing interest over the last years in both developed and developing countries. A wide range of theoretical and practical work is currently being pursued around the world and many different organizations are involved. These include research organizations, think tanks, non-governmental organization, government agencies and private companies. Most initiatives so far have been conducted in developed countries, notably the United States and Australia, but increasingly more activities are also emerging in developing countries such as in Costa Rica, Mexico or Kenya just to name some examples. Moreover, interest is also emerging to further explore the potential of PES to become an international mechanism for biodiversity finance. Specifically, the 8th Conference of the Parties of the Convention on Biological Diversity (CBD) held in Curitiba in March 2006 identifies as one of its focal areas the “maintenance of goods and services from biodiversity to support human wellbeing” and the need to explore innovative financial mechanisms for the implementation of the CBD and its 2010 biodiversity targets (CBD-8th COP 2006). In September 2006, an international experts' workshop organized by UN Environment Program (UNEP) and the World Conservation Union (IUCN), in close collaboration with the CBD Secretariat, started to explore the potentials for international payments for biodiversity conservation services.

In light of these developments, this note reviews the current debate on PES for biodiversity conservation by focusing specifically on its economic, social and ecological impacts. The term “conservation” is hereby understood as “the management of human use of the biosphere so that it may yield the greatest sustainable benefit to the present generation while maintaining its potential to meet the needs and aspirations of future generations” (Markandya *et al.* 2001). Based on a literature review, this note starts with a brief presentation of the concept before dealing with current practical approaches. It continues with a discussion on economic, ecological, and social considerations of PES, and ends with some tentative conclusions.

Conceptual approach

Alternative terminologies are applied to refer to the concept of environmental (or ecosystem) services. The *Millenium Ecosystem Assessment* (2005), for example, defines ecosystem services as the “benefits obtained by people from ecosystems” and identifies four functional types of services, i.e. provisioning services (genetic resources, food and fiber, fresh water), regulating services

(climate regulation, water regulation), cultural services (aesthetic values, social relations) and supporting services (soil formation, water cycling). A more technical approach is applied by the *Dictionary of Environmental Economics* defining ES as the “ecological functions currently perceived to support and protect human activities of production and consumption or affect the overall human wellbeing in some way” (Markandya *et al.* 2001). Other classifications tend to distinguish environmental services by the type of ecosystem providing the service such as forests, coral reef, wetlands (Huberman and Leipprand 2006). Whichever classification is used, they all emphasize the value of environmental services for human well-being. Crucial to note is the anthropocentric, utilitarian notion of this concept: environmental services are defined as such if they provide benefits to human well-being; other ecological functions, of lower utility to human well-being, may be neglected.

From an economic perspective, a major cause of environmental service degradation is due to market failure associated with the nature of ES being “externalities” or “public goods”. As result, local land managers do not receive any compensation for conserving them and thus ignore them in their private land use decision-making which often leads to socially sub-optimal land use decisions. Further causes of declining environmental service loss include incomplete information including ignorance and uncertainty regarding ecosystem functioning and conserving land use practices, as well as lags in time and space between environmental disturbance and recognition of environmental problems.

The economic recognition of environmental functions as valuable and scarce services for human wellbeing has thus led to efforts to valorize environmental services through payments for environmental services (PES). The idea of PES consists of environmental service beneficiaries making direct, contractual and conditional payments to local landholders and users in return for adopting practices that secure ecosystem conservation and restoration (Wunder 2005). The concept assumes that when compensating land users for the environmental services they provide, this will result in more socially optimal land uses.

Although PES schemes are generally perceived as means to internalize externalities, no unique definition of PES has been established so far. Some consider all types of direct payments as PES, others such as Wunder (2005) propose to define PES more narrowly as

- voluntary transactions where
- a well-defined environmental service (or a land-use likely to secure that service)
- is being “bought” by a (minimum one) ES buyer
- from a (minimum one) ES provider
- if and only if the environmental service provider secures ES provision (conditionality)

Wunder’s (2005) proposition captures the innovative features that characterize PES as new type of instrument. The first innovative feature refers to voluntary participation (Criterion 1) reflecting a bottom-up perspective to natural resource management which focuses on cooperation between stakeholders rather than coerced top-down type approach of natural resource management during the 1970s and 1980s. A further essential innovation of PES lies in a direct transaction between supplier and demander of ES (Criterion 3 and 4), as well as in the conditionality requirement (Criterion 5) which explicitly demands an ex-post service remuneration (after the services have been rendered). All these features together distinguish PES from other, similar incentive payments such as eco-subsidies or tax-cuts for environmentally-friendly actions.

Two further restrictions to Wunder’s (2005) definition are proposed by Pagiola (2006). The first refers to the requirement that Wunder’s “ES purchasers” should be actual “ES users”. Thus rather than having the government or donor agencies financing the provision of ES, the ultimate ES beneficiaries should be the ones paying for the service provision. This requirement underlines the crucial importance of identifying the actual beneficiaries and, more importantly, the potential buyers of ES (demand side). The second restriction refers to the requirement that PES should

primarily focus on internalizing indirect externalities, i.e. indirect use values obtained from ecosystems that are outside the market. Following the *Total Economic Values (TEV)* approach, ecosystem services can be classified into *use values* and *non-use values*, whereby use values can again be distinguished into *direct use values*, *indirect use values* and *option values* (Pearce and Warford 1993). In contrast to direct use values, i.e. ecosystem services that are used directly by human beings *within* ecosystems such as the enjoyment of recreational or cultural activities, indirect use values refer to benefits human beings outside ecosystems obtain from these ecosystems, e.g. storm protection functions from mangroves or water filtration functions from wetlands (Pagiola *et al.* 2004). While the environmental-economic toolset provides a wide array of measures to internalize direct externalities (direct use values from ecosystems), e.g. park entry charges, a tool for internalizing indirect externalities (indirect use values from ecosystems), so Pagiola (2006), had so far been missing. The ability of PES to internalize environmental services that present indirect use values (indirect externalities) is what some perceive as the actual strength of PES schemes compared to other environmental policy instruments. This is also why some criticize the use of PES for the internalization of direct use values such as scenery or wildlife observation, i.e. for ecoturistic purposes, for which other types of environmental policy instruments might be more adequate.

The approach of remunerating environmental service providers as mean to internalize environmental services is sometimes also referred to as “provider gets” approach to highlight the differing perspective compared to the more widespread application of the “polluter pays” principle. Policy measures that base on the latter principle such as Pigouvian taxes or pollution charges require that those who create negative externalities should pay for the damage they cause. As pointed out by Pagiola *et al.* (2005), it does not matter – from a pure efficiency perspective – whether “polluter pays” or “provider gets” applies. According to the Coase theorem, either approach will yield the same result provided that markets are competitive, property rights are enforceable, and there are no transaction costs (Coase 1960). In practice, however, few if any of these conditions hold in the case of environmental service (Pagiola *et al.* 2005). The argumentation is that (i) environmental services have the peculiar characteristic of being the cumulative result of a wide range of spatially dispersed land uses, and (ii) monitoring the impact of many land users scattered over a landscape on the provision of environmental services would be prohibitively costly. The latter is partly reflected by the insufficient compliance with many land use laws (e.g. deforestation bans, fire prohibition), especially in developing countries where equity concerns play an additional role and where adopting a polluter pays approach would impose the cost of environmental protection on often poorer land users rather on better-off service beneficiaries (Pagiola *et al.* 2005). These elements argue in favor of a “provider gets” approach rather than a “polluter pays” approach when seeking to internalize the generation or conservation of environmental services, especially in the context of developing countries.

There are strong conceptual arguments in favor of PES mechanisms being of greater efficiency than other comparable policy measures. A major advantage of PES compared to other environmental policy measures lies in its capacity to internalize indirect externalities, i.e. indirect use values, from ecosystems (Pagiola 2006). Besides, the relative efficiency of different mechanisms to address market failures has been the subject of considerable debate in the literature, beginning with the work of Weitzman (1974). With perfect information, price-based mechanisms (of which PES is an example) and quantity-based mechanisms (such as regulations prescribing particular behavior) could be equivalent. In cases with incomplete information, the specific circumstances define which mechanism is more efficient. Pagiola *et al.* (2005) find that one of the cases Weitzman examined is particularly relevant to PES, notably when there are multiple potential producers of a benefit with different marginal costs which are not observable by the service buyer. In this case, price-based mechanisms are more efficient as they “screen out the high cost producers, encouraging them to produce less and low cost units to produce more” (Weitzman 1974, 489). Moreover, there are compelling theoretical arguments on the greater cost-effectiveness of PES schemes compared to indirect financing schemes such as through integrated conservation and development projects (Ferraro and Simpson 2002, Simpson and Sedjo 1996) and traditional top-down type regulation (Siikamäki and Layton 2006). As with all instruments,

however, implementation is crucial as poorly designed PES mechanisms can be quite inefficient (Pagiola *et al.* 2005).

Taking stock of practical experiences

In practice, hardly any PES scheme corresponds entirely to the narrow definitions by Wunder (2005) or Pagiola (2006). Wunder (2005) observes that at least in Bolivia and Vietnam, no single PES scheme has satisfied all five criteria of his PES definition although several schemes satisfied more than one. The hardest criterion to meet results to be the conditionality criterion due to lenient or no monitoring or payments made prior to service delivery. Moreover, few of the existing initiatives to market environmental services are markets in the purist sense. Instead, PES tend to be defined more broadly as initiatives that involve the sale of environmental services to change the incentives of environmental service managers and/or to generate resource to finance conservation efforts whereby payments can be in cash, tax incentives, trust-fund disbursement or compensation between bilateral or multilateral parties (Pagiola *et al.* 2002, Grieg-Gran *et al.* 2005).

Major challenges in the implementation of PES are concerned with the identification of potential service buyers (demand side), scientific knowledge regarding the provision and generation of ES, institutional requirements as well as political-economic and ethical issues. While early applications of PES focused primarily on the identification and valuation of environmental services to be internalized (supply side approach), more recent experiences have shown that, for a PES system to be long-lasting, it is more relevant to identify the potential payers for environmental services (demand side approach). Sound scientific knowledge of the services provided or generated present hereby a crucial aspect as service buyers tend to request prove for the services they pay. This again requires precise knowledge of how (land use type) and what type of ES (e.g. flood control, water quality improvement) are generated or provided to avoid that PES are being established on incorrect assumptions on the links between ecosystems and the services they provide. In addition, adequate institutional arrangements (property rights, contracts between service providers and buyers, monitoring systems) and governance structures (clear identification of service providers and service buyers, as well as any intermediary agent, including their respective role and responsibilities) are also relevant in proper functioning of PES. Political-economic issues refer to the underlying interests or fears of the parties involved whereas ethical considerations refer to the impact of PES on poor people (equity concerns). Given these partly complex requirements, PES schemes have been tested primarily in developed countries where biophysical science tends to be stronger and legal frameworks and institutions exist that allows the development of more sophisticated markets (Scherr *et al.* 2004).

This paragraph seeks to take stock of practical experiences with PES. It hereby also reports approaches which, according to the definitions by Wunder (2005) or Pagiola (2006), may not count as PES in the strict sense. Specifically, this paragraph describes the main types of environmental services addressed within such payment systems, then typical approaches of PES before lastly the main mechanisms of PES found in practice.

Main types of valorized environmental services

Especially four types of ES are frequently reported as being subject to PES schemes (Wunder 2005, Grieg-Gran and Bann 2003, Landell-Mills and Porras 2002):

Watershed services

These refer to a wide array of services such as flood control or water quality control, and are related to specific natural ecosystems such as forests and freshwaters. Limitations to water service payments include political leverage of watershed service providers as well as scientific justification for the provision of water services.

Carbon sequestration

Forest ecosystems belong to the most important providers of carbon sequestration services. Payments for carbon sequestration services from avoided deforestation, however, are still challenged by high transaction costs and uncertainties with respect to international carbon-trading rules and long-term effectiveness (Grieg-Gran and Bann 2003).

Biodiversity conservation

Also provided by all natural ecosystems, biodiversity conservation services appear difficult to be subject of valorization due to their intangible nature, scientific uncertainties regarding service provision and unclearly identifiable and quantifiable beneficiaries which implies high transaction costs (Grieg-Gran and Bann 2003).

Landscape beauty

Provided by all natural ecosystems, the valorization of landscape beauty services can consist of eco-touristic operators paying for access to areas of high scenic beauty. A major limitation to the internalization of these services refers to the fact that so far, these services tend to base primarily on government provision and are characterized by below-cost pricing (Grieg-Gran and Bann 2003). Recall, however, that landscape beauty typically present direct use values (direct externalities) from ecosystems and that some prefer to apply PES primarily to indirect use values to distinguish the added value of PES from other environmental policy instruments.

Among these services, water services and carbon sequestration services present the most prominent services subject to PES schemes. This is due to the greater intuition of the importance to preserve or generate water or carbon sequestration services (compared to biodiversity services) which also facilitates the identification of potential buyers of such services.

Biodiversity conservation services are, so far, less frequently internalized. This is mainly because of methodological constraints, notably the quantification of the supply and demand of biodiversity conservation services. One approach consists in remunerations for the conservation of an ecosystem in its original state such as sought by conservation easements. Another approach consists in internalizing biodiversity conservation services through “biodiversity offset” requirements which require land developers to compensate for the unavoidable harm to biodiversity (ten Kate *et al.* 2004). Again another approach is being explored through “service bundling”, i.e. several environmental services sold as “package” rather than selling each service individually (unbundled). For example, payments for water services, such as when preserving standing forests, also tend to benefit biodiversity conservation. Thus rather than directly selling biodiversity conservation services the conservation objective is achieved via a more indirect approach. Payments for bundled environmental services also reduces the danger of substituting the more marketable service for other less “marketable” but maybe equally important environmental services (trade-offs). For example, as growing trees capture more carbon than grown-up forests, reforestation projects are preferred over deforestation avoidance measures for providing carbon sequestration measures although avoiding deforestation in primary forests has a significant role in providing biodiversity conservation services. In sum, although payments for biodiversity conservation services face several peculiar challenges, increasingly more efforts are dedicated to explore the opportunities and limitations for biodiversity PES.

Main focus of PES schemes

The origin of the PES schemes can be seen in pro-market approaches which focused on efficiency gains while complying with current environmental legislature. A well-known example refers to the wetland mitigation banks in the US which arose in the 1980s in response to the Clean Water Act of 1972. Another example refers to the private-sector led initiative by the drinking water company Vittel in France which compensates local landholders for the watershed conservation services they provide (Vittel 2006).

PES have subsequently been explored specifically as instrument to induce greater conservation, notably to finance conservation. This approach is motivated by the search for sustainable financing of conservation and implies that environmental services are broadly defined while focusing on overall ecosystem integrity and conservation gains. Examples include “conservation concessions”, now called “conservation incentive agreements” (Rice *et al.* 2001) or “conservation easements”. The former refer to buying out logging concessions in exchange for conservation purposes, i.e. by paying government or local resource users for conserving a previously identified ecosystem (Rice 2003). Widely experienced in the US, conservation easements refer to contractual arrangements by which landholders transfer, in perpetuity, their land use rights over a given land parcel to a conservation agency for conservation purposes.

With the application of PES in developing countries, equity and social development issues became additional concerns. While originally treated as “add-on” to existing conservation-focused PES schemes, they often entailed counter-productive social effects (WWF 2006). More recent experience suggests that when the social development is properly considered up front, PES can have a positive impact on poverty (Grieg-Gran *et al.* 2005). In turn, this approach to PES has a strong equity focus and seeks to improve the livelihoods for service providers who, especially in tropical countries, tend to belong to the poorer part of the population. The World Wide Fund for Nature for example focuses on pro-poor PES schemes (equitable environmental service payments) in various countries including Peru, Guatemala, Tanzania and the Philippines (WWF 2006).

Government-based PES schemes refer to systems in which the government has a major stake either as “intermediary agent” or “service buyer”, or in which other objectives such as income redistribution and paying backs to constituencies appear to be more important than the accomplishment of environmental objectives. Examples of government driven programs include the compensation payments for farmers to induce forest conservation on hill slopes in China within Sloping Land Conversion Program or the Brazilian ProAmbiente program which compensates small-farmers in the Brazilian Amazon for the provision of environmental services. Further prominent examples include the Costa Rican PES scheme in which the government agency FONAFIFO funds the preservation or generation of various forest environmental services (Chomitz *et al.* 1996), and more recently, the Mexican system of payments for hydrological services introduced in 2003 (Chomitz *et al.* 2006).

Table 1: Overview of environmental services common PES approaches

Focus	Motivation	Examples
Pro-market	efficiency gains economic development	wetland mitigation banks (USA) biodiversity credits (Australia) biodiversity offsets
Conservation	sustainable conservation finance	conservation concessions (Guyana, Belize) conservation easements (USA)
Social development	better livelihood conditions for service providers	equitable PES (Peru, Guatemala) rewarding upland poor for environmental services (Asia)
Government-based	diverse motivations including redistribution of national wealth or pay back constituencies	Sloping Land Conversion Program (China) ProAmbiente (Brazil)

Source: adapted from WWF 2006

Types of environmental service markets

There are numerous types of PES schemes. In a survey of 287 projects world-wide, Landell-Mills and Porras (2002) identify 11 different forms of PES schemes of which 35% of the projects consist of payments through an intermediary agency whereas only 17% of the projects are constructed around direct negotiations and transactions. An alternative more commonly cited classification bases on Scherr *et al.* (2004) who propose four categories of ES markets:

Public payment schemes

In this system, the government decides which ES are priorities for conservation and implement payment schemes targeted to preserve these services. Examples include conservation easements (guarantees that such land will not be logged or to be farmed; or programs to co-finance investments in conservation efforts or the PES system in Costa Rica.

Open trading under regulatory cap or floor

In this system a government defines a mandatory level of a specific ecosystem service to be provided, but to achieve this level the regulated party can decide whether to directly comply or to compensate by paying others who are in the position to supply the service more cheaply. The most developed program is for wetland mitigation under the Clean Water Act of 1972 which lead to the development of numerous wetland mitigation banks in the US (Bayon 2006).

Self-organized private deals

This approach involves direct, usually closed transactions between offsite beneficiaries and service providers. Examples include the deal between the France-based drinking water company Vittel and upstream land users to reduce the use of pesticides, and avoid water-intensive agriculture to ensure high water quality levels in the Vittel-relevant watershed, or the “conservation concessions”-type agreements between non-governmental organizations and governments or local land users to ensure conservation and to provide environmental services.

Eco-labeling

This approach is mainly handled by private actors whereby the ES component is embedded in a traded product. Producers sell products produced under a management system certified to enhance environmental service provision. Examples include the Forest Stewardship Council wood and non-wood certification. However, some consider eco-labeling as not being a kind of PES since it bases on a different mechanism to induce sustainable use of biodiversity (Wunder 2005).

In their assessment of PES schemes, WWF (2006) find that most current schemes tend to be local level arrangements that involve spontaneous, private market-type arrangements such as very common in nature-based tourism and protection of small watersheds. In contrast, large-scale PES schemes are mainly government driven, working at the state, provincial, national level and international level although large schemes can also market-type arrangements such as the carbon sequestration markets created by the Kyoto Protocol on Climate Change (*ibid.*).

As regards the types of payment schemes for biodiversity conservation, there is a major difference between developed and developing countries. While payments for biodiversity services tend to be primarily of public nature in developing countries (e.g. Costa Rica), more “open trading”-type schemes are experienced in developed countries, such as biodiversity offset requirements in the US or biodiversity credits in Australia. There is further a growing interest in promoting eco-labeling approaches as payments for biodiversity conservation services notably in developing countries.

Economic, ecological and social considerations of PES

Against the innovative approach of PES and the large number of cases actually exploring PES schemes in practice, this section discusses relevant economic, ecological and social considerations with respect to PES schemes. Table 2 summarizes the main economic, ecological and social considerations which are discussed in turn.

Economic considerations

From an economic perspective, there are substantial theoretical arguments that direct payments for environmental services can be very efficient means to conservation (Simpson and Sedjo 1996, Ferraro and Simpson 2002). In comparison to integrated conservation and development programs, such as ecotourism that indirectly generate ecosystem preservation as a joint-product, Ferraro and Simpson (2002) demonstrate that direct payment approaches can be far more cost-effective. In addition, if properly designed, PES can ensure long-term conservation financing as it is the ultimate users who pay for the generation or preservation of given services.

Yet for PES to be effective, their *additionality* needs to be ensured and evaluated. For the preservation of forest services, for example, an important point to keep in mind is that PES should only include those land users who constitute a considerable threat to the provision of these services (Wunder 2005). To illustrate this point, Wunder (2005) uses the example of two Brazilian states of the Amazon region: Compared to Amapá, a state with only low deforestation rates (i.e. where environmental services are preserved anyway), it appears more efficient to use PES schemes in Mato Grosso, where economic land use interests result in particularly high deforestation rates and thus high losses of environmental services.

However, the actual set-up of PES schemes imply high transaction costs associated with (i) the identification of ES sellers and buyers which is especially difficult for biodiversity services, (ii) the quantification of environmental services or the opportunity costs of conservation, (iii) the negotiation and structuring of deals and (iv) the implementation of accountability and transparency mechanisms within the existing political and legal framework (Pagiola and Platias 2004, WWF 2006, Grieg-Gran and Bann 2003; Waage *et al.* 2006). Especially in developing countries, important causes of high transaction costs include efforts dedicated to resolve situations of unclear property titles and illegal resource uses. Since clearly defined property rights are essential for PES, there is an increasing vote to only consider PES schemes in contexts of relatively clear and secure tenure structures (Wunder 2005, Chomitz *et al.* 2006) and to accept that if transaction costs are prohibitively high, PES mechanisms are less likely the adequate policy choice.

There are lastly also concerns regarding political-economic aspects of PES. On the one side, there is the issue of national sovereignty over goods and services from national ecosystems. While some environmental services appear highly relevant for conservation at the global level such as biodiversity conservation or carbon sequestration services, local landholders or governments may be less inclined to conserve them due to the current incentive structure including cultural-historical reasons such as the fear of losing control over national resources or facing new dependencies from payments from “the north”. On the other side, there is the danger of governments taking advantage of PES once environmental service become marketable assets: As governments live to tax, it will seek opportunities to take their perceived fair share of the benefits and what starts out as a pro-poor program may become less so as governments attempt to capture more the rents (McNeely 2006). As further aspect on the political-economic side, there are concerns that pro-poor PES can entail adverse effects such as when the payments for environmental services become so significant that their “owners” of the services (the poor) are enticed into selling the source of those services to the highest bidder, leaving the seller with cash but no continuing income stream (McNeely 2006). Examples of where the value of assets owned by the poor become too valuable for them to continue owning the resource can be seen in the Brazilian Amazon: while agrarian reform projects seek to redistribute land to landless poor, many of these

initiatives fail as smallholders prefer to sell their lands and move on to the frontier rather than keeping their land for longer term agricultural cultivation (e.g. Campari 2002).

Table 2: Economic, ecological and social considerations of PES

Economic considerations	Ecological considerations	Social considerations
efficiency potential high transactions costs political-economic issues	scientific uncertainties marketing potential of ES & associated trade-offs	social equity social development ethical considerations

Source: own classification

Ecological considerations

From an ecological viewpoint, a major challenge refers to scientific uncertainties regarding ecosystem functioning. There is a danger of underestimating the importance of a given ES as well as to not clearly understand the linkages between the “quantity” of services a given land use area provides (e.g. what is the minimum area? how should it be managed?). This is especially important to keep in mind as the underlying paradigm of the PES concept is utilitarian in which ecological functions are recognized as “services” only if these functions have a value for human wellbeing reflecting a clear anthropocentric view and raises concerns as to whether other essential life-supporting functions not immediately of value for human wellbeing are being equally conserved. These and other concerns induce some authors to reject the approach of PES and to opt for alternative ways to conservation such as expressed recently by McCauley (2006) in an article in *Nature*. Proponents of PES acknowledge these difficulties associated with PES but point to the insufficient outcome of traditional conservation approaches and the need to balance economic and ecological interests (e.g. Reid 2006, Costanza 2006).

Due to valuation difficulties, there is further a question regarding how to best internalize or market environmental services, especially biodiversity conservation services. This issue is often linked to the question whether to bundle or not to bundle services for PES. In the realm of biodiversity conservation services, bundling biodiversity conservation services to other environmental services and thus to PES appears very appealing. However, service bundling requires careful upfront analysis on the actual “bundling potential”. This caution is underlined by a recent study finding surprisingly low and various negative correlations between biodiversity and six ecosystem services in California (Chan *et al.* 2006). There can hence be real trade-offs in the services considered for internalization through PES.

Social considerations

An important aspect refers to social equity on both the supply and demand side. On the supply side, there is the danger that the participation of the less well-off part of the population in PES is difficult as they do not necessarily have proper land titles or the necessary knowledge and ability to manage administrative tasks required by PES schemes. Zbinden and Lee (2005), for example, find evidence that PES participants in Costa Rica tend to be characterized by larger farms with legal land title, higher human capital endowment, with higher farm incomes than non-participants and conclude that less educated (and presumably poorer) farmers appears to be less likely in the position to benefit from PES schemes. On the demand side, there is concern that only the worse-off part of the population (the poor) has to pay for services that were previously provided for free which entails the danger that the poorer part of the population is actually becoming worse off due to PES (Gutman 2006, Rose *et al.* 2004).

Another important point concerns the issue of poverty reduction objectives and their potential combination with PES. According to the literature, the impact of PES schemes on poverty varies

and there are concerns regarding adverse effects on poverty. On the one side, many traditional PES schemes were not rural-poor oriented as the initial objective of such schemes lies in sustainable conservation financing with potential livelihood considerations added later. On the other side, there are arguments in favor of PES schemes managing to reconcile conservation with poverty reduction objectives when poverty reduction objectives are integrated into program design from the very beginning (Grieg-Gran *et al.* 2005, Pagiola *et al.* 2005, Zilberman *et al.* 2004). However, there remain concerns with respect to the objective of reconciling development and conservation goals because of it being over-ambitious and thus most likely confronted with the same difficulties (and failures) as past integrated development projects (Zbinden and Lee 2005).

There is also the criticism against PES for presenting “rents against development”, i.e. compensating the poor for not developing (e.g. Karsenty 2004). This criticism refers especially to PES with strict conservation focus in which landholders are remunerated for keeping a given area in their original state without providing complementary income sources to local land users. While the criticism may be justified in these cases, most current PES tend to be sensitive to equity issues and thus seek to avoid such inequalities.

A last aspect refers to the issue of cultural differences in the valuation of environmental services. The valuation of sacred site, for example, may be totally different if undertaken by economists or if undertaken by indigenous people for whom the site is sacred. This leads to the question which valuation has priority and how to choose the “proper” valuation technique (McNeely 2006).

Tentative conclusions

Are payments for environmental services a solution for biodiversity conservation? Current experiences suggest that PES can indeed be a promising tool for conservation finance, but should not be regarded as panacea. PES are especially of value to internalize environmental services that present indirect externalities and for which the traditional environmental economic toolset was deficient. In a context of reduced funding for biodiversity conservation, PES can thus help mobilize new constituencies notably from the private sector such as currently experienced within the scope of the Clean Development Mechanism of the Kyoto Protocol or within biodiversity offset requirements.

The concept of PES has emerged over the past 10 years and it is expected that it will gain further relevance in the near future. The literature on PES has grown substantially such as the number of practical experiences around the world. Moreover, at least for forest environmental services, markets are expected to grow over the next 20 years in both developing and developed countries (Scherr *et al.* 2004), and similar tendencies can be also expected for other environmental services. Poverty and equity consideration have been the focus of more recent contributions on PES and this topic will probably remain of relevance, particularly when dealing with developing country contexts.

Despite its attractiveness, PES face several challenges. These include scientific uncertainties (and the willingness to make use of the best scientific knowledge available) regarding the inter-linkages and trade-offs between environmental services as well as how these services can be provided; the design and enforcement of respective institutional arrangements (property rights) and associated transaction costs as well as other political-economic and ethical aspects. While initially there was a large debate on the valuation of environmental services (supply side), the more recent debate focuses on the identification of potential service buyers (demand side) as well as the necessary institutional arrangements to create functioning PES markets while taking into account social equity and political-economic aspects. The subject of transaction costs is especially relevant in the context of PES for biodiversity conservation as it remains very difficult to identify buyers of biodiversity services. As a result, there is now a general consensus that the implementation of PES schemes is time-intensive and thus less adequate for a “quick fixes”-approach.

In conclusion, although payments for environmental services have promising features, they cannot present the adequate policy response in all cases. A similar conclusion has also been reached by the Millennium Ecosystem Assessment (2005). More in-depth evaluation is needed, especially what regards PES for biodiversity conservation purposes and its actual suitability for countries with weaker institutional and governance structures such as in Africa. New opportunities are being explored within the current debate on international payments for biodiversity conservation initiated by IUCN, UNEP and the CBD Secretariat in 2006, as well as with the re-emerged debate on financing “avoided deforestation”. The latter was reintroduced into the international climate negotiations by Papua New Guinea and Costa Rica in 2005 and followed up in 2006 by Brazil, the World Bank and TNC. Although so far explored primarily for carbon sequestration services, global payments for “avoided deforestation” can entail fundamental benefits for biodiversity conservation and merit therefore an analysis of their actual potential to induce biodiversity conservation locally.

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