Conservation Letters
A journal of the Society for Conservation Biology

When will payments for environmental services work for conservation?

Journal:	*Conservation Letters*
Manuscript ID:	Draft
Manuscript Type:	Mini Reviews
Date Submitted by the Author:	n/a
Complete List of Authors:	Wunder, Sven; CIFOR,
Keywords:	incentives, motivation, institutions, economics, equity

When will payments for environmental services work for conservation?

Sven Wunder

Center for International Forestry Research (CIFOR), Rio de Janeiro, Brazil, swunder@cgiar.org.

[submitted to *Conservation Letters* for category "Mini-review"]

Abstract

Using the article by Muradian *et al.* (this issue) as entry point, I develop a broader framework for the conditions needed to allow PES to emerge and function. It is argued that PES are designed as "win-settle" instrument with clear goals, and will function without markets, economic valuation, or commoditized services. As a highly adaptive management tool, PES are particularly suited for achieving equitable and flexible conservation outcomes. However, PES do require a payment culture and good organization from service users, a trustful negotiation climate, and well-defined land- or resource-tenure regimes for providers. These demanding preconditions may explain why PES implementation, while promising in many cases, has only spread reluctantly in low-income countries.

Word count (main text): 3990 [max4000]

Table/figure: 1

1. Introduction

Muradian *et al.* (this issue) discuss the suitability of payments for ecosystem services (PES), and warn about “over-reliance on payments” as a conservation tool. They do so from a PES-sceptical angle, in what Tacconi (2012) recently called the “ecological economics perspective” on PES, although their thinking arguably contains also positivist, institutional economics angles. Over the last half-decade, especially Roldan Muradian’s and his co-authors have *inter alia* in two special sections criticized the mainstream approach to PES (Muradian *et al.* 2010; Farley and Costanza 2010); others make in another PES special section (Brockington *et al.* 2011) various related points.

The PES mainstream, in Tacconi’s words the “environmental economics perspective”, represents the PES-confident thinking that originally developed the concept, propagated its dissemination, and engaged early in real-world PES implementation and learning processes (e.g. Ferraro 2001, Wunder 2005, Pagiola *et al.* 2007), with case analyses published in another special issue (Engel *et al.* 2008; Wunder *et al.* 2008). Notably, the two schools of thought are not fully antagonistic, especially compared to others that more categorically dismiss the PES concept (e.g. McCauley 2006). Yet, they still have quite distinctive views on whether the PES glass is half-full or half-empty.

In the following, I will start out from the main PES suitability issues raised by Muradian et al (this issue), but analyze them from the viewpoint of somebody who sees a half-full PES glass in front of us. Along the way, I will try to alleviate some PES concerns raised by Muradian *et al.*, but also flag a few new ones they did not consider. In essence, I will argue that PES are among the best suited instruments to deliver equitable conservation outcomes, which are particularly at the heart of ecological economist’s concerns for nature, justice, and sustainability. Hopefully, this article can thus contribute to an enlightened vision on when PES are appropriate conservation tools, and what we can then realistically expect us from them.

Throughout the text I will prefer the broader term "environmental services" over "ecosystem services", given that not all the services we consider are of systemic nature, but noting that the two terms are *de facto* widely used as synonyms. Also, I will depart from my own definition of PES as a voluntary, conditional transaction between at least one buyer and one seller of a well-defined service (or corresponding land-use proxy) (Wunder 2005). I will do so well aware that alternative definitions have recently been proposed, but will defer this discussion to later, in the belief that semantics will not be quintessential to the conservation strategy discussion that follows.

The structure will be as follows. First, I will comment on Muradian's basic perceptions of PES as a supposed "win-win", and as a tool allegedly requiring economic valuation and markets. Second, I will scrutinize what necessary conditions are needed for PES to emerge and function, focusing on three areas: a) the perceived economic benefit and costs, b) cultural features in paying and receiving incentives, and c) institutional requirements. Third, I will look at whether PES implementation is in fact "booming" to an extent of risking "over-reliance". I'll finish with a few conclusions and perspectives.

2. Are PES designed as win-win solutions to solve multiple goals?

Muradian *et al.* (this issue) provide us with a good critique of why declared "win-win" interventions have often failed, being based on weak and often wishful assumptions. From the Brundtland report (WCED 1987), carried through the Rio 1992 political negotiations and beyond, we inherited the widespread belief that most environmental problems can only be effectively addressed if first (or at least simultaneously) we alleviate poverty. As mentioned by Muradian *et al.*, integrated conservation and development projects (ICDP) incarnated this belief, implying that strategically conservation interventions had to be indirect by first changing the logic of local production, improve alternative incomes, and then achieve "conservation by distraction" (Ferraro and Simpson 2002, 2005).

But are PES really part of the win-win family, as Muradian *et al.* claim? In fact, PES were more than a decade ago conceptualized as a direct alternative to ICDPs, by remunerating people for conserving rather than investing in their alternative livelihoods (Simpson and Sedjo 1996; Ferraro 2001; Ferraro & Kiss 2002). PES are by design fully focused on achieving environmental outcomes, while any poverty alleviation impacts are beneficial side-effects (Pagiola et al 2005; Wunder 2008). This cannot be termed a multi-objective “win-win” design. Obviously, by being a voluntary mechanism, PES need to be an (expected) interpersonal “win-win” across all its participants; otherwise they would not join. This also makes it likely that poverty alleviation side-effects will eventually occur. However, the objective-oriented design is rather what has been called “win-settle”, i.e. achieving one goal while making sure others are at least not worsened (Barrett *et al.* 2011).

While user-financed PES programmes tend to focus on their environmental goals, government-financed programmes often *de facto* come to politically drift into win-win spheres of multiple side-objectives, such as poverty alleviation, regional development, or electoral motives (Wunder *et al.* 2008). Are Muradian *et al.* thus advising us that PES should stick more to their environmental design goals, avoiding getting politically side-tracked? If so, I could not agree more. Paradoxically though, Muradian and co-authors are among those who have argued most forcefully that PES should be less environmentally centred and pursue more holistic goals, e.g. Corbera and Pascual’s (2012) *Science* commentary “Ecosystem services: heed social goals”, or Muradian et al (2010:3) seeing “efficiency and distribution as interdependent goals”. In fact, are the partisans of the ecological economics perspective in their current PES writings any less fatally attracted by “win-win” than were the proponents of ICDPs?

3. Do PES depend on markets and economic valuation?

Muradian *et al.* use a “market-based” label for PES, but observe also correctly that “not all payments are markets” -- the latter being defined as “a constellation of buyers and sellers involved in transactions”. A slightly more precise definition of markets states: “An actual or nominal place <u>where forces of demand and supply operate</u>, and where buyers and sellers interact (directly or through intermediaries) to trade goods, services, contracts or instruments, for money or barter.” (my emphasis, accessed 5 January 2013 at http://www.businessdictionary.com/definition/market.html#ixzz2H8HVRTcx. If we accept the highlighted stronger market-defining notion of an exchange with supply and demand interaction – i.e. some degree of competition being at play in markets – then the verdict on PES becomes even clearer: only in exceptional cases do PES operate through markets with competitive forces (see below).

Globally, government-financed PES schemes are area-wise clearly the dominant mode, and typically governments are hesitant to use market-based instruments, such as procurement auctions. Many small-scale user-financed schemes are emerging, especially in watershed protection and in Latin America, but these normally involve bilaterally negotiated contracts, not actors that compete with each other to shape demand, supply, and prices. Typically, the competitive element in PES comes more from outside engineered solutions, e.g. is building a sediment-reducing dam cheaper than paying upstream farmers to control erosion? The single exception here is carbon services, a homogenous globally valued service with significant market integration (Kossoy and Guignon 2012). Carbon apart, we see generally very little genuine (competitive) market PES outside the USA and Australia. Admittedly, a society-wide market enthusiasm in the 1990s led PES enthusiasts to link rhetorically to markets, e.g. in the Katoomba Group (http://www.katoombagroup.org/). But as global financial concerns lead social mood worldwide to become more sceptical of markets, this formerly convenient rhetorical linkage seems bound to unwind.

Another frequently applied misconception is that economic valuation is a pre-requisite for PES (e.g. McCauley 2006; Muradian *et al.* 2013:1: "PES is...valuing and paying for services"). Nature's values transcend monetary figures, so the argument normally goes – and if we don't know what it is worth, how much should we then charge for it? The answer is that payment levels are either negotiated between service buyers and sellers, or if pre-determined by service buyers on a take-it-or-leave-it basis, can be informed just as much by provider costs. In other words, even a service of infinite value can be protected through cost-priced PES, as strictly speaking we don't need to know what the service is worth, as long as we know that we want to keep it. Economic valuation can thus be a tool that is helpful in PES design, but it is neither a necessary nor a sufficient condition for implementation.

If PES seldom work through genuine markets, and if services need not be valued in monetary terms, what is then left of the reiterative ecological economics critique that PES induces "commodity fetishism" (Kosoy and Corbera 2010; Brockington 2011; Gomez-Baggethun and Ruiz-Perez 2012)? This feature obviously has relevance for carbon services, given their widespread (and arguably convenient) commoditization. But for other real-world transactions, the characterization is less applicable: if service user A pays landholder B for changes in farm management, measured by land-use proxies, what would be "commoditized" about that arrangement?

4. Economic preconditions: benefits exceed costs of incremental service provision

PES has relevance where hard conservation trade-offs between the private interests of potential service providers (e.g. upstream landowners) and external beneficiaries (e.g. downstream water users) prevail. Landowner actions imply environmental externalities, which users may be willing to pay for. However, no PES deal is possible if users' maximum willingness to pay (WTP) falls short of providers' minimum willingness to accept (WTA) compensation. Such a situation would typically reflect that the perceived values of the service are lower than the estimated cost of provision landowners are facing for deviating from their first-best land-use plan. "Perceived value" and "estimated costs" would refer to expected monetary cost and benefits, but also be moulded by non-monetary values (e.g. cooperative and governance benefits), perceived PES risks (of non-payment and non-delivery of services, respectively) vs. business-as-usual risks (e.g. from fluctuating commodity prices), or the impact of land-use regimes (e.g. variable tenure security, (il)legality of use).

Both service users and providers will also have to consider in their equation informational requirements and transaction costs (Section 6). For instance, to scientifically verify benign land uses in a micro-watershed, the studies needed could be more expensive than the potential payments to farmers. Yet, it could also be that water users choose to follow a precautionary principle of widely protecting the pre-existing land cover that has worked well in providing services in the past.

Distribution-wise, Muradian *et al.* also have "important equity concerns" for cases where service buyers are poorer than to-be-paid providers. But that should matter less, as long as both buyers and sellers eventually become absolutely better off in net terms.

If the economics of WTP and WTA do not square, there is no basis for PES. If profits from alternative land uses (say, forestland converted to soybeans) are too high, then service users cannot offer sufficient landowners compensations to entice the latter's voluntary participation: conservation cannot compete. From emerging experiences in CIFOR's study on Reduced Emissions from Deforestation and forest Degradation (REDD) projects worldwide, high opportunity costs of compensating even just smallholders, together with limited funding horizons, are main reasons why implementers are holding back regarding on-the-ground implementation of PES tools.

This is also what Muradian *et al.* refer to as "the trap of the compensation logic": the demand for compensation may rise over time, so that service users become unable to "buy out" commodity frontier expansion. Rather than a drawback or "trap", I see this highly participatory feature of PES as a major strength: conservationists cannot top-down declare a new protected area or change a land-use regulation irrespective of local costs of development forgone. Instead, they need to transparently make the accounts of how much different local stakeholders would need to be compensated to persuade them to voluntarily participate – including possible contextual changes over time. Negotiated conservation such as PES is clearly not the easiest, nor the only legitimate way to achieve conservation, but arguably it is equitable conservation practice at its finest.

5. Cultural preconditions: user and provider motives for action

Even if the basic economics are right, PES can only work if there is the right culture of give and take: service users can get their act together to pay, and service providers feel motivated by receiving payments to deliver more services. These are not conditions we can automatically take for granted. Among watershed users, many PES implementers worldwide have noticed that irrigating farmers are seldom willing to make PES payments even when they are relatively wealthy, are the volume-wise largest water users, and would have a clear interest in protecting watershed services they heavily rely on (Landell-Mills and Porras 2002; Porras *et al.* 2008). This lack of payment culture can be related to perceived historical water rights and customary "free" services, to insufficient institutional depth in user organization (see next section), or to an expectation to be able to free ride later on other water users' actions.

On the service provider side, the general literature points to the danger that especially small payments can come to undermine moral sentiments in recipients, so that monetary self-interests in incentives "crowds out" their altruistic motives for doing good (Frey and Jegen 2001; Bowles 2008). Ecological economists have thus strongly suspected for years that PES could crowd out intrinsic conservation motives (Vatn 2010; Kosoy and Corbera 2010; Farley and Costanza 2010; Muradian *et al.*, this issue). Conversely, some literature also points to "crowding in" options, as PES institutionalizes improved governance and cooperation with outsiders (Rosa *et al.* 2003), and because even participation in pure market exchanges promotes a greater sense of fairness and cooperation in social organization (Henrich et al 2010).

Unfortunately, despite all long-term suspicions we still lack solid empirical analyses of real-world PES to move beyond sheer conjectures. Yet, incipient efforts do exist. One of Roldan Muradian's co-authors (Vatn) had three Masters students look into crowding-out options in Juma, Brazil's first REDD project that uses small cash payments to landowners among its interventions. The authors find that the payments served to greatly increase recipient's knowledge about forest conservation (a crowding-in factor), and thus concluded that "crowding out does not seem to be an issue" (Agustsson *et al.* 2010:123). Another co-author (Pascual) conducted with a PhD student framed field experiments offering indigenous Andean communities agro-biodiversity PES for their conservation of landraces. Interestingly, they found that collective payments in communities with strongly established collective conservation norms would cause "crowding-out", while in those with weak intrinsic pre-attitudes it would cause "crowding in" (Narloch *et al.* 2012). However, if PES instead is provided individually, the conclusion is unanimous: "Individual-level payments appear to stabilize conservation levels above critical thresholds by strengthening reciprocity-based behaviour, and thus crowding in pro-social dynamics" (Narloch 2011:121).

While this is an area where future research has great potential to inform our wisdom, even these two small empirical examples from Muradian *et al.*'s own ecological-economics inspired work show us that "crowding-in" is just as possible an outcome of PES as "crowding-out". Why are we then in conservation strategy papers by ecological economists always confronted unilaterally with the PES "crowding-out" menace? It seems "crowding-out" is more likely when intrinsic motives and social norms are strong (Vollan 2008). But if collective conservation attitudes are working out well locally, why then go and implement PES there in the first place? It seems that PES have a function exactly where these collective conservation values have already been seriously undermined, which also happens to be where "crowding-in" scenarios are more likely.

6. Institutional preconditions: trust, transaction costs, and tenure

If natural-resource externalities are widespread globally, why have PES only in few places developed spontaneously between service users and providers? First, we observe that external intermediaries and facilitators can play important roles in creating trust between actors that either do not usually interact (e.g. global service users with local providers), or may already be in conflict (e.g. entrenched upstream-downstream watershed tensions). Without basic trust, voluntary PES agreements will not materialize. External facilitators can help building trust towards expected mutual contract compliance and excluding impious motives, such as frequent provider fears that service users would abuse PES contracts to expropriate their lands (Asquith et al 2008; Rosa *et al.* 2002).

Secondly, service user and provider internal institutions have important PES enabling functions, including in curbing transaction costs (Farley and Costanza 2010; van

Noordwijk *et al.* 2012). Especially PES start-up costs can be high (Wunder *et al.* 2008). Precisely because environmental services cannot be 'commoditized' into one-off, over-the-counter transactions, but instead require complex social interactions over time, the competitive forces of markets are seldom the right institutional frame for PES: if all service users and providers were to operate atomistically on perfectly competitive markets, transaction costs would become prohibitive for most PES to emerge in the first place.

Typically, it is service users who tend to take the initiative for PES establishment. Most PES develop where either just one main (monopsonic) service user exists (e.g. a hydro-electrical power plant), or where service end users are effectively organized under one single umbrella (e.g. a water-user association). For instance, Ferraro (2009) explains that one main reason for Africa's severely lagging status in watershed PES implementation has been that urban water use(r)s often are little organized, with ample free-riding water consumption, hence also disabling the establishment of a payment vehicle for water-related environmental services. Service provider organization can equally enable collective action, reduce transaction costs and thus make PES more viable (Muradian *et al.* 2010).

Last not least, the probably most restrictive of all PES preconditions (surprisingly not mentioned by Muradian *et al.*) is tenure clarity and security among service providers. Almost any conservation policy will be enhanced by clearly defined, secure natural resource stewardship, but PES simply cannot function without it, as service providers need to be accountable for actions on "their" territory. If such well-defined stewardship does not pre-exist, then local land users will lack the crucial right to exclude third-party access, making them unreliable service providers with insufficient control over service delivery. It has been argued that such clarity of local rights and control can sometimes be established with external help, as part and parcel of a collective PES deal (van Noordwijk 2012).

Still, in many forest frontier settings dominated by land grabbing, overlapping claims and widespread violence, these conditions cannot be swiftly fulfilled. For Brazil, Börner *et al.* (2010) estimated that only about one fourth of threatened Amazon forestland would have tenure conditions that immediately lend themselves to PES implementation. This share sounds low, illustrating just how binding land-tenure obstacles can be for PES. Yet, in absolute terms we are talking about more than 35 million ha of threatened Amazon forestland with land-tenure potential to implement PES – compared to under 50,000 ha currently under PES in all of Brazil (Pagiola *et al.* 2012:322).

7. Is world conservation at risk of over-reliance on booming PES?

Muradian *et al.* (this issue) believe this question should be answered with a "yes". It is basically impossible to obtain globally comparable statistics that would answer the question precisely, but at least some ad-hoc numbers can demonstrate the dimensions in developing countries. Initially we note that in Africa PES development is completely nascent, with only a handful mostly carbon and watershed initiatives being carried out. In Asia, China and Vietnam apart the situation is not much better (Ferraro 2009; Huang *et al.* 2009; Porras *et al.* 2008). In Table 1, we thus look instead at area dimensions in assumedly PES-bulging Latin America, with three alleged real boomers: PES poster child Costa Rica, Mexico with its large state-financed watershed PES, and Brazil where about a dozen of watershed PES have recently mushroomed (Pagiola *et al.* 2012).

[Table 1 here]

Comparing the area under PES first to the country´s total land area (2nd column), we note a fairly high figure for Costa Rica (6.7%), but even Mexico is much lower (1.1%), not to speak of Brazil (0.006%) where many PES efforts remain small-scale. PES shares are obviously somewhat higher vis-a-vis forest area, being the main PES target (3rd column). In column 4 we register protected area (PA) size, and divide it in column 5 by PES area. Even in Costa Rica, protected area has three times more extension than PES, in Mexico ten times more, and in Brazil 4480 times more. What, then, about recent trends? The last column shows how change in protected areas during the decade 2000-

10 compared to areas under PES. In Costa Rica indeed there was some increase in PES area while none in PA, but in both Mexico (factor 3.2) and Brazil (factor 1596), PA expansion clearly outsized the much more hesitant "boom" in PES. In other words, the idea that PES is domineering conservation implementation has little empirical evidence to show for: the world is still expanding traditional command-and-control conservation such as parks at a much more rapid pace.

8. Conclusions and perspectives

Muradian *et al.* (this issue) portray PES as a market-based tool designed for "win-win" conservation with blurred objectives, which is linked to economic valuation and nature's commoditization. Impact-wise PES allegedly suffer from a compensation logic trap; they unilaterally risk "crowding out" altruistic motives, and possibly hurt equity. Increasing over-reliance on booming PES implementation thus looks like trouble ahead.

Above I have argued instead that PES are designed as "win-settle" with clear goals; they seldom use markets, economic valuation, nor commoditize. Their negotiated compensation logic enables participation and remarkably equitable and flexible conservation outcomes, including people's right to say "no" to conservation. Whether PES incentives would possibly "crowd-in" or "crowd-out" intrinsic motives is *ex ante* uncertain and highly context-specific. However, PES do require a payment culture and good organization from service users, a trustful negotiation climate, and well-defined land/resource tenure regimes for providers. Hence, PES are admittedly a quite sophisticated and demanding tool.

Additionally, Muradian *et al.* also allege that environmental economists usually analyze PES in depoliticized isolation, and that PES are often used as one-size-fits-all single tools to solve conservation problems. On both points, I tend to disagree. For instance, the case studies in our special issue (Wunder *et al.* 2008), all carefully looked at the political context in which PES were born and developed. That proved also highly necessary, because usually PES constituted supplements to complex local or national policy mixes, e.g. ongoing ICDP interventions or pre-existing semi-defunct command-and-control measures. Almost never are PES the only game in town.

It is thus also not surprising that PES in developing countries have spread disproportionally faster in middle-income countries with more advanced institutions and clearer land tenure, especially in Latin America. Overall PES remain, if not in an infant than at least an adolescent stage of implementation. The academic PES literature has burgeoned, and perhaps also certain donor interest, but on-the-ground efforts still lag well behind. Rather than pulling the brakes on PES now, as Muradian *et al.* would seemingly suggest, we actually need more PES efforts to balance command-and-control expansion – not as the new universal panacea, but as a tool neatly fitted to the conditions described above. Yet, we should also have more PES programmes build in vigorous impact evaluation mechanisms from the outset, so we can actively learn from them (Ferraro 2011), although the current chronic scarcity of conservation impact studies is by no means limited to PES (Miteva *et al.* 2012).

Finally, it seems important for analysts and practitioners alike to open-mindedly assess innovative conservation tools such as PES, looking beyond the ideologically stained glasses. Obviously, once a convenient straw man of PES has been built, one can scorn it and shoot it down – in some cases, apparently again and again. But to the extent that the straw man consistently diverges from the original, the criticism risks looking like a rebellion without a cause. The ecological economics perspective has provided important inputs into the PES debate, including in its insistence on the importance of equity and the diversity of institutional contexts. Yet, arguably these lessons have widely been taken on board already by the environmental economists. Is it thus time for ecological economists to acclaim victory for their own efforts?

References

Agustsson, K. M., A. Garibjana, and E. C. Soto Rojas (2010), An assessment of initial impacts of applying a payments for environmental services programme on forest protection and livelihood security: a case study of the Forest Allowance Programme in the Juma Sustainable Development Reserve, State of Amazonas, Brazil, Agricultural University of Norway, Aas.

Barrett, C. B., A. J. Travis, and P. Dasgupta (2011), On biodiversity conservation and poverty traps, *Proceedings of the National Academy of Sciences*, *108*(34), 13907-13912.

Bowles, S. (2008), Policies Designed for Self-Interested Citizens May Undermine "The Moral Sentiments": Evidence from Economic Experiments, *Science*, *320*(5883), 1605-1609.

Brockington, D. (2011), Ecosystem services and fictitious commodities, *Environmental Conservation*, *38*(04), 367-369.

Börner, J., S. Wunder, S. Wertz-Kanounnikoff, M. Rügnitz-Tito, L. Pereira, and N. Nascimento (2010), Direct conservation payments in the Brazilian Amazon: scope and equity implications, *Ecological Economics*, *69*, 1272-1282.

Corbera, E., and U. Pascual (2012), Ecosystem services: heed social goals, *Science*, *225*, 6069.

Engel, S., S. Pagiola, and S. Wunder (2008), Designing payments for environmental services in theory and practice: an overview of the issues, Ecological Economics, 65(4), 663-675.

FAO (2010), Global Forest Resources Assessment 2010: Main Report, 344 pp, FAO, Rome.

Farley, J., and R. Costanza (2010), Payments for ecosystem services: From local to global, *Ecological Economics*, *69*(11), 2060-2068.

Ferraro P.J. (2001) Global habitat protection: limitations of development interventions and a role for conservation performance payments. *Conservation Biology*, 15, 990-1000

Ferraro, P. (2009), Regional review of payments for watershed services: Sub-Saharan Africa, *Jounal of Sustainable Forestry*, *3-4*(28), 525-550.

Ferraro, P. J. (2011), The Future of Payments for Environmental Services, *Conservation Biology*, *25*(6), 1134-1138.

Ferraro, P., & A. Kiss. (2002). Direct payments to conserve biodiversity. *Science* 298 (5599):1718-1719.

Ferraro P. & Simpson R. (2002) The cost-effectiveness of conservation payments. *Land Economics*, 78, 339-353

Ferraro P. & Simpson R. (2005) Protecting forests and biodiversity: are investments in eco-friendly production activities the best way to protect endangered ecosystems and enhance rural livelihoods? *Forests, Trees and Livelihoods*, 15, 167-181

Frey, B. S., and R. Jegen (2001), Motivation Crowding Theory, *Journal of Economic Surveys*, *15*(5), 589-611.

Gneezy, U., and A. Rustichini (2000), Pay Enough or Don't Pay at All, *The Quarterly Journal of Economics*, *115*(3), 791-810.

Gomez-Baggethun, E. and M. Ruiz-Perez (2012). Economic valuation and the commodification of ecosystem services. *Progress in Physical Geography* **36**(6).

Henrich, J., *et al.* (2010), Markets, Religion, Community Size, and the Evolution of Fairness and Punishment, *Science*, *327*(5972), 1480-1484.

IUCN and UNEP-WCMC (2011) The World Database on Protected Areas (WDPA): Cambridge, UK: UNEP-WCMC http://www.wdpa.org/Statistics.aspx (accessed on 7 January 2013).

Kosoy, N., and E. Corbera (2010), Payments for ecosystem services as commodity fetishism, *Ecological Economics*, *69*(6), 1228-1236.

Kossoy, A., and P. Guignon (2012), State and trends of the carbon markets 2012, 138 pp, The World Bank, Washington DC.

Landell-Mills, N., and I. T. Porras (2002), *Silver bullet or fool's gold? A global review of markets for forest environmental services and their impact on the poor*, 249 pp., IIED, London.

McCauley, D. J. (2006), Selling out on nature, *Nature*, *443*(7), 27-28.

Miteva, D. A., S. K. Pattanayak, and P. J. Ferraro (2012), Evaluation of biodiversity policy instruments: what works and what doesn't? *Oxford Review of Economic Policy*, *28*(1), 69-92.

Muradian, R., E. Corbera, U. Pascual, N. Kosoy, and P. H. May (2010), Reconciling theory and practice: An alternative conceptual framework for understanding payments for environmental services, *Ecological Economics*, *69*(6), 1202-1208.

Muradian, R., *et al.* (2012), Payments for ecosystem services and the fatal attraction of win-win solutions, *Conservation Letters*, no-no.

Narloch, U. (2011). Payments for agrobiodiversity conservation services: how to make incentive mechanisms work for conservation Corpus Christi College. Cambridge, University of Cambridge. PhD Land Economy**,** 220pp.

Narloch, U., U. Pascual, and A. G. Drucker (2012), Collective Action Dynamics under External Rewards: Experimental Insights from Andean Farming Communities, *World Development*, *40*(10), 2096-2107.

Pagiola S. & Platais G. (2007) Payments for environmental services: from theory to practice. World Bank, Washington DC

Pagiola, S., A. Arcenas, and G. Platais (2005), Can payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date., *World Development*, *33*(2), 237-253.

Pagiola, S., H.v.G. Carrascosa, and D. Tafarello (Eds.) (2012), *Experiências de pagamentos por serviços ambientais no Brasil*, 274 pp., Secretaria do Meio Ambiente & Coordenadoria de Biodiversidade e Recursos Naturais (State of São Paulo), São Paulo.

Porras, I., M. Grieg-Gran, and N. Neves (2008) All that glitters: a review of payments for watershed services in developing countries, 130 pp, International Institute for Environment and Development (IIED), London.

Rosa H., Kandel S. & Dimas L. (2003) Compensation for environmental services and rural communities. p. 78. PRISMA, San Salvador

Simpson R. & Sedjo R.A. (1996) Paying for the conservation of endangered ecosystems: a comparison of direct and indirect approaches. *Environment and Development Economics*, 1, 241-257

Tacconi, L. (2012), Redefining payments for environmental services, *Ecological Economics*, *73*, 29-36.

van Noordwijk, M., B. Leimona, R. Jindal, G. B. Villamor, M. Vardhan, S. Namirembe, D. Catacutan, J. Kerr, P. A. Minang, and T. P. Tomich (2012), Payments for Environmental Services: Evolution Toward Efficient and Fair Incentives for Multifunctional Landscapes, *Annual Review of Environment and Resources*, *37*(1), 389-420.

Vatn, A. (2010), An institutional analysis of payments for environmental services, *Ecological Economics*, *69*, 1245-1252.

Vollan, B. (2008). Socio-ecological explanations for crowding-out effects from economic field experiments in southern Africa. *Ecological Economic* 67: 560-573.

WCED (1987), *Our Common Future*, Oxford University Press, Oxford.

Wunder, S. (2005), Payments for environmental services: Some nuts and bolts, *CIFOR Occasional Paper*, *#42*, 24.

Wunder, S. (2008), Payments for environmental services and the poor: concepts and preliminary evidence, *Environment and Development Economics*, *13*(3), 279-297.

Wunder S., Engel S. & Pagiola S. (2008) Taking stock: a comparative analysis of payments for environmental services programs in developed and developing countries. *Ecological Economics*, 65, 834-52.

Table 1: Area under payments for environmental services (PES) and protected areas (PA) in three Latin American countries

Country	Land area under PES (1) (mio. ha, 2012)	PES in country land area share (2012)	PES in country forest area share (2012, 2010)	Terrestrial (2) protected area (mio. ha, 2010)	Area ratio PA / PES (2010, 2012)	Change area PA / PES (2000 - 2010)
Costa Rica	0.34	6.7%	13.1%	1.1	3.2	0
Mexico	2.20	1.1%	3.4%	14.8	10.0	3.2
Brazil	0.05	0.006%	0.01%	144.4	4480	1596

Notes:
(1) Approximate figures

Sources:
Pagiola *et al.* (2011), FAO (2010), IUCN and UNEP-WCMC (2011).