

Ecosystem service curse: what new or extended problems might emerge if payments for ecosystem services grow big?

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Abstract

Payments for ecosystem services (PES) have received much praise and are increasingly perceived as a promising tool to ensure the protection of global ecosystems as well as being able to help alleviate poverty in areas rich in ecosystem services. Given current trends, the scale of payments is likely to grow, creating new circumstances within which ecosystem services will be managed. In this dynamic context, following a precautionary approach, one should focus on establishing systems to handle the risks involved. Based on an analogy to resources which have long been included in the system of market transactions, we suggest that the rapid development of PES can negatively influence regional and potentially national economies. Resource revenues are highly correlated with economic problems in poor countries that are not able to use those revenues to ensure sound development. Problems similar to those that affect resource-rich countries may emerge in the case of economies rich in ecosystem services once PES increase in spatial and monetary scale. The most prominent examples of such problems include rent seeking, unequal bargaining power of buyers and sellers, volatility of payments, which are all related to the quality of institutions. To ensure the long-term positive impacts of PES, such systems should be carefully designed paying particular attention to distribution of property rights and transparency, decentralization of revenues, and capacity building to ensure further development opportunities.

Keywords

ecosystem services, PES, global PES, resource curse, aid curse

INTRODUCTION

Payments for ecosystem services (PES) are perceived as a promising and efficient approach that allows protecting ecosystem services by integrating them into the market system. So far PES have been developed mostly on a regional scale, although international examples are also available (Landell-Mills and Porras 2002, Mayrand and Paquin 2004, Swallow et al. 2009). Their spatial and monetary scale has remained limited and they have not made significant impacts on economies in which they were implemented. And yet, with their rapid adoption so far (Carroll and Jenkins 2008), their effects are likely to change. Had PES increased in scale with new international and global conservation initiatives using this instrument, and had these payments reflected the ‘real value’ of ecosystem services, they would generate significant revenue streams particularly in the case of poorer but environmentally well-endowed countries. What may then be “the broader effects on the economy from scaling-up PES schemes” (Jack et al. 2008:9470)? And, “to what extent is PES compatible with an economically viable development trajectory for economies as a whole” (Bulte et al. 2008:247)?

The experience gained so far with provisioning services (such as food and fiber), many of which have long been included in the system of market transactions, reveals that poorer countries may have difficulties to benefit from such revenue streams. The literature on the ‘resource curse’ demonstrates that resource-rich countries are often not able to fully utilize their resources to ensure economic development (e.g., Sachs and Warner 1995). Instead, they suffer from different types of economic and social distortions aggravated by resource revenues, along with additional nuisances for local populations living in resource-rich areas. Similar problems have been observed in the case of other capital flows, including aid, especially when these are significant relative to the scale of the receiving economy (Bräutigam and Knack 2004, Harford and Klein 2005, Djankov et al. 2008), workers’ remittances (Abdih et al. 2012), and tourism revenues (Wilkinson 1992). We reflect on what can be termed as an ‘ecosystem service curse’, whereby countries rich in ecosystem services would receive payments significant enough to distort their economies, or at least to distort local economies where ecosystem services originate.

In this article, we call for caution through indicating potential problems that may emerge if PES develop too quickly. In the next section, we review the reasons for the growing popularity of PES and an increasing support for the creation of a global system of PES. Then, we refer to the experiences of resource-rich countries that have not been able to reap the benefits from selling provisioning services (resource curse). We analyze whether the same problems may appear in the case of other ecosystem services for which countries are likely to receive increasingly significant payments. Based on this analysis, we briefly summarize some key design elements for PES systems to help avoid such problems.

TOWARDS A GLOBAL SYSTEM OF PES?

Despite important obstacles to the wide adoption of PES, such as lacking willingness to pay for ecosystem services, limited experience and knowledge on how to design and establish PES, inadequate governance structures, including monitoring, legal framework and established property rights, and insufficient communication (Wunder 2007, Ferraro 2009), PES are increasingly perceived as an opportunity for achieving a more sustainable development. PES are seen as an approach that would be more effective in protecting ecosystem services than those used so far. In particular, PES are supposed to be more cost-effective in delivering services to buyers, more effective in generating economic opportunities for sellers (new cash flows, diversification of income sources, and reduction of income disparities), and are perceived as being institutionally simpler (Simpson and Sedjo 1996, Ferraro 2001, Ferraro and Kiss 2002, Ferraro and Simpson 2002, Pagiola et al. 2008). It is also expected that PES can ensure new funding for public goods, especially where funding has been declining, such as in the case

of biodiversity protection (Pagiola et al. 2008), and in countries where funds are relatively scarce (Kerr 2002, Grieg-Gran et al. 2005, Pagiola et al. 2005, Wunder 2008, Wunder et al. 2008b).

Because of the above perceived benefits of PES, numerous local to regional and several global level PES initiatives have already emerged. The latter include the UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD) and the Kyoto Protocol's Clean Development Mechanism (especially its afforestation component) as the most prominent examples. PES have been considered for application at an international level also for several other reasons.

- The international or even global dimension of many ecosystem services, such as carbon sequestration and maintaining carbon storages, requires global collaboration (Huberman 2009, Strassburg et al. 2009).
- Higher willingness to pay for ecosystem services in developed countries might serve as an opportunity to protect ecosystem services of global importance in less developed countries, where willingness to pay is lower. Even payments that would be relatively small from the developed countries' perspective might significantly improve the protection of ecosystem services in developing countries (Stern 2007, Wunder and Wertz-Kanounnikoff 2009).
- One additional dimension of the global North–South argument is that so far the North has largely contributed to the exploitation of the South, making it difficult for the South to manage its ecosystems in a sustainable manner (Bhaskar and Glyn 1995, Roberts and Parks 2007). A global PES system could contribute to a better balance of North–South relations (Romero and Andrade 2004, Huberman 2009, Kronenberg 2012), compensating developing countries for foregone alternative development paths that would have degraded important ecosystem services.
- PES are also perceived as an opportunity to alleviate poverty (Wunder 2006). Thus, an international system of PES might be seen as an opportunity to lessen the North–South income disparity problems. However, there is no compelling evidence that indeed PES can alleviate poverty, an issue to which we shall return later.
- It has been suggested that negotiations over PES, for example between upstream and downstream watershed inhabitants, have in some cases improved regional collaboration and environmental governance (Hayward 2005, Wunder 2006, Bulte et al. 2008). Analogously, one may expect negotiations over a global PES to bring similar benefits on a global scale.
- Economies of scale related to a global system might reduce the transaction and planning costs of individual projects.

The calls for a global PES recently appeared in academic writing (e.g., Sultanian and van Beukering 2008, Huberman 2009, Wunder and Wertz-Kanounnikoff 2009), policy-oriented reports (TEEB: ten Brink 2011, OECD 2010), and political declarations (Heredia Declaration 2007). Although some authors complained that the small scale of their application had not allowed PES to make a significant impact (Porrás et al. 2008, Wunder 2008, Leimona et al. 2009), this is likely to change with increasing scale of PES and especially when a global system of PES is created. According to one estimate, ecosystem service markets may generate benefits for 600–800 million rural poor by 2030 (Milder et al. 2010). Carroll and Jenkins (2008) calculated that broadly interpreted PES-related transactions are likely to amount up to US\$1.1 trillion by 2050, compared with about US\$87 billion in 2006. Thus, PES are seen as being able to make increasingly important contributions to economies of countries providing extensive ecosystem services. For some of the poorer countries, these can be fairly large windfall gains, similar to other large international capital flows, including resource revenues and aid.

LESSONS LEARNT FROM PAYING FOR PROVISIONING SERVICES

Provisioning of materials is an ecosystem service (e.g., Costanza et al. 1997, Rodríguez et al. 2006, Wallace 2007) which, unlike most other ecosystem services, is largely included in the system of market

transactions. Thus, the experience gained in this area may now be used in creating markets for other ecosystem services. Interestingly, resource revenues have often turned out to be counterproductive and instead of bringing prosperity they brought economic problems, which led to the emergence of the resource curse hypothesis. Although this principally refers to non-renewable resources, it has also been observed in the case of renewable resources, such as timber and agricultural products (e.g., Ross 2001b, Dube and Vargas 2006).

The idea that abundant resources may have detrimental effects on economic growth emerged with the Prebisch–Singer hypothesis (Prebisch 1950, Singer 1950) and the so-called Dutch disease (Corden and Neary 1982). The former relates to declining commodity prices. The latter shows that large resource revenues may lead to significant changes in foreign exchange rates and shift production factors to the extractive sector, to the detriment of other sectors. The resource curse concept received much attention in the 1990s and refers primarily to experiences gained in the second half of the 20th century in developing countries. From the initial macroeconomic explanations (e.g., Sachs and Warner 1995), the focus has gradually shifted towards institutions (‘rules of the game’), suggesting that the effects of resource abundance on economic performance depend on the quality of institutions (e.g., Mehlum et al. 2006a,b). Thus, the most widely adopted explanation is that, unless good institutions are already in place, resource revenues remove incentives to improve institutions and infrastructure, and encourage rent seeking (Harford and Klein 2005, Brunnschweiler and Bulte 2008, Wick and Bulte 2009). Indeed, most other manifestations of the resource curse depend one way or another on institutions (see the Appendix for an overview).

Several recent publications on the resource curse provide an exhaustive review of the debate so far (Auty 2007, Wick and Bulte 2009, Torvik 2009, van der Ploeg 2011, Frankel 2012). Nevertheless, the resource curse hypothesis has also been questioned and a number of studies have not found any evidence to support it (e.g., Alexeev and Conrad 2009, Brunnschweiler and Bulte 2008, Wick and Bulte 2009). Apparently, some countries have been able to avoid the resource curse and this might have depended on a variety of factors, such as saving resource income, their political system and the quality of institutions, the stage of industrialization and the type of natural resources (Torvik 2009). The main intrinsic characteristic differentiating resources that might have influenced the situations of resource-rich countries is their appropriability or ‘lootability’. Resources that are easier to appropriate facilitate rent seeking, corruption, conflict and smuggling, thus potentially preventing economic growth (Mehlum et al. 2006b, Boschini et al. 2007). Appropriability is further related to spatial concentration. Point resources, such as precious metals, diamonds and oil (as opposed to diffuse resources, such as agricultural land), are unevenly spread across a territory which makes them easier to appropriate (Leite and Weidmann 2002, Sala-I-Martin and Subramanian 2003, Isham et al. 2005, Ross 1999, 2001a, Wick and Bulte 2006).

Because of its importance for development, the resource curse hypothesis has attracted much attention among researchers and international organizations, including the World Bank, the WTO and the IMF. For at least three reasons, it is useful to derive lessons from the resource curse for ecosystem services:

1. both debates refer to nature-based wealth;
2. there is a growing focus on institutions and governance in both areas; and
3. both debates link to sustainability.

Like resources, ecosystem services are distributed unevenly across the globe by natural processes, providing some countries with an absolute advantage in their delivery. However, the relative value of ecosystem services as share of GDP especially in developing countries rich in ecosystem services is likely to grow, while the share of mineral production will inevitably decline. Interestingly, the main focus of the resource curse literature is not on resources as stocks but on the flows of resource rents. In particular the focus is on the risk of wasting the potential that these rents might bring for economic

development. Rents from ecosystem services can be defined similar to resource rents as the difference between their market value and all costs of delivery. Ecosystem services are provided through abstaining from some economic activity or modifying production processes, thus their costs of delivery are often related to opportunity costs for land users which lays the foundation for PES. In the case of resources, rents are often private and can be taxed. In the case of ecosystem services, rents only emerge when they are subject to market transactions that reveal the market value of those services. Thus, PES, like other market transactions, will in most cases lead to the privatization of ecosystem services rents.

There is no agreement in the literature on whether resource revenues prevent the development of quality institutions (Sokoloff and Engerman 2000) or whether problems occur because of poor institutions (Mehlum et al. 2006b, Robinson et al. 2006). With regard to PES, the institutional context is gaining increasing attention (e.g., Ferraro and Kiss 2002, Corbera et al. 2009, Clements et al. 2010, Muradian et al. 2010, Vatn 2010). So far, institutions and social actors dealing with PES often have limited knowledge about coupled social-ecological systems and the effects that the introduction of financial or other instruments might have, sometimes leading to counterproductive social and environmental consequences (Redford and Adams 2009).

With regard to sustainability, while non-renewable resources are extracted and depleted, ecosystem services can be delivered in perpetuity, depending on the condition of natural capital. This links to the weak vs. strong sustainability debate and to substitutability between different forms of capital. In the case of exploiting mineral resources, long-term development can only be ensured by substituting natural capital with other forms of capital (e.g., strengthening institutions). Indeed, countries with low or negative so-called net or genuine savings tend to be more affected by the resource curse (Atkinson and Hamilton 2003, Dietz et al. 2007). Meanwhile, ecosystem service ‘providers’ are paid for ensuring that ecosystems provide those services for which their beneficiaries are willing to pay. PES depend on providers’ ability to maintain natural capital so that it provides the services under consideration in perpetuity. Depleting natural capital in this case would have more serious consequences than in the case of mineral resources as it would deprive a given locality of a potentially infinite stream of revenues. Furthermore, PES can increase the total (natural and human made) wealth of a given area if the money is used to generate other forms of capital. PES can serve as a stimulus for further development, through co-investment or seed capital, or through in kind payments (e.g., in one project in Bolivia, beehives were provided to ecosystem service providers, thus incentivizing them to protect the forest for their own purposes; see Robertson and Wunder 2005). Nevertheless, as in the case of resource revenues, this development potential may be wasted if the money is not used for development purposes but dissipates within an economy.

SOCIO-ECONOMIC IMPACTS OF PES

The literature on PES has already touched upon many of the problems related to the resource curse. However, these references remain scattered and are often only raised as side issues. We shall now refer to these problems, first reflecting on the general doubts whether PES would help to achieve the socio-economic objectives of poverty alleviation and economic development.

Areas with important ecosystem services are often scarcely populated and mainly inhabited by the poor (Pagiola et al. 2005, 2008, Sunderlin et al. 2007, Wunder 2008). Furthermore, it is often poverty that drives ecosystem degradation (Bulte et al. 2008). Thus, many attempts have been made to study the impacts of PES on the poor and to devise PES in such a way that would help improve the situation of the poor (e.g., Grieg-Gran et al. 2005, Pagiola et al. 2005, 2008, Bulte et al. 2008, Wunder 2008, Jourdain et al. 2009, Milder et al. 2010, Muradian et al. 2010). However, empirical studies have not confirmed that PES schemes have so far contributed to poverty alleviation (Wunder 2008, Pattanayak et al. 2010). Rather, they indicate that if PES attempt to solve both poverty and environmental problems at the same time, this may reduce their efficiency in meeting these objectives. Thus, some authors argue

that PES should focus on one of these objectives at a time – i.e. protection of ecosystem services for which they were created (Bulte et al. 2008, Zilberman et al. 2008, Wunder 2008) and then the other might be achieved as a side effect. Ferraro (2009) even suggested that trying to satisfy both objectives at the same time had been the main obstacle for the development of PES in Africa. However, ignoring this dual nature of PES might lead to important unintended side effects.

For example, Karsenty (2004, 2007) suggested that PES might keep poor communities in a poverty trap as they would receive payments for refraining from some types of activity that might harm ecosystem services. They might become passive ‘conservation rentiers’, losing any dynamism and innovation potential they might have had, had they pursued their traditional development path. Activities that are prohibited may have actually been more labor intensive (Pagiola et al. 2005) or related to higher innovation and learning-by-doing gains (Karsenty 2004, 2007, Hutton et al. 2005). Clements et al. (2010) suggested that the new economic incentives to protect ecosystem services may lead to the erosion of local rules and social norms which may also affect preferences for different forms of economic activity. Indeed, abundance of resources and the related resource gains reduce innovation potential of resource-rich countries. Often it is not the abundance of production factors that forces innovation and enhances competitiveness but their scarcity (Porter 1990).

Wunder (2006) responded that in many poor countries economic development or innovation do not frequently occur and indeed PES may be a unique opportunity offered to such communities. Wunder (2006) suggested that PES do not necessarily mean capping development because people in poor communities are involved in diversified activities only some of which might conflict with providing a given ecosystem service. However, Wunder (2006) agreed that the negative social phenomena related to extra financial flows for ecosystem services (‘PES trap’) had not occurred because so far these payments have not been large enough to change the situation in this way. Indeed, most of the above cited studies adopted a narrow focus, studying individual projects and their income redistribution impacts. At the same time, they neglected the regional, national and especially international context in which important welfare or development issues emerge. Larger scale PES could also have significant unintended side effects on the poor (also on those who would not take part in PES) (Pagiola et al. 2005, Wunder 2008, Zilberman et al. 2008). For example, retiring land from agriculture and other uses leads to higher land prices and lower accessibility of land and non-protected ecosystem services; as well as higher prices of commodities, especially food.

In light of the above, without proper compensation, the poor are unlikely to benefit from PES and indeed their situation may deteriorate when the land they have been using so far is diverted to the provision of different ecosystem services. And they will not receive compensation if they have no property rights ensuring their ability to participate in PES schemes. Although there are also potential opportunities to create jobs with the use of PES, such as in tree-planting, tourism or silvopastoral practices, as well as potential positive externalities for agriculture (from forest and water conservation), and further economic opportunities may emerge with new capital available to poor communities; again, all of these depend on how PES are designed. These opportunities may be undermined by the three problems discussed in the next section.

SOCIO-ECONOMIC IMPACTS OF PES RECONSIDERED: THE RISK OF AN ECOSYSTEM SERVICE CURSE

Of all the factors that affect the development opportunities of resource-rich countries discussed in the context of the resource curse, three are also highly relevant in the case of countries rich in ecosystem services: rent seeking, unequal bargaining power and volatility of payments. We discuss these issues, first defining them, then explaining their underlying mechanisms in the case of ecosystem services, and finally highlighting some preliminary evidence.

Rent seeking

Definition. Rent seeking emerges when new actors take over rents, often by manipulation, corruption or force, from those who would have been entitled to receive those rents in normal circumstances.

Mechanism. PES increase the value of land that is important in terms of ecosystem services. As PES are usually tied to land ownership, PES might lead to further concentration of wealth and to excluding poorer land users from the land they have been using in order to capture PES (Redford and Adams 2009, Milder et al. 2010). Additionally, rent seeking and appropriation of land providing ecosystem services may lead to conflicts (Ferraro and Kiss 2002).

In developing countries land users are not necessarily landowners (Karsenty 2004, 2007, Wunder 2006, 2008, Porras et al. 2008). Although so far it has been thought that customary rights might often guarantee effective control and no formal systems of property rights need to be introduced (Wunder 2006), with a global system of PES this would probably have to change, in order to ensure its objectivity and universality within an international setting. Indeed, when institutions are weak and stakes are high, various forms of rent seeking become more attractive, which is known as a moral hazard effect.

Even if environmental objectives are considered as the most important, and indeed the only ‘statutory’ objectives of PES, then still the problem of rent seeking and exclusion of small scale ecosystem service providers remains an important issue. If small scale providers are excluded from the land they have been using, they will have to move elsewhere, including pristine areas or marginal and vulnerable land that have not been exploited so far and thus encroach on other ecosystem services – also referred to as ‘leakage’ (e.g., Ferraro and Kiss 2002, Pollini 2009, Barkmann et al. 2010).

Nevertheless, positive examples are also available suggesting that PES can enhance local cooperation and prevent conflicts (Wunder 2008). If the above threats are taken into consideration when designing PES, they can help to improve land rights and may lead to local capacity building (Rosa et al. 2003, Grieg-Gran et al. 2005, Wunder 2006, 2008).

Evidence. Rent seeking already appeared in the PES-related literature as a potential threat (Ferraro and Kiss 2002, Landell-Mills and Porras 2002, Rosa et al. 2003, Karsenty 2004, 2007, Pagiola et al. 2005) but most authors downplayed its importance on the grounds that PES have not been large enough to attract larger players (Rosa et al. 2003, Robertson and Wunder 2005, Wunder 2005, 2006, 2008). Rent seeking has been feared by some donor agencies which were considering getting involved in PES (Wunder et al. 2008a) and by some providers of ecosystem services (Wunder 2008). For example, rent seeking was identified as a serious problem in the case of an internationally financed carbon sequestration project in Madagascar where large amounts of available money attracted powerful players. As a result, profits from selling carbon credits did not reach local communities but led to the appropriation of resources by the state and other actors (Pollini 2009).

Evidence of rent seeking can also be found in the earlier examples of government-funded PES-related schemes, such as soil conservation programs in the US. Farmers who conformed to the initial standards were soon overridden by powerful local committees that influenced the government to change the rules regarding what practices could be funded (Elmendorf 2003). Other examples of strategic behavior emerged with reference to other government subsidy schemes with environmental objectives, including the largest US and EU agri-environmental programs (Martin et al. 1982, Baylis et al. 2004, Salzman 2005, Wunder et al. 2008b, Wunder and Santiago 2010).

Unequal bargaining power

Definition. Negotiations between the participants of the ecosystem service market are affected by unequal bargaining power – in most of these cases, buyers are exploiting their position to the detriment of providers' interest.

Mechanism. Apart from uncertain land tenure, other problems, such as limited experience and understanding of novel mechanisms or poor enforcement of legal contracts may limit the access of ecosystem service providers to PES (Ferraro and Kiss 2002, Kosoy and Corbera 2010). In principle, this is most often the case of relatively isolated groups that do not have enough knowledge and experience to make informed decisions when confronted with new ideas presented by powerful external stakeholders. Alternatively, if not exploited, smallholders may be excluded from participation in PES schemes due to higher transaction costs of organization and inclusion. Commodification of ecosystem services can create new socio-economic hierarchies, re-positioning of actors, or can reproduce unequal power relations in access to wealth and environmental resources (Kosoy and Corbera 2010). Indeed, PES criticisms often focus on the related problems of equity and legitimacy (Karsenty 2004, 2007, Corbera et al. 2007, Hubacek et al. 2009).

Romero and Andrade (2004) emphasized that conservation organizations may expect to make a deal paying relatively little for conservation in poor countries where the current opportunity costs of environmental protection are low compared to developed countries. Exploiting this disadvantage of poor countries, conservation organizations could to some extent limit the development prospects for those countries. In the case of most markets for ecosystem services, there are fewer buyers than sellers, the buyers are better informed and more entrepreneurial, and thus the buyers in those circumstances would dictate the conditions (Wunder 2008). The less unique a service is, the easier it might be for the buyer to change a provider (providing the buyer with higher bargaining power because of substitutability), thus undermining the financial sustainability of a scheme.

PES are often arranged through intermediaries who have major influence on the price and conditions of the transaction. Not only is their bargaining power much larger than that of most ecosystem service providers when deciding on the conditions of the transaction, but also they may use many other opportunities to capture a disproportional part of benefits (Neef and Thomas 2009, Kosoy and Corbera 2010, Vatn 2010). For example, offering to 'help' by providing access to a bank account to those who do not have access to an account and would not be able to receive the payments otherwise. There is a strong focus in the literature on the need to employ 'honest brokers' ensuring that the interests of both buyers and sellers are secured (Rowcroft et al. 2011).

Alternatively, large ecosystem service providers, sometimes those that have pushed out smaller providers in the first place, may resort to dishonest practices by demanding higher prices than economically justified. This is related to information asymmetry – providers may know or at least pretend to know the specificity of ecosystem services better than the buyers and inflate the opportunity costs of supplying these services. This may happen especially when ecosystem service providers realize that the scheme is not monitored well enough and that no sanctions are imposed on those who do not fulfill the original agreements (Salzman 2005, Ferraro 2008, OECD 2010, Pattanayak et al. 2010).

Evidence. Based on some preliminary evidence with initial voluntary projects, some authors feared that relatively large REDD payments might "create incentives for government and commercial interests to actively deny or passively ignore the rights of indigenous and other forest-dependent communities to access and control forest resources" (Brown et al. 2008:113). Based on experiences from Meso-America, Corbera et al. (2007) indicated that the above problems are more likely to emerge in PES programs carried out in protected areas where managers and intermediaries make all decisions. Another study of PES in Mexico demonstrated that because of poor knowledge of ecosystem service providers and their poor capacity to prepare project proposals, "substantial funding was lost in the preparation of unsuccessful project proposals" (Corbera et al. 2009:751). Finally, according to one Forest Trends'

study, transaction costs in forest carbon projects reach over 50% (and sometimes even over 90%) of the total value of payments (Scherr et al. 2006) which indicates the scale of intermediaries' intervention.

Volatility of payments

Definition. Due to various (primarily external) reasons, the value of PES may vary significantly over time.

Mechanism. The discussion on PES so far has not paid enough attention to the dynamics of the situation that PES are supposed to solve. Ecosystem services change over time, as do the pressures on ecosystem services, properties of ecosystems, and the preferences and needs of society. In addition, service recipients may not be satisfied with the service or they may find a more cost-effective way of acquiring the same service elsewhere. The above dynamics may influence price fluctuations similar to those experienced in other natural resources-related markets. Volatility of payments would translate into volatility of income for ecosystem service providers. Pagiola et al. (2005) noted that the stability of income for ecosystem service providers depends on the financial sustainability of the PES scheme. Although incomes are likely to be stable in the short term, one cannot ensure that the scheme would last in the long term. When funding ends with the end of a given project, the local population may not find it easy to identify and pursue new development prospects (Hutton et al. 2005, Carolina Elia, personal communication).

Furthermore, the above dynamics is likely to change, along with the changing perceptions on the value of different ecosystem services. For example, the sustainability of payments depends on whether protecting the service is perceived as successful and useful. If it is very successful and the service is protected, the buyers may no longer wish to pay, because the service is no longer endangered and because of larger supply, its value from their perspective diminishes. If it is not successful, the buyers may also wish to look for other options for getting the same service, or for its substitutes, and again the buyer may no longer be interested in paying for the original service. A stable level of a given ecosystem would be more likely to ensure the financial sustainability of a PES scheme. But even in this case the preferences of buyers may change, affecting the situation of ecosystem service providers. The attention and preferences of the public might change and recognize the importance of certain services but these might not be available anymore due to previous overharvesting or destruction. A change in preferences cannot just create new service flows given certain irreversibility and uncertainty with regard to ecosystem responses (Hubacek et al. 2009). Finally, knowledge about the importance of certain ecosystem services may change, diverting attention of buyers to different services and thus creating impacts to ecosystem service providers. Had a given community specialized in one type of ecosystem services, its vulnerability and dependency on PES would increase.

Evidence. On a global scale, the unpredictability of carbon prices provides the most obvious example of how preferences and payments change. In particular, the REDD+ scheme exhibits the many risks that affect the level of payments, such as unknown future demand for carbon credits, unclear plans of donors, market pressure favoring the lowest-cost solutions, and undecided future of the scheme itself (Phelps et al. 2011).

POLICY IMPLICATIONS AND CONCLUSIONS

With increasing scale of PES, new problems may emerge, similar to those that have been linked to other relatively large revenue streams, notably resource revenues. These problems are not specific to ecosystem services and yet, on a limited scale, they have already occurred in the case of PES. At least to some extent these problems can be mediated by proper design of PES and thus, they should attract the attention of all stakeholders responsible for developing this instrument. Further research is necessary on how to design a global system of PES taking into consideration the risks that we have

highlighted. Indeed, all of these risks refer to governance structures, including institutional frameworks, monitoring, communication and participation, and ensuring the positive long-term effect of PES.

Strengthening institutions emerges as the most important issue; this includes enforcement of regulations and decentralization of resource revenues. Targeting providers directly and studying the socio-political situation in regions where important ecosystem services exist prior to offering PES to those regions might prevent rent seeking. It would also ensure that PES do not cause counterproductive distributional consequences that might negatively affect the environment. Where applicable, this could also be achieved by reducing the appropriability of ecosystem services, for example introducing objective eligibility criteria, such as period of use of a given plot of land. Similar to some other international undertakings, accredited auditors should be responsible for verifying whether the system works in countries receiving PES, preventing any negative consequences as early as possible. Ensuring the transparency of this system will also require tight controls in order to avoid exertion of undue bargaining power.

A global system of PES would require the creation of national agencies that would be responsible for promoting the system in the respective countries and adjusting global standards to local conditions. These agencies would have to be independent from national authorities to minimize the problems of rent seeking and corruption. These agencies should be responsible for promoting information on local markets internationally thus fostering efficient and effective design of PES transactions (e.g., prices, services, cooperation rules, socio-political situation in regions rich in ecosystem services). Nationally, these agencies should improve access to information on PES, including promoting PES good practices in local languages. Apart from reducing the differences in bargaining power and thus promoting the participation of smaller ecosystem service providers in PES, information availability should increase the influence of service providers on designing PES. Indeed, thanks to participation of service providers in designing PES, their interests are better taken into account than in the case of traditional resource management where the decisions are frequently made centrally. Involving providers into discussions on PES might enhance their engagement and interest in participation (Corbera et al. 2007, Turner and Daily 2008, Hubacek et al. 2009). This would also help to avoid some of the problems indicated above (e.g., conflicts) and it would bring additional benefits to the protection of ecosystem services, such as learning-by-doing and preventing free riding.

Finally, a global system of PES needs to reduce the vulnerability of its participants to price volatility. Such a system should promote mechanisms that guarantee a fair price to ecosystem service providers in order to encourage a long-term provision of these services. Again, examples of such mechanisms are available in the commodity market. In poorer communities such a system would need to introduce capacity building mechanisms to ensure that these communities can absorb the funds, and to bring about other benefits such as improved social capital, and future development opportunities. A good system of PES should help to diversify the economies of poor countries so that they did not depend exclusively on PES but still managed their ecosystems in a sustainable way. Indeed, PES should have an educational component on the importance of ecosystem services and on the mutual dependence of providers and buyers. After all, because of irreversibility, new markets reflecting new preferences will not be able to undo many of the changes that we introduce to ecosystems.

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Appendix. Manifestations of the resource curse.

Problems	Selected references
Dutch disease (appreciation of the real exchange rate leading to export difficulties of the manufacturing sector, resulting in losing the related positive externalities in an economy, undermining its long-term competitiveness)	Corden and Neary 1982, Sachs and Warner 1995, Sachs 1999, Gylfason et al. 1999
Volatility of commodity prices and their long-term decline relative to the prices of manufactures	Prebisch 1950, Singer 1950, Hausmann and Rigobon 2003
Volatility of resource export earnings (changes in demand and prices in international markets), contributing to macroeconomic boom and bust cycles (borrowing in good times, repaying in bad times; high levels of government spending in good years followed by deep cuts in bad years); often combined with volatility of exchange rates	Knack and Keefer 1995, Manzano and Rigobon 2001, van der Ploeg and Poelhekke 2010
Volatility of rates of extraction (may be affected by technological processes but also by political instability)	Humphreys et al. 2007
Volatility of timing of payments by corporations to states, again leading to macroeconomic boom and bust cycles	Humphreys et al. 2007
Poor institutions that have not been able to ensure development without resources are not able to be effective once resources are discovered and exploited, either (imperfect markets, poor legal systems, badly defined property rights)	Ross 1999, 2001b, Mehlum et al. 2006a,b, Robinson et al. 2006, McSherry 2006, Smith 2007
Weak democracy (weak, unaccountable states – fewer connections between the state and citizens, fewer taxes, less information, lower demand for government services by citizens)	Moore 2001, Ross 2001a
Corruption (spending in political campaigns or coercion – funding militias); related to poor institutions and weak democracy	Sala-i-Martin and Subramanian 2003, Vicente 2010
False sense of security leading to overconsumption and underinvestment (resource windfalls encourage unsustainable and unwise policies, unnecessary projects, clientelism, unjustified public expenses, excessive borrowing, insufficient investment in educational and social reforms); related to poor institutions and weak democracy	Mansoorian 1991, Ross 1999, Gylfason 2001, Manzano and Rigobon 2001, Robinson and Torvik 2005, Aslaksen and Torvik 2006, Robinson et al. 2006, Collier and Hoeffler 2009
Rent seeking and conflicts (those in power and those who already control resources abuse their authority to appropriate resource revenues and remain in power, either by various forms of bribery, delaying reform, etc., or through armed conflict); additionally, this diverts resources away from more productive activities; related to poor institutions and weak democracy	Gelb 1998, Baland and Francois 2000, Acemoglu et al. 2004, Auty 2001ab, Ross 2001a,b, Torvik 2002, Fearon and Laitin 2003, Humphreys 2005, Collier and Hoeffler 2005, Acemoglu and Robinson 2006, Robinson et al. 2006, Bulte and Damania 2008
Unequal expertise (foreign extractor may know more about the resource, its value, quantity, extraction technologies than the government of the resource-rich country leading to differences in bargaining power)	Bougrine 2006, Humphreys et al. 2007
Grievances for local populations (reducing quality of life as a result of resource extraction: forced migration, inadequate job opportunities, environmental degradation, unfair distribution of benefits, military repression)	Collier and Hoeffler 1998, 2004, Azam 2001