

Research Article

Upscaling Payments for Environmental Services (PES): Critical issues

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Abstract

The concept of payments for environmental services (PES) lends itself to an extremely diverse array of experimentations. At a time when PES are likely to be scaled up massively in certain parts of the tropics, notably in the context of REDD+, it is important to refine the scope of implementation of the instrument to avoid several perverse effects specific to PES and sustain its benefits over time. We analyze recent developments in PES based on a review of literature and emerging practices as we observe them in the field. Using various elements from the theory of economics, public action and environmental management, we flag five key aspects of PES that are often overlooked in most influential studies on PES: (1) the nature of the environmental service providers, (2) the actual efficiency gains of involving industrial and commercial actors, (3) the type of contractual obligations incumbent to the providers and duration of payments, (4) the potential macroeconomic effects of an upscaling of PES, and (5) the risk that PES undermine the consolidation of fragile states. If these elements are not properly addressed in the design of PES, this paper explains that the instrument risks delivering only ephemeral environmental results, while inducing a dangerous shift towards the 'polluter-profits' principle. Conversely, we explain how systematically going beyond monetary payments and integrating elements of technical support to encourage alternative productive activities is key to sustain PES benefits over time.

Keywords: land use change, polluter-pays principle, compensation principle, tropical deforestation, sustainability, large scale implementation, conditionality

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Introduction

A need for critical debate

Among the fiercely debated concepts in the field of conservation, that of Payments for Environmental Services (PES, also called Payments for Ecosystem Services) is now one of the most prominent [1]. The emergence of PES is concurrent with increased attention to the need to maintain ecosystem services, defined as "services that are provided by ecosystems" by the Millennium Ecosystem Assessment [2].

What exactly is a PES scheme? The underlying principle is based on contractual payments to users of a natural resource, such payments being subject to the condition that they maintain a pre-defined environmental service. This straightforward principle is elaborated in a definition by Wunder [3], which continues to provide a reference today. This definition indicates that PES are (i) a voluntary transaction, by which (ii) a well-defined environmental service (iii) is being "bought" by at least one buyer (iv), from at least one provider (v) if - and only if - the service is actually preserved (conditionality). We henceforth adopt this terminology, where the "provider", as the user of a resource, is susceptible to receive a payment for the maintenance or restoration of an associated ecosystem service, while the "buyer" is the beneficiary of this service.

The undeniable popularity of PES certainly relates to the fact that it seems to follow an inexorable logic: the internalization of environmental services to attract additional funding makes conservation profitable and financially sustainable through the mutual interest of both parties [4]. Others would argue that the instrument addresses the problem head on, more directly than other conservation instruments [5].

The accumulation of literature, whether scientific or grey, and ever increasing experience are precisely the reasons why this is an opportune moment to submit the PES concept to a detailed critical examination. As Redford and Adams [6] rightly point out, "*conservation has a history of placing great faith in new ideas and approaches that appear to offer dramatic solutions to humanity's chronic disregard for nature (...) only to become disillusioned with them a few years later. The payment for ecosystem services framework fits this model disturbingly well*".

Five key questions about PES

The rapid emergence of PES has indeed been built on a somewhat hasty consensus based on the merits of these payments. The intention in this article is to participate in this debate with the "*spirit of constructive criticism*" that Redford and Adams [6] call for, in order to improve understanding of the mechanisms at work and ultimately to improve the real contribution of PES to conservation efforts. In particular, we will consider the application of this instrument on a large scale – a prospect that is made possible by the high esteem in which the concept is held and the future need to channel REDD+ (Reducing Emissions from Deforestation and Degradation) money down to resource users.

Among a profusion of unresolved questions, we propose to focus on five aspects that we consider crucial in the prospect of an upscaling of PES:

1. Why is the nature of the service providers not neutral?
2. Is the economic efficiency of PES enhanced by the involvement of industrial and commercial actors?
3. PES for immediate gains or longer-term changes: how to specify PES contracts for lasting impacts?
4. What could be the macroeconomic effects of an upscaling of PES?
5. What links do contract-type instruments such as PES maintain with public legislation and authorities?

The analyses¹ that follow for each of these questions are based first and foremost on the concept of PES as defined in literature. We compare this with various elements from the theory of economics, public action and environmental management, as well as from future developments of this mechanism that we consider plausible for various reasons. To the extent possible we referred to emerging practices to support our points; yet the significant gap between project documents and reality on-the-ground has been a disincentive to rely too much on literature. Furthermore reliable assessments of the impacts of various projects will take time, and we consider that such sound assessments are not available yet. Consequently some of our assumptions could not be verified rigorously, in particular the merits of asset-building compared to use-restricting PES.

The nature of sellers is critical for equity issues

The two main stakeholders in a PES scheme are obviously the buyer and seller of a given service. The nature of the seller involves most fundamental issues for consideration, in our opinion, and is thus addressed in this section. PES have traditionally been conceived and applied in contexts where the providers of the service are populations (as opposed to industrial companies) – fishermen, farmers, forest dwellers – which has several important implications. Indeed, the financial amounts are usually limited by the size of sites and by the low opportunity costs of relatively poor populations. In addition, populations in receipt of payments reside more or less "on site", even if their rights over the resource may be informal (not recognized by public authorities). This inclination towards poor rural populations is logical for an instrument that leaves the initiative to a buyer whose interest is to best negotiate the provision of an environmental service. This is especially true when the service concerned has a more widespread usage, carbon being an emblematic example, as potential providers are then numerous and in competition.

This phenomenon can be observed today with the proliferation of studies dedicated to the identification of sites where the costs to reduce carbon emissions from deforestation are the lowest. It is precisely the objective of studies such as the diagram representing the abatement costs of emissions across all sectors [7], those centered on the main forest countries [8], or those limited to single countries [9] (on the Congo). This approach explains why the PES instrument was considered from the perspective of poverty reduction and economic equity by both the academic world [10] and practitioners [11].

However, given that PES are now applied more widely and presented as a suitable instrument for very contrasting environments, the question of the nature of the service providers must be raised explicitly. It is indeed possible that radical changes will occur, and we are seeing the beginnings of this process. In the near future we could thus move from a situation where PES are an emergency solution – to bring a rapid halt to environmental degradation by contractually binding individuals with reduced negotiating power and limited demands in terms of compensation levels – to a situation where the service providers consider these payments as the result of commercial activity in a portfolio of income generating activities. One case illustrates this perfectly: a British investment fund (Canopy Capital) has bought the Guyanese government's international trading rights to the environmental services of a forest with an area of 371,000 hectares, which includes the maintenance of rainfall levels, climate regulation, biodiversity preservation or water regulation (Mongabay.com, 27 March, 2008).

These two situations are very different in many respects, and we see how difficult it is to justify a uniform application to practitioners of slash and burn agriculture in Central Africa, cattle ranchers in the Amazon, paper manufacturers in Indonesia, tuna fishermen in the Mediterranean and

¹ This article expands on a working paper by the same authors : Pirard, R., Billé, R. and T. Sembrés, 2010, *Questioning the theory of payments for ecosystem services (PES) in light of emerging experience and plausible development*, IDDRI, Paris.

investment funds with a speculative orientation. The relevance of calculating the payment based on opportunity costs may differ for various categories of resource users and service sellers. We can justify this line of thought by considering three typical contrasting situations: a village population in an isolated area, a population composed of migrants near a pioneer frontier, and a private company in possession of an exploitation license. In these three situations the legitimacy of the payments is not identical, not to mention the difficult question of property rights: opportunity costs correspond respectively to the production of goods for self-sufficiency, to the generation of additional income, or to the pursuit of profits from the exploitation of a public resource. The issue of the ecological effectiveness of the PES mechanism is raised in the same terms in all three cases. But as far as the legitimacy of compensation paid to villagers with little or no alternative can be defended, if only for reasons of economic redistribution, the compensation paid to the commercial sector benefiting from rights granted by society (government or local authorities) is at best questionable. Yet this concern is well grounded in reality, as recent news suggests: in Indonesia, the NGO Fauna and Flora International is planning to negotiate with major private palm oil producers, who benefit from licenses granted by the State for public land, in order to share profits from the sale of carbon credits if forests are left intact (www.mongabay.com, 22 July 2009). This tendency is consistent with the proliferation of studies estimating opportunity costs, which are a consequence of the pervasiveness of the compensation principle in the field of environmental conservation, i.e. the fact that compensations are more and more commonly referred to as the solution to environmental degradations². While the causes of deforestation increasingly originate in industrial rather than subsistence agriculture [12], the application of PES to industrial companies as providers is an expected consequence.

In the three aforementioned examples, the calculation method for the compensation amount, according to the nature of the provider, is also subject to discussion (in addition to the strict relevance of distributing compensations based on opportunity costs levels). The production of subsistence goods does not pass through the commercial circuit and the estimation of its value using the conventional methods for calculating opportunity costs is therefore problematic. One must then consider the possibility of taking into account the cost of supplying substitute consumer goods, the valuation of unpaid work, as well as the weakness of capital costs due to the possible absence of economic alternatives³. For migrants who invest in the conversion of land with the support of considerable financial capital, the capacity to invest in other places or sectors may exist, and the pertinence of compensation that would take into consideration the capital cost is therefore more important. Finally, for private companies that have benefited from the granting of an exploitation license for a public resource, a classic calculation of opportunity costs may be equivalent to the payment of a rent that is actually only related to the good will of the public authority that decided to grant the license. However, it is clear that these distinctions do not often appear in literature, for example in the influential works devoted to the mapping of potential PES for carbon storage in the Amazon according to opportunity costs (e.g. [13]). As we argue, the apparent simplicity of the concept of opportunity costs makes it attractive for those who either wish to estimate the cost of reducing deforestation or those who wish to make fast deals for conservation. But this attraction hides crucial differences between social and private opportunity costs; it also leads to evaluators

² One striking example of this trend, which we find extremely problematic, is excerpted from a recent McKinsey document (“Creating low carbon prosperity in Central Kalimantan”, draft): “*avoiding deforestation by pushing new estate crops or pulpwood plantations to degraded land requires some form of payment to compensate the concession holder from the lost revenues of not cutting down their forests*”. The terminology itself is problematic in such influential documents that are used by national or local authorities to design their REDD+ strategies: payments are *required* (without further justification) for not logging *their forests* (but they are on public lands).

³ Another problem associated to this situation is analysed by Lescuyer [14] who undertook a study in East Cameroon to look at the validity of monetary valuation to make environmental management decisions: “*In these societies where market logic does not prevail, it seems difficult to consider currency as a correct and neutral means for revealing individual or collective preferences*”.

usually neglecting the context in which the calculation occurs to adapt their calculations [15]. And its massive utilization nowadays carries the risk of deflecting attention from all the other types of costs associated with long term and effective forest conservation due to the implementation of the right policies [16].

Is economic efficiency enhanced by the involvement of industrial and commercial sectors?

While the previous section clearly questioned the equity implications of having industrial and commercial actors as sellers of environmental services, it is often argued that efficiency alone could justify their involvement.

The criteria for economic efficiency can be defined as follows: efficiency is greatest if ecosystem services are preserved in the long term, with the lowest possible usage of financial resources. In this context it is clear that focusing on major industrial stakeholders, whose decisions and practices have an impact on sizeable areas and a large quantity of ecosystem services, will apparently multiply the effects considerably. From a transaction costs perspective, it is more efficient to negotiate with one concessionaire who controls hundreds of thousands of hectares than with thousands of small owners, whose titles are often informal and likely to be challenged by the State.

Following this line of thought, the emergence of intermediary stakeholders to bridge the gap between the buyers who benefit from the service and the providers – especially, if not exclusively, when considering global services such as the fight against climate change – may be seen as a positive means to achieve the optimum while reducing transaction costs by decreasing the number of stakeholders involved. An example would be an investment fund that is active in the area of environmental services, and is responsible for trading carbon credits on international markets rather than the populations that own the formal or informal property rights for the resource. Such an investment fund would have market knowledge, contract negotiation capacity and the objective of profit maximization, which are all factors that should theoretically enable it to accelerate the process and achieve the application of PES on the ground. However, we can see two failures in this system: first, the issue of multiple contracts will probably not be resolved because the intermediary must also negotiate with all those that have entitlements to the site, except if these rights are not recognized (which is a real risk); and second, the intermediary is likely to negotiate directly with the public authority, in a way that lacks transparency, and by generating a profit margin which results in an increase in costs and leakage of capital outside the developing country (which corresponds to the case of Guyana mentioned in the section on the nature of sellers).

While the argument for efficiency should be tempered – especially in the case of intermediaries as argued above – there is clearly a dilemma regarding the involvement of industrial actors as service providers in PES. But as previously mentioned the beneficiary pays principle is widely considered an exception to the polluter pays principle, when polluters are not solvent. Otherwise, the rationale for transferring the cost of pollution, or its avoidance, towards beneficiaries is weak. Although it is difficult to cite the polluter pays principle for environmental externalities that are distant and diffuse, it should be emphasized that the State itself can become an intermediary between the representative global organizations and the polluter. This is what we observe with the Climate Convention, and some States that comply with their commitments to reducing emissions by making domestic emitters pay (e.g. through a carbon tax or the auction of emission quotas), thus enforcing the polluter pays principle.

Designing PES for immediate gains or longer-term changes?

In their conception, the aim of PES is to preserve the environment through payments that are conditional on abandoning degrading activities. In principle, the instrument is intended to obtain immediate results, whilst the issue of achieving a long-term solution to the problem is not addressed. Indeed, periodic payments reflect a mode of action consisting of removing a threat for as long as payments are maintained. These payments are calculated on the basis of the conditions observed at the time the contract is made, and are potentially subject to future revisions according to diverse parameters: price of agricultural commodities, labor costs, costs of inputs, yields, etc.

In principle, the PES therefore does not structurally remove the possibility of its occurrence. This observation can be regarded positively or negatively: on the one hand, it may be seen as a means to retain flexibility over time, allowing more satisfactory solutions to be found; on the other hand, it can be seen as an incomplete solution to the problem, leaving a sword of Damocles hanging over the situation that will fall once the funds are no longer available or if the contract is broken. This is all the more true with most of PES developed in the framework of “projects” where buyers are donors rather than beneficiaries (at least they do not derive economic benefits from the service).

There are, however, specific examples, such as Vittel in France [17], which convincingly illustrate the fact that PES can encourage new practices and bring long-term solutions to the threat of environmental degradation. In this example, through external aid and technical support, farmers have been encouraged to modify their practices with the intention that this reorientation will be “definitive”, or at least structural, with the payments expected to trail off after a certain period. It is legitimate to consider a replication of this model, which is resolutely turned towards lasting solutions, but at the price of a specific understanding of payments.

Therefore, it can be argued that the conventional definition of PES overlooks fundamental aspects of the instrument and fails to draw a line for risky experiments. This debate on the duration of PES contracts (permanent compensations *versus* temporary investments) relates to the question of *how* the ecosystem service is delivered by the provider. After showing that the type of seller should matter for PES, it is also crucial to consider the specifications of the PES contract, and more precisely, the type of obligations incumbent upon the provider. A clear divide can be made between providers who are receiving money simply to “freeze” some rights over the natural resource and those who receive payments (not necessarily monetary transfers) conditional to investing in alternative activities that are compatible with the permanence of the ecosystem service (e.g., engaging in agroforestry, shifting from extensive to intensive ecological farming systems, building capacity and infrastructure for a tourist activity, etc.).

Wunder [3] coined these two types of PES respectively “use-restricting” and “asset-building”. The example of Vittel in France is clearly an “asset-building” type of PES, whereas, at the other end of the spectrum, conservation concessions – whereby a conservation agency (e.g. NGO) buys logging rights to public forest from the government – illustrate “use-restricting” contracts. While the latter are commonly cited in written documents, the former seem to be more frequently implemented in practice (see e.g. [18-21]).

“Asset-building” PES schemes have the highest probability (but no certainty) of building the conditions for temporary payments and potentially remove the risk of bargaining for permanent compensations, at least not from the part of the same stakeholders. The appeal of “use-restricting” PES lies in their simplicity and their lower costs in the short term compared to “asset-building” PES. It is easier to give cash and monitor the cessation of logging in a given tropical forest than to provide training and equipment for setting up tree nurseries and sustainable forest management practices.

However, in the longer term, the “use-restricting” PES are likely to become both costly (continued payments and upward bargaining) and ineffective (people still need wood).

“Use-restricting” PES ignore basic demand-side pressures. The delivery of ecosystem services by the providers may be effective at project level, but demand for agricultural products, energy, timber and minerals will still have to be met somehow. In the rural tropics, cash is hardly a substitute for these products, which are either produced for self-consumption or traded locally. The relative abundance of cash and relative scarcity of basic commodities (as a result of the progressive freezing of rights over natural resources) is expected to increase the price of these commodities and PES alike (through rising opportunity costs). “Use-restricting” PES are thus likely to result in quick ecosystem benefits that will vanish into leakage effects.

Conversely, with an ideal case of “asset-building” PES, payments would become unnecessary to ensure the provision of the environmental service after a number of years. We are, however, not so blindly optimistic as to believe that this outcome is easy to achieve. In many instances, investing in sustainable productive activities through PES (ecological intensification of agriculture, sustainable forest management, off-farm business strategies, etc.) is not a perfect substitute for conventional practices. When PES contracts expire, some previous unsustainable activities (e.g. poaching) may resume, regardless of the continuation of the sustainable alternatives introduced by the PES scheme. In other words, new sustainable alternatives may be pursued *in addition* to previous activities when people are no longer tied to a contract. Some alternative comments on the two types of PES are provided in the Box.

The issue to which we would like to draw attention here echoes the question of trajectory changes, for which climate change is a good illustration. The objective of limiting global warming to less than 2°C is an aim that implies rethinking the development models in use today. Trajectory changes in most areas are therefore required as soon as possible, as opposed to targeted measures that would not fundamentally challenge the way we live, produce and use natural resources, or the way in which development and economic growth are perceived. For instance, merely setting-aside large plots of forest through PES without changing agricultural technologies and diets may fall short of expectations: if supply decreases (less cultivated land without increasing yields) but demand increases (population growth and higher purchasing power), then remaining forests should be under higher pressure. In this case, a trajectory change would be to invest in education for changing diets, or to invest in the adoption of appropriate technologies for boosting yields. Doing direct conservation is not bad by itself, but supportive activities are necessary to secure and even reinforce the positive impacts.

The risk with PES schemes that would only postpone the destruction of environmental services is that they may further strengthen the very same socio-economic model that we must urgently reform. This perverse effect is increasingly believed to be a feature of carbon compensation schemes such as the Clean Development Mechanism (CDM) and voluntary carbon offsets in the transportation sector. At worst, some poorly designed carbon PES could both help northern polluters to temporarily offset their carbon footprint, allowing them to carry on business as usual, and induce sellers to postpone much-needed reforms at home.

Large-scale implementation of PES and the macroeconomic implications

Programs that promote the extension of PES on a large scale through replication of the original blueprint must be regarded with caution. For instance, with necessarily limited financial resources, a crowding-out effect may occur (in the sense that other actions may no longer receive funding). Then, allowing the belief that the proliferation of PES schemes is a solution to the current problem of

massive environmental degradation carries the risk of deflecting attention away from the necessary political choices regarding development trajectories.

The issue of financial resources for the large-scale implementation of PES can be considered on at least two levels: (i) where does money come from and in substitution for what? Private financial resources to replace a productive investment, public investment as an alternative to development aid, etc.? (ii) How can we globally account for the loss of production due to the cessation of a productive activity (condition of payments)? It thus appears that large-scale implementation of use-restricting PES could have important repercussions in terms of global well-being through constrained production.

Another point to consider regards the implications of a model that is similar to a rent economy. In Southern countries, where PES for carbon and biodiversity services are expected to thrive due to lower opportunity costs, the sale of user rights over natural resources could become an additional item on the list of rent-seeking opportunities. But the economic rent is not so much a sign of wealth as the indication of an international specialization that is imposed on a country [22]. The trade imbalance between rich and poor countries could be accentuated through PES, with poor countries specialized as providers of raw materials and “environmental rights”. Southern countries have no control over commodity prices and this is unlikely to be different for global environmental services such as carbon sequestration. Overall, the application of large-scale PES can potentially contribute to freezing efforts to change the development trajectory of countries with significant natural resources that generate environmental services.

PES, law and public policies

The general context of the rapid development of PES cannot be ignored. In southern hemisphere countries, we are often dealing with States that at best are undergoing construction and, at worst, are in decline. In this context, some PES may be a way for stakeholders to escape the control of public authorities – with a well understood advantage for both parties: effective environmental protection for the buyers, remuneration rather than regulation for the providers – or to compensate for their weakness, which is often a real absence of the State in rural tropical environments.

Arguably, PES may come into direct conflict with certain principles of public action. We initially think of the polluter pays principle, which, if not universal, has been promoted by the OECD since 1972. According to this fundamental principle of environmental policy, it is the user of the resource and not the beneficiary of the environmental service that should bear the financial negative externalities. We understand that in some cases PES may be justified in preference to the polluter pays principle, as already discussed in previous sections. However, when it comes to the question of addressing the degradation of services that are related to global public goods, and therefore to replicating the PES model on a large scale, it is no longer possible to avoid the conflict with the polluter pays principle.

Another debatable aspect of pragmatism is that PES often have an ambiguous relationship with the law. In certain cases, which are sufficiently numerous to be of interest, the providers are compensated for abandoning illegal practices. Such cases have been documented e.g. in Madagascar with the Durrell Wildlife Conservation Trust [20] or in Vietnam where WWF (Dang Thuy Nga, Asia Europe Environment Forum, 29-30 June 2009, Hayama, Japan) facilitates a PES between a company operating a hydroelectric dam and people engaging in illegal forestry exploitation in the watershed. In Tanzania, WCS supports a PES scheme, which, among other, aims at preventing unlicensed hunting [19]. Indeed, in some situations it is unrealistic to consider mitigating the threat of environmental degradation without agreeing to negotiate with users that benefit from their *de facto* control of the resource. But where are the limits of pragmatism? At what point are illegal practices encouraged (by other stakeholders and/or in other places) by creating a dangerous precedent? Important questions

need to be raised about the political philosophy of PES, in light of basic democratic principles such as the idea that “*public tolerance of a crime may exempt it from punishment, but shall not give rise to any right to profit derived from the crime*” [23].

Box: Use-restricting versus asset-building PES

An important aspect of our analysis is the distinction between use-restricting and asset-building PES. Our preference goes to the latter, for a number of reasons presented in the article. The reasons we list do not build on a specific literature review; instead they usually rely on a logical reasoning and a description of the expected consequences of following one or another approach. We must admit that to our knowledge few documents exist that propose a sound assessment of the PES outcomes, so that we can hardly use literature to support our own analysis (except for a couple of references in the conclusive section). This was confirmed by our field research on a number of sites, where we could notice significant gaps between the official presentation of experiences on one hand, and reality on-the-ground on the other hand.

Yet we disclose here several points that arose during our field research in Indonesia, which relate to the use-restricting *versus* asset-building PES issue [24,26]:

- PES prove extremely difficult to implement in practice and usually appear to be quite different from the canonical Wunder definition of the mechanism
- High transaction costs not only impede implementation, but also tend to provide a prominent role to international donors and/or international organizations with a preference for asset-building PES (if only for poverty alleviations considerations). The history of Official Development Assistance [27] shows that such heavy external involvement generates a risk of disconnection between PES and public policies.
- PES in practice offer good prospects to combine with public policies and can be viewed in some contexts as a way to support forest management for productive purposes (e.g. agroforestry).
- It appears unrealistic in practice, at least for the several cases we investigated, to implement strictly use-restricting PES due to its low acceptability for resource users. Acceptability can also be low sometimes for the payers, as illustrated by [28].

Discussion: *Drawing red lines to optimize the effects and reduce the risks of PES*

The issues raised in the previous sections focus on the risks linked to a large-scale application of PES (through a multiplication of sites) when adhering to their strict definition, which could involve the multiplication of financial compensations for users of natural resources (use-restricting PES). These risks must be taken seriously because the compulsive replication of this model is currently under debate, especially within the framework of the REDD+ mechanism. Its scope of application could therefore cover a major proportion of the forests situated in developing countries, which have carbon stocks that have now become a prime issue.

The probability of PES large-scale application is even higher if we consider the following fact. The potential development of a market logic applied to forest conservation will clearly result in the development of markets for environmental services – with carbon as the spearhead within REDD+ – which are likely to rely mainly on private investments. According to this reasoning, the investment would be directed primarily towards the direct payment of compensation for agents of deforestation in order to obtain immediate results. It is unrealistic to expect investors to engage in the financing of policies and measures aimed at changing modes of production (asset-building PES), especially

agricultural, the results of which would be more uncertain in the short term and thus the income generated by the sale of environmental services lower.

The emergence of carbon markets applied to forest conservation is beginning to produce concrete effects on the possible proliferation of PES, which could be applied to private companies operating on public lands and with licenses granted by competent public authorities. This apparently surprising scenario is actually quite plausible. It is already under debate for industrial plantations of palm oil in Indonesia ("Palm oil companies trade plantation concessions for carbon credits from forest conservation": Mongabay.com, 22 July 2009) and could extend outwards as it prolongs and applies the innumerable efforts directed towards estimating the opportunity costs of forest conservation. If the polluter pays principle is abandoned for the industry, the door will be open to all sorts of blackmail; the very fact of threatening an ecosystem will then become a serious business. We believe that it is vital to establish a limit that must not be exceeded.

Several recent examples reinforce this statement, pushing the principle of compensation for opportunity costs to absurd limits, for example: a proposal from the Ecuadorian government not to exploit around 20% of its oil resources located in the subsoil of the Yasuni National Park, which protects one of the planet's richest tropical forests in terms of biodiversity; claims from the Gulf countries related to the economic loss associated with a gradual decrease in the world's oil consumption due to the fight against global climate change (submitted by Saudi Arabia to the UNFCCC, February 6, 2008); and even a proposal by a fur manufacturer to renounce its quota for hunting baby seals in Namibia in exchange for a payment of 14 million USD from NGOs involved in environmental protection...

It is particularly important to define this limit for global ecosystem services, derived most notably from biodiversity and carbon stocks. Indeed, initiatives related to PES that aim to preserve these services could stimulate substantial financial flows (particularly large in the case of REDD+) and involve a group of stakeholders ranging from the populations that use the resource to the national or sub-national authorities, through private companies operating on private or public land and international funds or organizations in charge of ordering payments. It is then necessary to agree on rules that will govern these financial flows and on a few basic principles that should be observed. These principles should address the nature of the eligible beneficiaries of PES (populations, private sector, the State), payment terms (periodic, duration, calculation of the amounts), and the nature of the reward granted (payments, technical support, property rights).

For the sake of efficiency, PES will probably focus on private companies or large landowners. While this has never been the stated objective – indeed PES have traditionally been associated with development goals and poverty alleviation – it would be too difficult in practice to multiply arrangements with a dispersed group of stakeholders such as small and poor landowners [24]. However, it is precisely in situations where the service provider is a private company or a large landowner that a PES scheme becomes debatable for the aforementioned reasons (conflict with the polluter pays principle, dilution of financial resources that otherwise could be used to produce changes in agricultural practices, etc.).

We believe that a promising option to properly and effectively address these risks is to both specify and broaden the PES concept, and to reduce the scope of application when public financing is at stake. These safeguards are less pressing for *user-financed* PES in which benefits associated with the transaction remain private. However, this type of private PES is likely to remain quite marginal as the growth potential for PES clearly comes from two global public goods, namely carbon sequestration and biodiversity conservation. It should be possible to systematically go beyond monetary payments and to integrate elements of technical support to encourage changes of practice for productive

activities. This would make it possible, *inter alia*, to guarantee that: mobilized financial resources are usefully invested; the relevant agents remain part of the production process; vital environmental conservation does not fall under the sole control of “market logic”; and it also minimizes the risk of wealth hoarding by economic agents who are well-informed and well-connected with political elites.

PES should be designed as a means of guiding production practices in a direction that is desirable both for the environment and for the creation of wealth and revenue. Wunder’s definition of PES may be elaborated in this way: PES are (i) a voluntary transaction in order (ii) to preserve or enhance at least one well-defined environmental service, between (iii) at least one provider, (iv) who clearly cannot be subject to the polluter pays principle⁴, (v) and at least one buyer, (vi) who offers a payment over a limited period (vii) as a means for investment in locally productive and sustainable activities.

Conclusion

We call for research to expand the application method for PES, which should explicitly include agricultural issues in the perspective of forest conservation. This should be made a priority in order to illustrate the urgent and compelling need to extend policies and measures beyond the threatened sites. Let us consider an example that is at the heart of our reasoning. Deforestation is often, and justifiably, presented as resulting from differential rents to the benefit of agriculture: agricultural rent (income from the cultivation of forest land) is higher than forest rent (income from the sustainable exploitation of forest resources), which constitutes an often irresistible incentive for deforestation (see Angelsen [25] for a good review of this issue). PES is then a way to counter this phenomenon by increasing the forest rent by the internalization of environmental externalities. However, the productive activity is then generally reduced and the forest rent is guaranteed by external financial payments, which is equivalent to providing a crutch for local activity. We would like to consider the possibility of reversing this logic to develop a virtuous cycle, where the agricultural rent would be increased but not in the forest area, and under conditions that the forest must be maintained. Ideally, the same economic agents would then be encouraged (and financially supported) to develop new agricultural techniques that are generally more profitable (e.g. through higher yields) while maintaining forested land. The question is then to develop new types of contracts suited to this purpose, to identify or invent the relevant farming systems, and to give us the time and means to attain this goal. This aim is indeed ambitious, but seems inescapable; hence the need to avoid the dilution of efforts which can only achieve less sustainable solutions.

For this it is possible to draw inspiration from two attempts to expand the PES concept. The first concerns the Vittel source in France, where users of the resource, who in this case were dairy producers, have benefited from financial aid to change their practices in order to sustain the beneficial effects on the environment without drastically reducing the local activity, and with the expectation that these payments will eventually stop [17]. The second concerns a forest conservation project in Madagascar, where the establishment of a system has been proposed based on “a specific currency” which allows payments given to households that abandon hunting activities to be reinvested in effective technical solutions for food production [29].

In both examples, we notice that the users of a resource are encouraged to pursue a productive activity while reducing their impact on the environment and its services. It should inspire current and future thinking on the development of virtuous PES that are able to jointly address environmental and development issues.

⁴ Let us specify what is meant by “Who clearly cannot be subject to the polluter-pays principle”: it can be either by lack of solvency, or because buyers want to incentivize efforts to *generate* ecosystem services beyond the mere conservation of what already exists (situation where PES seek to internalize positive externalities and where resource users cannot be assimilated with “polluters”).

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