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Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America

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Summary. — This paper examines the main ways in which Payments for Environmental Services (PES) might affect poverty. PES may reduce poverty mainly by making payments to poor natural resource managers in upper watersheds. The extent of the impact depends on how many PES participants are in fact poor, on the poor's ability to participate, and on the amounts paid. Although PES programs are not designed for poverty reduction, there can be important synergies when program design is well thought out and local conditions are favorable. Possible adverse effects can occur where property rights are insecure or if PES programs encourage less labor-intensive practices.

Key words — Payments for environmental services, poverty, conservation, market-based mechanisms

1. INTRODUCTION

Recent years have seen considerable interest in using Payments for Environmental Services (PES) to finance conservation (Landell-Mills & Porras, 2002; Pagiola, Landell-Mills, & Bishop, 2002; Pagiola & Platais, forthcoming). PES programs seek to capture part of the benefits derived from environmental services (such as clean water) and channel them to natural resource managers who generate these services, thus increasing their incentive to conserve them. Latin America has been particularly receptive to this approach. PES programs are in operation in Costa Rica, Colombia, Ecuador, Mexico and elsewhere, and others are under preparation or study in several countries.

A critical dimension of these systems concerns their impact on the poor. Many potential links have been hypothesized, and some are supported by anecdotal evidence, but few have yet been researched and documented. This paper examines the possible linkages between PES programs and poverty, drawing on the experience of the main on-going and planned PES programs in Latin America.

This paper begins by reviewing the PES approach and some of the efforts that have been made to date to implement it. It then discusses the main ways in which PES approaches are thought likely to affect poverty. The main factors involved are then discussed in detail, concluding with some initial thoughts on how PES programs might be designed so as to maximize their poverty reduction impact and avert potential negative impacts. It is in many cases too early to arrive at conclusive results on the likely poverty impacts of PES programs.

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The paper draws on the few studies carried out to date (notably by the World Bank and the International Institute for Environment and Development, IIED) to identify clearly several concrete research hypotheses. As will be seen, the specific characteristics of both the PES programs and the areas they are implemented in are likely to play critical roles in how the relationship between PES and poverty plays out.

2. PAYMENTS FOR ENVIRONMENTAL SERVICES

Land users can provide a variety of environmental services ranging from the regulation of hydrological flows to biodiversity conservation and carbon sequestration. Nevertheless, land uses that provide such services, such as forests, are being lost at rapid rates. An average of almost 15 million hectares of forest were lost every year during the 1990s, mostly in the tropics (FAO, 2001). An important reason for this loss is that land users typically receive no compensation for the environmental services they generate for others. As a result, they have little incentive to provide these services.

Recognition of this problem and of the failure of past approaches to deal with it has led to efforts to develop systems in which land users are paid for the environmental services they generate, thus aligning their incentives with those of society as a whole (Landell-Mills & Porras, 2002; Pagiola, Landell-Mills *et al.*, 2002). The central principles of the PES approach are that those who provide environmental services should be compensated for doing so and that those who receive the services should pay for their provision (Pagiola & Platais, forthcoming). [1] This approach has the further advantage of providing additional income sources for poor land users, helping to improve their livelihoods. Several countries are already experimenting with such systems, many with World Bank assistance.

The logic of PES is simple. Land users often receive few benefits from environmentally-benign land uses such as forest conservation—often, less than the benefits they would receive from alternative land uses, such as conversion to pasture. It thus tends to be in their individual interest to convert forests rather than conserving them. But deforestation can impose costs on downstream populations, who no longer receive the benefits of ecological services such as water filtration. A payment by the downstream beneficiaries can help make conservation the more attractive option for land users, thus inducing them to adopt it. The payment must obviously be more than the additional benefit to land users of the alternative land use (or they would not change their behavior) and less than the value of the benefit to downstream populations (or they would not be willing to pay for it).

PES programs promise to be more efficient than traditional command-and-control approaches (Pagiola, Landell-Mills *et al.*, 2002; Pagiola & Platais, forthcoming). [2] The reason for this advantage is simple: the costs of achieving any given environmental objective are rarely constant across all situations. Market-based instruments such as PES take advantage of this difference, by concentrating efforts where costs are lower. Likewise, the benefits of conservation can differ substantially from case to case. Market-based instruments seek out and concentrate on the higher-benefit cases. Moreover, by basing payments to service providers on payments from service users, PES programs have a built-in feedback mechanism: service users have a strong incentive to ensure that their money is spent effectively, and to request changes in the program if it is not. [3]

Two important aspects of PES are particularly noteworthy from the perspective of its potential impact on poverty. First, because services are the result of particular kinds of land use, payments made under PES programs are payments to land users. This makes the distribution and ownership patterns of land critical for the poverty impact of PES programs. Second, participation in PES programs is voluntary, and participants receive payments for doing so. This creates a *prima facie* presumption that participants are at least no worse off than they would be without the PES program. Were this not the case, they could simply decline to participate. Many have concluded from this that the impact can only be positive. As we will see below, the situation is a little more complicated.

There has been considerable interest in the use of PES throughout the world. Interest has been especially high in Central and South America, where the effects of Hurricane Mitch in 1998 underscored the dependence of the population, especially poor people, on the environmental services and the protection provided by natural ecosystems.

Costa Rica has the most elaborate PES program: the *Pago por Servicios Ambientales*

(PSA) program, operated by the National Fund for Forest Financing (*Fondo Nacional de Financiamiento Forestal*, FONAFIFO) (FONAFIFO, 2000; Pagiola, 2002). Under the 1997 Forestry Law, land users can receive payments for specified land uses, including new plantations, sustainable logging, and conservation of natural forests. Costa Rica has also seen numerous other PES initiatives, including the use of 'environmentally adjusted water tariffs' by the town of Heredia to finance watershed conservation (Castro, 2001; Cordero, 2003) and a bilateral agreement between La Manguera SA, a private hydroelectric power producer, and the Monteverde Conservation League, the nongovernmental organization (NGO) that owns the watershed from which the La Esperanza hydroelectric plant draws its water (Rojas & Aylward, 2002).

Other countries also have a range of PES initiatives. In 2003, Mexico created the Payment for Hydrological Environmental Services program (*Pago por Servicios Ambientales Hidrológicos*, PSAH), which pays for the conservation of forests in hydrologically critical watersheds using revenue from water charges (Bulas, 2004). In Colombia, water user groups in the Cauca Valley pay for conservation activities in their watersheds (Echevarría, 2002b). In Ecuador, the city of Quito has created a water fund (FONAG) with contributions from the water utility and the electric power company to pay for conservation in the protected areas from which it draws its water (Echevarría, 2002a). Similarly, the water and electric utility serving the city of Cuenca, ETAPA, uses part of its revenue to pay for watershed conservation (Echavarría, Vogel, Albán, & Meneses, 2002; Lloret Zamora, 2002). Many countries have also seen a wide range of small-scale local initiatives. In El Salvador, for example, the municipality of Tacuba pays upstream farmers to safeguard the spring from which it draws potable water, and that of San Francisco de Menéndez provides funding for the El Imposible National Park to protect its water source (Herrador, Dimas, & Méndez, 2002). The World Bank is working with several countries to develop PES programs, through loans, technical assistance, and capacity building (Pagiola & Platais, forthcoming). [4]

Water services are one of the main environmental services that PES programs often seek to provide. Others include biodiversity conservation, carbon sequestration, and the preservation of scenic beauty. Costa Rica's Forest Law No. 7575, which established the country's PES program, cites all four of these services, for example (FONAFIFO, 2000). As the overview above demonstrates, however, most PES programs in Latin America have focused on water services. This review, therefore, will likewise reflect primarily the experience with water service-related PES programs.

3. PES AND POVERTY

The PES approach was conceptualized and undertaken as a mechanism to improve the efficiency of natural resource management, and not as a mechanism for poverty reduction. Many proponents have argued however, that PES can also have positive impacts on poverty (Landell-Mills & Porras, 2002; Pagiola, Landell-Mills *et al.*, 2002).

In thinking about the potential impact of PES on poverty, two aspects need to be distinguished. The first is whether PES can help reduce poverty among program participants and, indirectly, nonparticipants in areas where PES programs are implemented. The second is the broader question of whether PES can help reduce overall poverty in a country. We focus here on the first question. The answer to the second will depend partly on the answer to the first and partly on the extent to which PES approaches are applied, which would affect both the number of participants and the magnitude of potential indirect effects through labor, food crop, and other markets. This broader issue is outside the scope of this paper.

In most cases, the main mechanism by which PES is assumed to contribute to poverty reduction is through the payments themselves, which are thought to go mainly to poor land users. This assumption can be seen most explicitly in the very name of the RUPES program in Asia: Rewarding the Upland Poor for Ecosystem Services (REECS, 2003). This is the main mechanism envisaged for the beneficial poverty impacts expected in the PES projects supported by the World Bank. In some cases, this positive impact is implicitly assumed to occur automatically; in others, activities under the PES program are specifically targeted to poorer land users. Thus, the Western Altiplano Natural Resources Management Project in Guatemala targets as beneficiaries the poor rural farm households and emphasizes the impact of market-based natural resource management strategy on the livelihood of the poor (World

Bank, 2003). Similarly, the proposed National Environmental Management Project in El Salvador explicitly links poverty reduction goals with market-based natural resource management, also targeting small farmers to benefit from this strategy.

The impact of PES programs is not necessarily positive, however. Two main concerns have been expressed. Landell-Mills and Porras (2002) warn that by increasing the value of currently marginal land, PES programs could increase the incentive for powerful groups to take control of it. Thus PES might exacerbate problems in situations where tenure is insecure. A different concern is voiced by Kerr (2002b). He cautions that the livelihoods of the landless poor—the women and herders who are nonparticipants in PES programs and who often depend on gathering nontimber products from forests—may be harmed if PES conditions limit their access to forested land.

These considerations lead to several questions that need to be addressed to further the understanding of the poverty dimensions of PES. These are partly logical, and partly empirical. They are as follows:

— Who are the actual and potential participants in PES, and how many of them are poor?
— What are the obstacles to the poor's participation in PES?
— What are the impacts of PES on participants?

The following sections examine these issues in turn.

4. WHO ARE THE POTENTIAL PARTICIPANTS IN PES PROGRAMS?

Any PES program involves two main groups of participants: the downstream service users who pay for receiving services, and the upstream service providers who get paid. In addition, other groups may be affected indirectly.

(a) *Upstream service providers*

Payments made under a PES program are payments for land use, and thus payments to land users. An initial, critical question thus concerns the identity of land users in upper watersheds. The presumption has been that these land users tend to be among the poorer members of society. Indeed, most of the poor tend to be found in rural areas, and particularly in marginal areas such as the steep slopes of the upper watersheds (CGIAR, 1997; Heath & Binswanger, 1996).

In Guatemala, Nelson and Chomitz (2002) find that watersheds that are most hydrologically sensitive (defined as watersheds in which the interface between agriculture and forest is found on slopes of 8% or more and represents a significant proportion of the watershed's area) also tend to have the highest concentration of poverty. The 77 most sensitive watersheds had a poverty rate of 70% and included a third of the country's poor. They find a similar result in Honduras, although the relationship there is less pronounced. Studies of the biological corridors targeted for GEF-financed payments under the Ecomarkets program—some of which overlap with watersheds targeted by water service payments—found them to be among the poorest areas in Costa Rica (World Bank, 2000).

These findings are tantalizing, but not conclusive. For one, they do not take into account the extent to which watersheds provide services. Some hydrologically sensitive watersheds may have very few downstream water users, and so little potential for being included in a PES program. Moreover, Nelson and Chomitz's definition of "hydrologically sensitive" focuses on watersheds in which deforestation is actively occurring. But the role of PES is not limited to avoiding deforestation so as to avoid further loss of ecosystem services. It may also include restoration of ecosystem services in watersheds where they have already been lost. Indeed, these longer-settled watersheds may be more important from a water service perspective because of their greater concentration of population and other water users. These watersheds, however, may have much lower concentrations of poor inhabitants. Thus in Costa Rica's densely populated Cordillera Volcanica Central area, many landowners are relatively well-off urban dwellers. As a result, a large proportion of participants in Costa Rica's PSA program in this area were found to be urban dwellers with substantial nonagricultural income (Miranda, Porras, & Moreno, 2003; Ortiz Malavasi, Sage Mora, & Borge Carvajal, 2003).

Second, even if poverty rates in target watersheds are high, it does not follow that payments will be received solely, or even principally, by the poor. Even in watersheds with high poverty rates, some land users are likely to be better off, and there can be substantial variability in the level of poverty among the poor.

In some cases, targeting of PES programs may go beyond targeting individual watersheds to targeting specific areas within those watershed. Within a watershed, some lands may be particularly important from the perspective of generating the desired environmental services (for example, riparian lands often play an important role in preserving water quality, and steeper slopes in avoiding sedimentation). Which area is critical depends on the specific service being sought, and so may vary from case to case. If payments are targeted to such areas, poorer households will receive payments only to the extent that they have land within them. To date, however few PES programs have been targeted to this degree. Costa Rica's PSA program, for example, only targets individual watersheds to a limited extent, and does not target specific areas within those watersheds (Pagiola, 2002). Most PES programs, including Costa Rica's PSA program, are evolving toward more targeted approaches, so this issue will become more salient. In Mexico, the pilot PES program in the Coatepec watershed targets specific areas within the watershed (Muñoz *et al.*, 2004).

There is a clear need, therefore, to have a better sense of who the potential participants are. As PES programs are tied to areas with substantial downstream benefits, they cannot be targeted to areas of high poverty. The composition and structure of the population in the upper watershed will matter both to the success of the PES program itself and for its impact on poverty levels.

(b) *Downstream service users*

In general, downstream service users are likely to be better off than upstream service providers. Urban residents with access to services such as electricity and piped water are almost by definition better off than the vast majority of rural residents. Likewise, farmers with irrigated land tend to be better off than farmers in upper watersheds, being able to grow higher-value crops and having more reliable output.[5] But there may well be important subgroups of beneficiaries of environmental services that are not well off. One group stands out in particular: the poor may be disproportionately represented among those at risk from flooding.

PES programs aim to have these beneficiaries pay for the services they receive. As such, PES programs appear to impose an additional cost on users, and so have the potential of imposing a hardship on them. While this is true, the alternative is generally that services go un-protected and hence are lost—a result likely to have much higher adverse consequences than the need to pay an additional fee. Water vendors, for example, often charge prices that are 10 times or more those charged by public utilities (Pagiola, Martin-Hurtado, Shyamsundar, Mani, & Silva, 2002). It is also worth noting that it is very hard to get floodplain residents to pay for flood risk reduction services (Pagiola & Platais, forthcoming), so the fact that they are mostly poor does not matter in practical terms.

The extent to which downstream service users can be said to participate voluntarily in PES programs requires some further discussion. In most cases, payments are not negotiated with the end-users of the services but with intermediaries, such as hydroelectric power producers, water utility companies, or irrigation water user associations. In many cases, these intermediaries absorb the cost of PES into their budgets, and justify it on the basis of the avoided costs they will face, in terms of reduced water treatment costs, for example. Thus the electricity and water companies that finance the FONAG water fund in Quito do so by allocating part of current revenues, not by levying additional fees on consumers (Echevarría, 2002a). In other cases, explicit additional fees have been levied. In Colombia's Cauca Valley water user associations have assessed themselves additional charges and used the revenue to finance conservation activities in their watersheds (Echevarría, 2002b). In Costa Rica, the town of Heredia has added an "environmentally adjusted water tariff" to its water bills (Cordero, 2003). As with all such fees, efforts can be made to reduce possible adverse impacts on the poor by mechanisms such as increasing block pricing.

(c) *Other groups*

Beyond participating land users, many other groups may find themselves affected by PES programs. These include people who are employed in agriculture or who collect a variety of products from forests.

As with any program that affects land use, the employment impacts depend on the difference in labor demand between current land use practices and those promoted under the PES program. In many cases, this impact might be negative. Maintaining natural forest cover, for example, may require less labor than

converting that land to agricultural use. If PES-promoted land uses reduce demand for labor, those who depend on such employment for their livelihood could be adversely affected. Costa Rica's PSA program, for example, mostly involves conserving existing forest (FONAFIFO, 2000; Pagiola, 2002), a much less labor-intensive land use than crop production. [6] The extent of this impact will depend both on the change in local labor demand and on the existence of other sources of employment. But note that it is not necessarily true that PES-promoted land uses reduce labor demand. The silvopastoral practices promoted under the World Bank's Regional Integrated Silvopastoral Ecosystem Management Project (RISEMP), for example, are expected to increase farm labor use in the project areas by 8–13% in Colombia, 34% in Costa Rica, and as much as 100% in Nicaragua (World Bank, 2002).

The impact of PES programs on the collection of nontimber products depends on the extent to which they affect availability and access to such products. Availability will depend on the specific change in land use. The silvopastoral practices promoted under the RISEMP project are likely to result in a substantial increase in availability of fuelwood, fodder, fruit, and other forest products, and forest conservation under Costa Rica's PSA program preserves forest products which would have been lost had land been cleared for agriculture. Whether access is affected depends on the local context. To the extent that PES programs are implemented on private land, any nontimber products may not in any case have been accessible to the community. One instance in which such effects are of concern is when PES involves the land of communities or cooperatives, such as Mexico's *ejidos*. Use of common land within the *ejido* for pasture and collection of fuelwood and other products is particularly important for the poorer members (Alix, de Janvry, & Sadoulet, 2003). Enrollment of that land in a PES program might limit or curtail such use, but the resulting payments may not necessarily be distributed in the same proportion as the lost benefits.

More broadly, it is conceivable that there be other indirect effects. If PES programs result in a switch from agriculture to forestry, the resulting reduction in agricultural production might cause food prices to increase. Such an effect appears quite unlikely, however, as the areas enrolled in PES programs are relatively small except in Costa Rica's PSA program. [7] Moreover, the most productive agricultural land is unlikely to be enrolled, as its opportunity cost is too high. The production impact of PES programs, therefore, is likely to be proportionately smaller than the area involved. In contrast, where PES programs encourage more intensive land uses, such as in the RISEMP project, the pressure on food prices is likely to be downward, although again the impact is likely to be limited by the small area involved.

5. WHAT ARE THE OBSTACLES TO PARTICIPATION IN PES?

The potential impacts of PES programs will only be realized by those who participate in the program. Most such programs are too recent for an assessment of participation decisions. But, insights into the factors that are likely to play an important role can be gleaned from the substantial literature that examines the determinants of participation in reforestation, land conservation, and other rural programs. [8] The factors considered here are those which seem most likely to differ depending on whether households are poor or not.

Figure 1 summarizes some of the main factors that might affect a household's decision to participate in a PES program. These are grouped into three groups: factors that affect eligibility to participate, which depend on the program's targeting as discussed above; factors that affect their desire to participate; and factors that affect their ability to participate. The three groups form a logical sequence (ability to participate only becomes an issue for households that wish to do so, and that in turn is only relevant for households that are eligible to participate), but within each group the order of the factors is arbitrary. At every step, a "no" answer would mean that the household would either not wish to participate or find it difficult to do so. In each case, household characteristics and program characteristics interact to determine whether participation is desirable or possible for a given household. As discussed later, this gives PES program designers some latitude to tailor details so as to maximize the ability of the poor to participate.

(a) *Profitability of PES practices*

The expectation that participation will be expected to be profitable (in the sense of generat-

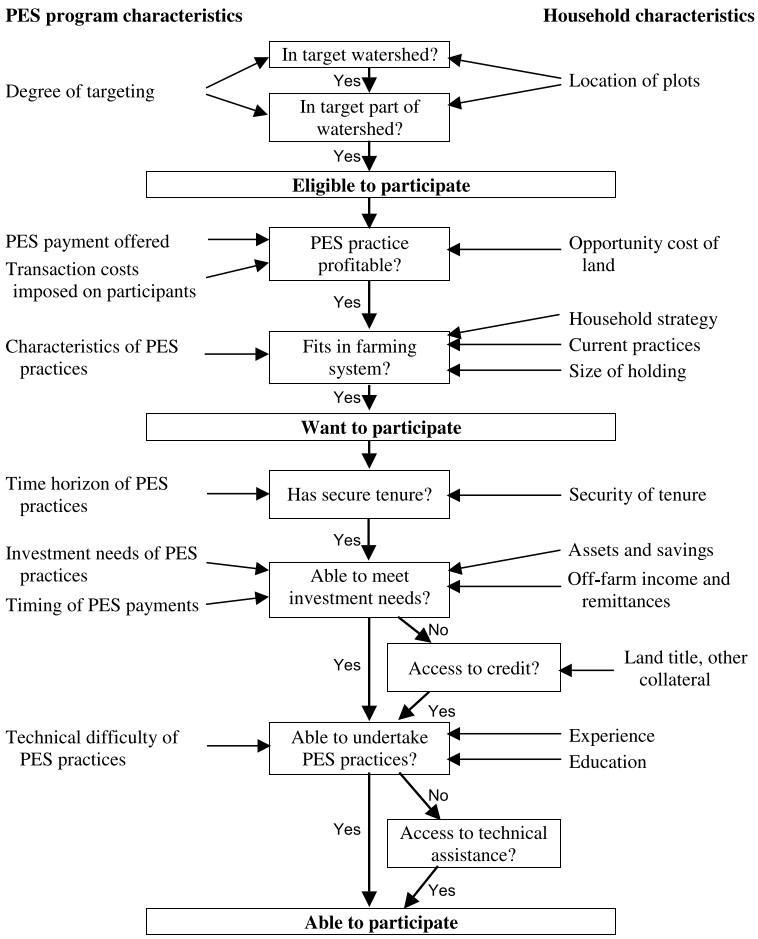

Figure 1. *Factors that affect household participation in payments for environmental services programs.*

ing greater benefits than the next-best land use) is an essential element of participation decisions. As PES payments per hectare are the same for all participating landowners adopting a given practice, [9] the critical factors that might differentially affect the poor are on the cost side. (Transaction costs are discussed separately below.)

Landowners with high-productivity land are less likely to participate in a PES program, as their opportunity cost is much higher. Payments will thus tend to go primarily to owners of low-productivity land. This may seem to make the poor more likely to receive payments, but again it is important not to succumb to facile generalizations. In areas such as Costa Rica's Central Cordillera, substantial areas of marginal lands are owned by well-off urban dwellers who use them as second or vacation homes (Miranda *et al.*, 2003). A substantial literature demonstrates that there often exists an inverse relationship between farm size and productivity (Carter, 1984; Tomich, Kilby, & Johnston, 1995). Thus, larger farms may well find participation in PES relatively more attractive.

The desirability of adopting a PES-promoted land use depends not only on its per hectare profitability, but also on whether it fits into the overall farming system. Larger holdings may have more flexibility in adopting PES-promoted land uses than smaller, subsistence-oriented holdings (Nowak, 1987). The evidence of this effect from other types of projects is mixed. Studies of the factors affecting adoption of agroforestry practices that included a farm

size variable found it to be positively correlated with adoption in 50% of cases, but negatively correlated in 28% of cases (Pattanayak *et al.*, 2003).

(b) *Ability to participate in PES programs*

A household may want to participate in a PES program and yet be unable to do so, for a variety of reasons (Figure 1). Given the role of land, tenure issues are often critical. The cost of investments needed to satisfy the requirements of the program may be an obstacle, as may be the technical difficulty of the practices themselves.

(i) *Tenure issues*

As PES payments are payments to particular land uses, it may not be possible to undertake a PES program if tenure is insecure. This will often be the case in frontier areas with active deforestation. The importance of secure tenure is likely to be particularly important in cases where PES programs require long-term investments, such as reforestation or some of the silvopastoral practices promoted by the RISEMP project.

As noted above, some have argued that by making land more valuable, PES could result in politically powerful groups muscling out poorer land users who lack secure tenure (Landell-Mills & Porras, 2002). There is anecdotal evidence that this has happened in Colombia's Cauca Valley, for example. Conversely, Costa Rica's PSA program has been said to improve tenure security by preventing land kept under forest being considered "idle" and providing protection against land invasions (Miranda *et al.*, 2003). Clearly, careful consultations with stakeholders are necessary before initiating a PES programs in areas where tenure situation is unclear.

Titling, although often treated synonymously with tenure security, is a separate issue: Lack of titles should not automatically be equated with tenure insecurity (Pagiola, 1999). Generally, titles may not be necessary as long as tenure is secure. Titles did emerge as an issue in Costa Rica's PSA program, however, as national law forbade using public funds to pay landowners who lacked formal title. This not only prevented many of the poor from participating—as they were more likely to lack titles than better-off farmers—but it also impeded the effective functioning of the program (Pagiola, 2002). When FONAFIFO is administering private funds, however, the legal restrictions do not apply. The solution, therefore, was to create a parallel contract, similar in all respects to the PSA contract, but financed entirely with funds provided by the service buyers. More recently, the law was changed to allow participation of landowners that lack titles.

The situation of tenants is particularly problematic: for rented land to participate in a PES program, there would have to be some agreement between landlord and tenant over the distribution of the resulting costs and benefits. The availability of PES payments might also affect the landlord's incentive to continue renting out the land. To date, the Nicaragua component of the RISEMP project is the only PES program implemented in an area where land rental is common. Experience there will provide the first empirical evidence on this issue.

Another particular situation arises in the case of indigenous groups and other groups that operate land collectively (such as Mexico's *ejidos* or some agrarian reform cooperatives in El Salvador). The decision to participate must then be made collectively, and implemented collectively. Whether the resulting costs and benefits are distributed equitably within the group becomes a major issue, as noted above (Alix *et al.*, 2003).

(ii) *Investment costs*

Participation in a PES program requires adoption of the land uses promoted by the program. In some cases, this may simply involve retaining existing forest. In others, however, participants may be required to undertake investments such as reforestation. Even if this option is in principle profitable, poor land users may be unable to adopt it if they cannot finance the necessary investment. For example, farmers with a 20-ha farm in Nicaragua wishing to undertake a variety of silvopastoral practices to receive payments under the RISEMP program might have to invest, in the first year, about US$500 (equivalent to about 70% of net income under current practices), in addition to forgoing part of their normal income in that year. [10] These are heavy costs for poor households. Savings, remittances, or off-farm income may help some households undertake the necessary investments, but poorer households will tend to have fewer such alternatives, and need them more for subsistence requirements.

The solution to overcome this obstacle is naturally access to credit. But, rural financial mar-

kets in developing countries are often in considerable disarray as a result of years of ill-advised government interventions, leaving state-owned financial institutions too weak to provide credit and making commercial banks, where they exist at all, reluctant to participate. As a result, rural credit is effectively unavailable in many areas. Even when it is available, it might require collateral that poor farmers do not have or are not prepared to risk. Addressing these problems is outside the scope of PES programs.

One approach that is within the scope of PES programs, however, is to adapt the payment schedule to take investment constraints into consideration. In Costa Rica's PSA program, payments under the reforestation contract are front-loaded, with a large part of the payment in the early years of the contract, and much smaller payments in later years. [11] In contrast, payments under the forest protection contract, which does not require any initial investment, are spread in equal installments over the length of the contract. In the RISEMP program, an initial payment is made for the services that current land uses already provide (Pagiola *et al.*, 2004); this payment is received prior to having to undertake any new practices, and thus helps finance their implementation. Front-loading payments can induce other problems, however, and should be used with care. In particular, it should not be seen as an alternative to a long-term payment stream, or the incentives that are central to PES will be lost.

(iii) *Technical constraints*

If adopting PES-promoted practices requires substantial technical capacity, the poor may find it more difficult to participate as they may lack education or access to technical assistance. Some PES programs, such as RISEMP, provide technical assistance to PES recipients, but most do not. Few PES programs, however require the adoption of land uses as complex as silvopastoral practices can be. Indeed, in many cases, PES payments may be for doing nothing—for maintaining natural forest, as in Costa Rica's PSA program.

(c) *Transaction costs*

One of the most obvious and significant potential hindrances to the poor's participation in PES is transaction costs. Working with many small, dispersed farmers imposes high transaction costs.

Two sets of transaction costs need to be considered: the costs to the PES program of contracting with each participant, and the costs imposed on participants themselves. Many of the costs faced by PES programs to contract with participants are per contract rather than per unit area. The transaction costs involved in arranging and signing a contract, for example, are largely independent of farm size. As a result, there is a definite incentive for PES programs to contract primarily with larger farms. Transaction costs imposed on participants also tend to be more burdensome on smaller farms. Costa Rica's PSA program, for example, requires all applicants to submit a management plan prepared by a certified forest engineer. As the cost of preparing such plans is also largely independent of farm size, the cost per hectare is much higher on smaller farms, tending to discourage them from participating.

Two approaches are possible to reduce the impact of transaction costs on the poor's ability to participate in PES programs. First, programs should be designed to keep transaction costs as low as possible. This is not only desirable in itself but will also reduce the incentive to focus on larger farms. Particular efforts are needed to avoid loading participants with high transaction costs. Costa Rica's PSA program, for example, requires applicants to fulfill 11 separate requirements, many of which—such as providing proof of payment of local taxes and that they do not owe anything to national health system—have nothing to do with their ability to provide environmental services (Miranda *et al.*, 2003). Paring down these requirements would reduce costs for both participants and the program without affecting its effectiveness. Second, mechanisms need to be created to overcome the obstacles that transaction costs can create to participation by the poor. In Costa Rica, a system of collective contracting ("*contratos globales*") has been developed through which groups of small farmers can join the PES program collectively rather than individually, thus spreading transaction costs over a large group (FONAFIFO, 2000).

6. WHAT ARE THE IMPACTS OF PES ON THE PARTICIPANTS?

The most obvious impact of a PES program on participants is through the additional income it provides. In addition, there might also be a range of nonincome impacts, such as social

benefits. There may also be indirect and second-order effects, as discussed earlier (see Table 1).

(a) *Income impacts*

As long as participation in PES programs is voluntary, there is a *prima facie* assumption that it will make participants better off. In particular, payments for environmental services could be an important addition to incomes of the poor. This will not happen automatically, however.

The PES payment itself is not a good measure of the financial benefit to participants. The appropriate measure is the payment net of the opportunity cost of adopting the PES-promoted land use. These can be quite different. For a 20-ha farm in Nicaragua participating in the RISEMP project, for example, payments are expected to range between US$220 and US$280. The benefit received by this farm, net of opportunity costs, however, will be as low as –US$120 in the first year (when significant investments have to be made) to US$190 in the fourth year; these represent a reduction in net farm income of about 15% in the first year, and an increase in net farm income of about 24% in the fourth year. [12] This obviously complicates the task of assessing the impact, as the payment is more easily observable than the opportunity cost.

An important factor in the extent to which PES can have affect poverty levels is the payment amount. In general, this amount must lie between the minimum willingness to accept (WTA) of upstream land users to change their land use and the maximum willingness to pay (WTP) of the downstream service receivers for the service they want. In practice, payment levels have tended to be set close to the minimum WTA. The RISEMP project, for example,

Table 1. *Potential impacts of PES programs on poverty*[a]

Providers	Potential impact	Extent of impact depends on	Comments
Participants			
Land owners with secure tenure	Income from PES (+)	• Amount of payment (+) • Opportunity cost (−)	
Land owners with insecure tenure	Income from PES (+)	• Amount of payment (+) • Opportunity cost (−) • Ability to participate (+)	Efforts by politically powerful groups to seize more land? (−)
Tenants	Income from PES (+)	• Amount of payment (+) • Opportunity cost (−) • Division of benefits with landlord	Change in landlord's willingness to rent? (−)
Downstream service users	Pay for PES (−)	• Amount of payment (−) • Consequences of lack of PES program (+)	
	Receive services (+)		
Nonparticipants affected by PES			
Farm workers	Change in labor demand (+/−)	• Relative labor needs for PES-promoted practices compared to current practices (+/−) • Other employment opportunities (+/−)	
People dependent on NTFP collection	Change in availability and access to nontimber products (+/−)	• Nature of current and PES-promoted practices (+/−) • Local context	

[a] Hypothesized impacts: (+) positive impact: poverty reduction, or increased welfare of the poor; (−) negative impact: poverty increase, or reduced welfare of the poor; (+/−) uncertain impact: depends on case-specific circumstances.

explicitly set the payment level at the minimum level required to "tip the balance" between current land use practices and the silvopastoral practices it supports (Pagiola *et al.*, 2004; World Bank, 2002). Likewise, Mexico's PSAH program has explicitly set payments based on the average opportunity cost of land (Jaramillo, 2003; Muñoz *et al.*, 2004). Costa Rica's PSA inherited its payment levels from earlier forest subsidy programs (though they have since been regularly adjusted for inflation) which were also based on opportunity cost of land in areas suitable for plantation (Pagiola, 2002). [13] Heredia also set its payments to landowners at the opportunity cost of land, while charging urban water users only a small fraction of their willingness to pay, as estimated in a contingent valuation survey (Castro, 2001). Upstream land users tend to be small and dispersed, and often ignorant of the downstream effects of their actions. The only information they know better than anyone else is their own opportunity cost of changing land use, but it is usually relatively simple to estimate this opportunity cost, at least on average. In contrast, it is much more difficult to estimate the maximum WTP of downstream users. [14] This places upstream service providers in a weak bargaining position relative to downstream service users, making it more likely that payment levels will be set near the minimum of their possible range.

The willingness of upstream land users to participate in a PES program provides an important indication of whether they perceive that it will improve their livelihoods. Thus, Costa Rica's PSA program has proven very popular with landowners, with requests to participate far outstripping available financing. By mid-2000, over 200,000 ha of forest had been incorporated into the program, and FONAFIFO had pending applications to participate covering an additional 800,000 ha, which it has been unable to fulfill due to lack of funding (FONAFIFO, 2000).

There is at present little empirical evidence on the extent to which income from PES increases household income among participants. In the Pimampiro watershed in Ecuador, payments under the local PES program were found to average about US$21 per month per household (Echavarría *et al.*, 2002), but as noted above, this is not a good measure of the benefits received. In Costa Rica, a survey of PSA program participants found that PES payments accounted for less than 10% of family income for almost three quarters of respondents (Ortiz Malavasi *et al.*, 2003). [15] A smaller sample survey in the Virilla watershed found that PES payments averaged about 16% of family income (Miranda *et al.*, 2003). [16]

An important aspect of the benefits provided by a PES program is that the income received by participating households is likely to be much more stable than the income they receive from other sources. Unlike crop prices, payments for environmental services do not vary from year to year, although they are subject to being periodically re-negotiated (every five years, in Costa Rica's PSA program). This stability might have important welfare benefits for many poor households. This stability, of course, is contingent on the financial sustainability of the program, which in turn is dependent on service recipients being satisfied that they are receiving value for their payments. It is also dependent on the promptness of payments; the efficacy of the administrative arrangements thus also plays an important role.

(b) *Nonincome impacts*

There are indications that the establishment of PES programs can also have social and cultural impacts that can affect the lives of the poor. Effective implementation of PES programs in upper watersheds often requires strengthening or creating institutions there—to negotiate acceptable agreements, and to reduce the high transaction costs of dealing with many small, dispersed landowners. This process can draw stakeholders together in a participatory environment and provide a forum for community members to forge relationships, thus contributing to building social capital. This is exemplified by the experience of Sukhomajri, in India, where the establishment of a system of payments for the services that villagers provide enhanced cooperation within the community (Kerr, 2002a). Similarly, Echavarría *et al.* (2002), found that the implementation of a PES program in Pimampiro, Ecuador, helped create an institutional capacity in the Nueva America community that enabled them to influence the municipality's decision to enforce environmental regulations.

The extent to which PES might help build social capital should not be exaggerated. Similar hopes have often been expressed about other approaches, and they have not often been rewarded. Whether it will occur in the case of PES programs depends on a large number of factors, including the benefits to be received

from PES, the need for coordinating institutions, the existence of obstacles to cooperation, and the complicated dynamics of the personalities involved.

7. CONCLUSIONS AND IMPLICATIONS FOR PES DESIGN

PES programs are not a magic bullet for poverty reduction, but there can be important synergies when program design is well thought out and local conditions are favorable. Table 1 summarizes the main direct and indirect impacts that PES can be hypothesized to have on poverty. Overall, the fact that participation is voluntary creates a strong presumption that participants are better off, particularly for service providers who receive payments. If this were not the case, they could simply refuse to participate, or end their participation. The extent to which they are better off is an empirical matter, which has been little studied to date. It clearly depends substantially on the amount of the payment, and on the opportunity costs landowners must bear to take part, including the cost of forgoing alternative land uses, and any transaction costs that participation may entail.

There is a considerable literature on targeting poverty reduction programs (Alderman & Lindert, 1998; Besley & Kanbur, 1993; Bigman & Fofack, 2000). Although PES programs are not designed as poverty reduction programs, this literature provides insights into how they might perform. PES programs could be considered as targeted poverty reduction programs that use a combination of geographic targeting and self-selection. Neither of these approaches to targeting has proven as effective as hoped. Targeted poverty-reduction programs have all experienced substantial ''leakage''—benefits accruing to nonpoor participants. A recent review of targeted poverty reduction programs (Coady, Grosh, & Hoddinott, 2004) found that those which used geographic targeting achieved a median targeting performance of 1.33; that is, they transferred 33% more payments to households in the bottom income deciles than a neutral program which distributed payments equally across all income deciles. Programs based on self-selection scored much worse, with a median targeting performance of only 1.1—albeit with substantial variation: programs that used a work requirement as a self-selection mechanism had the highest median targeting performance, at 1.89. But even these mechanisms are not always effective. Barret and Clay (2003), for example, document a case in Ethiopia in which labor market imperfections led to work-based self-selection to perform very poorly. Overall, targeted poverty reduction programs as a whole had a median targeting performance of 1.25. [17] There is no reason to think PES programs, as a group, would perform better. Indeed, there are reasons to think that, on average, they would perform worse. The geographic targeting employed in a PES program, for example, cannot prioritize poverty: it must prioritize those areas that provide services. This is very restrictive in the case of water services, and to a lesser extent biodiversity conservation. It is not at all restrictive in the case of carbon sequestration services. Prioritization on the basis of services may well correlate with poverty in many cases, but it will not always do so. Likewise, the self-selection criteria are based on ability to provide services at low cost, which may also not be correlated with poverty.

That upstream land users are likely to benefit from PES does not automatically mean that there will be a substantial poverty impact. The extent to which these benefits are received by the poor is also an empirical matter, and the few studies undertaken to date have divergent results. In many upper watersheds, a large proportion of the population is likely to be poor, making a positive poverty impact likely, but this will not necessarily be true everywhere. Even within watersheds with primarily poor populations, there is no guarantee that payments will reach the poorest.

Assuming that many potential participants are poor, obstacles to their participation might limit the poverty impact of PES. Unfortunately, many aspects that might prevent or limit participation in a PES program are likely to be correlated with poverty, including insecure land tenure, lack of title, small farm holdings, and lack of access to credit. The extent to which these problems will prove to be obstacles in practice remains to be seen. Much will depend on the specific characteristics of the PES program and the conditions under which it is implemented.

In addition to the direct effects on actual participants, PES programs might also have indirect effects, including changes in the pressure on lands with insecure tenure, changes in labor demand, and changes in the availability and access to nontimber products. Although such linkages can be hypothesized,

they have not been documented to date. All could, in principle, be either positive or negative depending on the details of the local situation. The impact on local labor markets, for example, depends on whether land use practices promoted by the PES program are more or less labor intensive than those currently in use. The extent to which these indirect impacts might occur, and their exact nature, will require further study.

For downstream service buyers, the presumption that they benefit depends not only on the amount they pay but also on their receiving the services they paid for (which could take the form of either an improvement in services or the averted loss of services). In general, service buyers are less likely to be poor, on average, than upstream service providers. This means that the potential for positive poverty impacts is likely lower, and that concern over possible adverse poverty impacts is also likely lower.

A broader understanding of the potential linkages between PES and poverty leads to specific policy questions:

— How can PES programs be designed to maximize poverty reduction and minimize possible negative ones?

— What are the trade-offs between generating environmental services as efficiently as possible program and poverty reduction objectives?

Based on the review above, there appear to be several ways in which PES programs can be designed to try to minimize adverse impacts and maximize positive ones. Probably the most important step is to design the payment mechanism so as not to exclude poor land users. This requires keeping the transaction costs as low as possible, and being creative in response to problems such as insecure tenure or lack of titles. This will be easier to do when there are strong local organizations such as community groups or NGOs that can help organize participants and provide a forum for discussing solutions to problems as they arise.

It is particularly important to consider the design of the program when there is reason to think that certain groups may be adversely affected. For example, if PES-promoted land use practices are much less labor intensive, so that farm laborers might lose their jobs, it might be possible to supplement the payments to land owners with programs of conservation work on public and common lands. There are probably many areas in every watershed that need conservation interventions but do not lend themselves to direct payments, as they are common lands, such as riparian zones and roadsides. A community-organized program to improve these areas could also help generate environmental services, and so be eligible for financing under a PES program, while generating employment opportunities to replace those lost by the switch to less labor-intensive practices on private lands.

In considering how to best design a PES program so as to improve its poverty impact, it is important not to fall into the trap of considering the program as being primarily a poverty reduction tool. Making poverty reduction objectives predominate is understandably attractive, but would prove ultimately self-defeating. PES programs will not be sustainable unless service recipients are satisfied that they are receiving the services they are paying for. Subordinating the objective of generating services to that of poverty reduction risks failing to deliver on the services, and thus undermining the very basis of the program. Once service users cease paying, neither poverty reduction nor resource management objectives will be reached. Thus there are many things that PES programs cannot do, no matter how desirable they might be from a poverty reduction perspective. They *cannot*, for example, target their interventions to areas of high poverty, as these may not be the areas that generate the desired services. Within an area that generates services, they *can* try to design the payment mechanism so as to allow the poor to participate. PES programs also *cannot* choose to promote particular land use practices solely on the basis of the poor being able to undertake them. But they *can* seek to provide support to poor land users, including technical assistance or access to inputs and credit, so that they can adopt the desired land use practices.

NOTES

1. The PES approach, which compensates those who provide *positive* externalities, can be contrasted to approaches such as pollution charges, which are based on the "polluter pays" principle that those who create *negative* externalities should pay for the damage they cause. The dividing line between undertaking land use practices that generate positive externalities and not undertaking those that generate negative externalities is

hard to draw, however. In many cases, they might be said to be two sides of the same coin. From a pure efficiency perspective, it does not matter whether "polluter pays" or "provider gets" applies. The Coase theorem (Coase, 1960) states that either will result in the same result, if markets are competitive, property rights are enforceable, and there are no transaction costs. In practice, however, few if any of these conditions hold in the case of environmental services. From a purely practical perspective, a 'polluter pays' approach is very hard to enforce in the case of dispersed nonpoint sources. Environmental services do not come out of a pipe—they are the cumulative result of a wide range of land uses dispersed over a large area. Monitoring the impact of many land users scattered over a landscape would be prohibitively costly. Thus, though many countries forbid cutting trees or cultivating slopes above a certain slope, these laws have proven impossible to enforce. In developing countries, these practical considerations are complemented by equity concerns. As discussed below, the land users that produce environmental services are often worse off than the users of those services. Adopting a polluter pays approach would impose the cost of environmental protection on poorer land users rather than on better-off service beneficiaries.

2. The relative efficiency of different mechanisms to address market failures has been the subject of considerable debate in the literature, beginning with the work of Weitzman (1974). With perfect information, price-based mechanisms (of which PES is an example) and quantity-based mechanisms (such as regulations prescribing particular behavior) could be equivalent. In cases with incomplete information, which mechanism is more efficient depends on the specific circumstances. One of the cases Weitzman examined is particularly relevant to PES: when there are multiple potential producers of a benefit with different marginal costs which are not observable by the service buyer, price-based mechanisms are more efficient as they "screen out the high cost producers, encouraging them to produce less and low cost units to produce more" (p. 489). As with all instruments, however, implementation is crucial. Poorly designed PES mechanisms can be quite inefficient.

3. Much of the literature on economic instruments ignores this aspect, being based on comparisons of alternative instruments adopted on a once-and-for-all basis. Unfortunately, most PES programs are too recent to assess whether this feedback mechanism will prove effective in practice—or, more precisely, whether institutional arrangements can be designed that make it effective at acceptable transaction costs. At least one PES program has payments to providers explicitly tied to service provision: La Manguera SA, a hydropower producer in Costa Rica, pays the owners of the watershed from which it draws its water an amount that varies with the availability of water for it to generate electricity (Rojas & Aylward, 2002).

4. The World Bank is implementing three projects that use the PES approach: the *Ecomarkets Project* in Costa Rica (World Bank, 2000), the *Regional Integrated Silvopastoral Ecosystem Management Project* (RISEMP) in Colombia, Costa Rica, and Nicaragua (Pagiola *et al.*, 2004; World Bank, 2002), and the *Western Altiplano Natural Resources Management Project* in Guatemala (World Bank, 2003). Additional projects that use the approach are under preparation in the Domincan Republic, El Salvador, Venezuela, South Africa, and Mexico. It should be noted that the World Bank did not originate the PES concept. It has played an important role in launching such projects primarily because its borrowing countries have requested its assistance in doing so (Pagiola & Platais, forthcoming).

5. "Downstream" service users are even more likely to be better off in the case of biodiversity conservation and carbon sequestration services.

6. This adverse impact will only occur however, if the land enrolled in the PES program would otherwise have been used for agriculture. In fact, it appears that—at least in the Central Cordillera—a significant portion of the land enrolled in the program would likely have been under forest even without the PSA program. Thus, the employment impact was actually positive, as applicants hired additional labor to prepare the required management plans and comply with their requirements (Miranda *et al.*, 2003).

7. The over 200,000 ha enrolled in Costa Rica's PSA program represent a substantial area compared to the country's 530,000 ha of cropland. As noted in note 6 above, however, much of this area would likely have been under forest even without the PSA program.

8. The factors affecting agroforestry adoption, for example, are discussed by Franzel and Scherr (2001), Scherr (1995), and Pattanayak, Mercer, Sills, and Yang (2003).

9. In principle, payments could differ across participants who adopt the same practice, as is the case, for example, in Australia's bush tender program (Stoneham, Chaudhri, Ha, & Strappazzon, 2002). All PES programs implemented to date in Latin America, however, have uniform payments for participants who adopt the same practice in the same area. Should differentiated pay-

ments be adopted (either targeted on poverty or by using some other means, such as a bid system) the analysis would clearly need to consider these additional factors.

10. Computed from data in Gobbi (2002) and Pagiola *et al.* (2004).

11. Under the reforestation contract, 50% of the total payment is paid in the first year, 20% in the second year, 15% in the third, 10% in the fourth, and 5% in the fifth.

12. Computed from data in Gobbi (2002) and Pagiola *et al.* (2004).

13. Because the same payment is offered nation-wide, however, Costa Rica has experienced substantial excess demand for participation (FONAFIFO, 2000; Pagiola, 2002).

14. In the case of domestic water users, WTP for an additional quantity of water or for cleaner water is relatively easy to assess, but it is very difficult to convert this into a WTP for conservation of a hectare of upper watershed land (Pagiola & Platais, forthcoming). WTP is harder to assess for commercial users, as it would require access to confidential business data.

15. This survey is suspect, however, as it was conducted entirely by telephone, and so likely oversampled better-off respondents.

16. Like the payment amount, the percentage of family income received from PES is a poor measure of the benefit to participants. Here too, a net measure is needed: the percentage increase in family income as a result of participation, for example. This will always be smaller, unless the opportunity cost of participation was zero. Thus one cannot conclude that PES provides a large benefit to participants solely because they receive much of their income from it. Conversely, however, it is safe to assume that the benefits to participants are small if they only receive a small part of their total family income from PES.

17. Most programs used several targeting schemes, so these results are not conclusive about the relative efficacy of each approach (Coady *et al.*, 2004).

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