

# MPRA

Munich Personal RePEc Archive

## **Payments for Environmental Services in Costa Rica**

Stefano Pagiola  
World Bank

20. December 2006

Online at <http://mpra.ub.uni-muenchen.de/2010/>  
MPRA Paper No. 2010, posted 05. March 2007 / 17:32

## **Payments for Environmental Services in Costa Rica**

Stefano Pagiola

Environment Department, World Bank

1818 H Str NW, Washington DC 20433, USA

Tel. +1-202-458-2997, Fax +1-202-522-1735, E-Mail [spagiola@worldbank.org](mailto:spagiola@worldbank.org)

December 20, 2006

Revised version of a paper presented at the ZEF-CIFOR workshop on Payments for environmental services: Methods and design in developing and developed countries, Titisee, Germany, June 15-18, 2005

### **Abstract**

Costa Rica pioneered the use of the payments for environmental services (PES) approach in developing countries by establishing a formal, country-wide program of payments, the PSA program. The PSA program has worked hard to develop mechanisms to charge the users of environmental services for the services they receive. It has made substantial progress in charging water users, and more limited progress in charging biodiversity and carbon sequestration users. Because of the way it makes payments to service providers (using approaches largely inherited from earlier programs), however, the PSA program has considerable room for improvement in the efficiency with which it generates environmental services. With experience, many of these weaknesses are being gradually corrected as the PSA program evolves towards a much more targeted and differentiated program. An important lesson is the need to be flexible and to adapt to lessons learned and to changing circumstances.

### **Key words**

Payments for Environmental Services, Costa Rica, FONAFIFO

## Introduction

Costa Rica pioneered the use of payments for environmental services (PES) in developing countries by establishing a formal, country-wide program of payments (*Pago por Servicios Ambientales*, PSA). The PSA program has been partly credited for helping the country, once known as having one of the world's highest deforestation rates, to achieve negative net deforestation in the early 2000s. Several other countries in the region have been watching this experience closely, and many are developing similar programs.

This paper examines the experience of Costa Rica's PSA program. The program's development is described in the first part of the paper. The second part assesses its effectiveness, based on currently-available evidence.

## Costa Rica's PSA program

Beginning in 1997, Costa Rica developed an elaborate PES program (Castro *et al.*, 1997; Chomitz *et al.*, 1999; FONAFIFO, 2000, 2005). Forest Law No.7575, enacted in 1996, explicitly recognized four environmental services provided by forest ecosystems: (i) mitigation of greenhouse gas emissions; (ii) hydrological services, including provision of water for human consumption, irrigation, and energy production; (iii) biodiversity conservation; and (iv) provision of scenic beauty for recreation and ecotourism. The law provides the regulatory basis to contract landowners for the services provided by their lands, and establishes the National Fund for Forest Financing (Fondo Nacional de Financiamiento Forestal, FONAFIFO).

The PSA program did not start from a blank slate. Beginning in the 1970s, concern over dwindling timber supplies led Costa Rica to provide incentives for timber plantations, initially through tax rebates. The Forest Credit Certificate (Certificado de Abono Forestal, CAF), created in 1986, broadened participation, which had previously been limited to larger companies with significant tax liabilities. Several variants of the CAF were introduced over the years. The introduction of the Forest Protection Certificate (Certificado para la Protección del Bosque, CPB) in 1995 was particularly significant, as it supported forest conservation rather than timber production. Over 150,000 ha received financing through the old system.<sup>1</sup>

When the PSA program was created, therefore, Costa Rica already had in place a system of payments for reforestation and forest management, and the institutions to manage it. The Forest Law built on this base, with two major changes. First, it changed the justification for payments from support for the timber industry to the provision of environmental services. Second, it changed the source of financing from the government budget to an earmarked tax and payments from beneficiaries. In other respects, the PSA program was very similar to previous forest sector incentives. Until 2000, the activities financed under the PSA program closely paralleled those financed by previous instruments: timber plantations, sustainable forest management, and forest conservation. Many details of implementation, such as payment amounts and scheduling, were also carried over from earlier programs. Indeed, at first CAF certificates were used to pay PSA program participants.

---

<sup>1</sup> All figures for which no specific source is indicated were provided by FONAFIFO.

Over the years, the PSA program has evolved considerably. In 2000, the array of instruments was simplified to only two: timber plantations<sup>2</sup> and forest conservation<sup>3</sup>. An agroforestry contract was introduced in 2004, and a natural regeneration contract is being introduced. Initially completely untargeted, the PSA program is moving towards a greater degree of targeting. On the demand side, FONAFIFO has secured agreements with many water users to pay for watershed conservation, and developed streamlined instruments to facilitate this. It was an early entrant in the global carbon market.

The PSA Program is managed by FONAFIFO, a semi-autonomous agency with independent legal status. FONAFIFO's governing board is composed of three representatives of the public sector (one each from the Ministry of Environment and Energy, the Ministry of Agriculture, and the National Banking System) and two representatives from the private forest sector (appointed by the board of directors of the National Forestry Office). FONAFIFO's status gives it a relative degree of autonomy in making personnel decisions and in managing funds, but it remains subject to a variety of governmental restrictions. Its budget must be approved by the Ministry of Finance, while payment levels and priorities are set annually by executive decree. Delays in these administrative procedures have often hampered FONAFIFO's work.

### **Who pays for the PSA program?**

To date, the bulk of PSA program financing has been obtained by allocating to FONAFIFO 3.5% of the revenues from a fossil fuel sales tax (about US\$10 million a year).<sup>4</sup> From 2001 to 2006, the PSA program was supported by a loan from the World Bank and a grant from the Global Environment Facility (GEF), through the Ecomarkets Project. A new project, Mainstreaming Market Based Instruments for Environmental Management (MMBIEM), will continue supporting the program from 2007.<sup>5</sup> The PSA Program has also received a grant from German aid agency KfW through the Huetar Norte Forest Program.<sup>6</sup> Efforts have also been made to charge various service users for the services they are receiving. Ultimately, it is envisaged that all beneficiaries of environmental services would pay for the services they receive. As discussed below, this objective has been met only partially to date, though progress is being made.

---

<sup>2</sup> This contract is called a 'reforestation' contract by FONAFIFO, but is intended to produce commercial timber plantations. To avoid confusion over its intent, it will be called the 'timber plantation' contract herein. The distinction is also important because, by law, critical areas such as steep slopes and riparian zones cannot be exploited commercially. These areas, therefore, are not eligible for the 'reforestation' contract.

<sup>3</sup> The forest conservation contract is also often referred to as the 'forest protection' contract.

<sup>4</sup> Initially, the PSA program was to receive one third of fuel tax revenues, but conflicts with the Ministry of Finance meant that only a small and variable part of these funds were actually received (FONAFIFO, 2000). Subsequently, Fiscal Reform Law No.8114 of 2001 reduced FONAFIFO's share of fuel tax revenues to 3.5%, but guaranteed this amount.

<sup>5</sup> In both the Ecomarkets and the MMBIEM Projects, the GEF grants represent additional resources for the PSA program, but the Bank loans do not. As discussed below, the GEF grants can be considered payments from biodiversity users.

<sup>6</sup> The EUR10.2 million (US\$11.9 million at the 2003 exchange rate) grant was received in 2003, but was made retroactive to 1999 by reimbursing FONAFIFO for earlier contracts it had entered into in anticipation of receiving the grant. This grant is essentially a traditional aid/development grant, which is implemented through the PSA program (an existing mechanism and a trustworthy institution up-and-running in the receiving country), rather than a conscious effort to pay for environmental services (G. Mes, pers. comm., 2005).

### *Water service payments*

Forest Law No.7575 explicitly recognized the role of forests in providing hydrological services. Payments from hydropower producers and other water users were always envisaged as one of the legs on which the PSA program would stand. Law No.7575 does not obligate beneficiaries to pay for services, however. Any payments must be negotiated with potential service buyers. FONAFIFO has dedicated substantial efforts to negotiating with water users for them to pay for the water services they receive and has reached a number of agreements (Table 1).

A first agreement, with hydropower producer Energía Global, was reached in late 1997 with the assistance of FUNDECOR, an environmental NGO. Under this agreement, Energía Global contributes to payments made to participating land users in the watersheds above the company's two run-of-the-river powerplants. Similar agreements were reached a year later with other hydropower producers, including state power producer Compañía Nacional de Fuerza y Luz (CNFL).

After a slow start, the number of financing agreements with water users rose sharply, helped by the development of a streamlined process based on environmental services certificates (Certificados de Servicios Ambientales, CSA) which are standardized instruments that pay for the conservation of one hectare of forest in a specified area. Rather than negotiating each agreement on an ad hoc basis, FONAFIFO can sell interested water users the appropriate number of certificates. Recent agreements include bottlers, municipal water supply systems, irrigation water users, and hotels. The amounts paid have also risen: early agreements saw water users paying for a quarter of conservation costs (based on the notion that water services are one of four services that the law said forests provide), while recent agreements involve water users paying the entire cost of conservation, as well as covering FONAFIFO's administrative costs. Agreements with water users are typically for five years.

In 2005, Costa Rica expanded the use of water payments by revising its water tariff (which previously charged water users near-zero nominal fees<sup>7</sup>) and introducing a conservation fee earmarked for watershed conservation. Once fully implemented, this fee will generate an estimated US\$19 million annually, of which 25% (about US\$5 million) would be channeled through the PSA program, the balance being allocated to the Ministry of Environment and Energy's Water Department (50%) and to protected areas (25%) (Fallas, 2006). This new tariff was instituted by Presidential decree, and will be embedded in a new Water Law which is under consideration in the National Assembly.

The water tariff represents a shift from voluntary agreements to compulsory ones. It will result in a rapid and substantial increase in the amount of funding available for conservation. After five years of efforts, voluntary agreements generated about US\$0.5 million annually. In a similar time period, the water tariff is likely to generate ten times the amount.

The move to compulsory payments has an important downside, however. In addition to funds, payments made under voluntary agreements, also generate information—on which areas are important for water supply, and on what kinds of services need to be protected. Voluntary agreements also contain an explicit feedback loop, as water users can withhold payment if they

---

<sup>7</sup> The discussion here centers on the fees that holders of water use permits pay to the government for the right to extract or use water, not to the fees paid by consumers. Hydropower producers, for example, paid 0.001 centavos/m<sup>3</sup> under the previous tariff.

do not receive the desired services. Neither of these desirable characteristics is present in the case of compulsory payments such as those mandated by the new water tariff. As fees are uniform nationwide (for a given type of user), prioritization must depend on FONAFIFO undertaking its own studies of conservation needs—and getting them right. And as payment of fees is compulsory, water users have no leverage to request changes if the program fails to improve water services.

Several features of the Costa Rican water tariff help reduce the extent of these problems. First, revenue from the tariff must be used in the watershed within which it is generated, and to benefit water users. This helps ensure that resources are used where water needs are greatest. Second, water users can deduct any direct payments to FONAFIFO from the amounts due under the water tariff.<sup>8</sup> This ensures that water users do not pay twice for conservation, once through the voluntary agreement and once through the tariff. In fact, this feature may result in an increase in voluntary agreements. By paying FONAFIFO directly, water users can ensure that their payments go to agreed purposes, rather than leaving the choice of activities entirely up to FONAFIFO.

### *Biodiversity payments*

The Ecomarkets Project included a US\$8 million grant from GEF, which can be considered a payment from the global community for the biodiversity services provided by Costa Rica's forests. US\$5 million of this grant were used to make payments in biodiversity priority areas and the balance for institutional strengthening. Another GEF grant, for the Costa Rica component of the Regional Integrated Silvopastoral Ecosystem Management Project, is also channeled through the PSA program (Pagiola *et al.*, 2004, Ibrahim *et al.*, 2006). This project aims to generate both biodiversity conservation and carbon sequestration benefits by using a PES mechanism to encourage the conversion of extensive pastures to silvopastoral land uses. The recently approved MMBIEM Project includes a further US\$10 million grant from GEF. Conservation International (CI) is also paying for biodiversity conservation through the PSA Program, by providing US\$0.5 million to pay 50% of the cost of agroforestry contracts in the Osa and Amistad Pacifico conservation areas; and by paying 50% of the costs of planting up to 80,000 trees under agroforestry contracts in the buffer zone of Chirripó National Park.

Unlike agreements with water users, these agreements are not intended to be renewable. Efforts to generate financing from the local tourism industry to conserve the indirect benefits of natural ecosystems have not yet borne fruit.<sup>9</sup> This creates a challenge for funding long-term payments to service providers in areas where neither water nor carbon payments are available. Within the 1.4 million ha of biodiversity priority conservation areas outside the protected areas, about 0.2 million ha have significant potential for carbon financing, and about 0.3 million ha have significant potential for water financing, leaving about 0.9 million ha that do not have potential for either water or carbon financing. An endowment fund is being established to provide a partial answer to the challenge of funding long-term payments for conservation in this area (Pagiola *et al.*, 2006).

---

<sup>8</sup> This feature means that the net increase in resources available to FONAFIFO will be less than US\$5 million, as part of the roughly US\$0.5 million that FONAFIFO already receives from water users will count against that. However, water users who are currently paying more than the tariff would require them to have signalled their intention to maintain the higher payment levels.

<sup>9</sup> Several hotels are paying for watershed conservation (see Table 1), but they are doing so to protect their water supplies, not to preserve biodiversity.

### *Carbon payments*

Fuel tax revenues can arguably be considered a payment from Costa Rican carbon users for the carbon sequestration benefits provided by the PSA Program. As with

From the beginning, Costa Rica's PSA program has also sought to sell carbon emission reduction credits. PSA contracts specify that the rights to any resulting emissions reductions belong to FONAFIFO. To sell these emissions reductions, FONAFIFO developed a standardized instrument, the Certifiable Tradeable Offset (CTO), which represented an externally certified 1-tonne net reduction in carbon emissions (Castro *et al.*, 1997; OCIC, 1999). The program got an early boost when the Norwegian Government and a consortium of Norwegian power producers paid US\$2 million for 200,000 CTOs. Under the agreement reached in Bonn in July 2001, however, only reforestation and afforestation are considered eligible under the Kyoto Protocol's Clean Development Mechanism (CDM). As most of Costa Rica's emission reductions are generated by avoided deforestation rather than reforestation, no additional sales of CTOs were made.

With the Kyoto Protocol now ratified, Costa Rica is returning to the carbon market. A first contract, with the World Bank's BioCarbon Fund, covers the sale of about 0.61 million tonnes of carbon dioxide equivalents (tCO<sub>2</sub>e) by 2017. This will be achieved through a mix of planting trees in agroforestry systems, natural regeneration, and commercial plantations. FONAFIFO is also exploring the potential for 'retail' (non-Kyoto) sales of emissions reduction. Already it has sold emission reductions from conservation of 100ha of forests in Talamanca to Italian firm Lifegate, in a deal arranged with the assistance of an Italian NGO, GEV-Modena.

To help provide Kyoto-eligible carbon emissions reductions, FONAFIFO is introducing a new 'assisted natural regeneration' contract. This contract is meant to be less costly to implement than the timber plantation contract, which also produces Kyoto-eligible emissions reductions but has proven to be insufficiently attractive financially for many land users.

### *Landscape payments*

The Forest Law mentions scenic beauty as one of the environmental services provided by forests. Negotiations were undertaken with several 'users', including hotels and a rafting company, to pay for this service, but they did not result in any agreements. Unlike water services, where there often is a single dominant user in a given watershed, the 'users' of landscape services tend to be many and fragmented, thus creating problems of collective action in securing payments.

### *Summary*

Overall, the PSA program is only partly financed by payments from service users. The bulk of its financing is from the fuel tax, which can only tenuously be regarded as a payment by service users. The PSA Program thus remains largely a "supply side" PES Program (Pagiola and Platais, forthcoming).

Although some progress has been made towards securing financing from service users, most users are not paying for the services they receive. This includes many water users, as well as the tourism industry, despite its profiting handsomely from Costa Rica's reputation as a "Green Country".<sup>10</sup> Initially, the reluctance of most service users to pay for conservation could have been ascribed to lack of familiarity with the PES approach. With the PSA Program now

---

<sup>10</sup> Many tourism operators benefit directly from the PSA Program by receiving payments for their forest holdings.

well established, well-known within Costa Rica, and widely perceived as being very successful, resistance to payments is most likely due to a desire to free ride on the efforts of the government and other users. This is particularly likely to be true where multiple water users share the same watershed, or in the case of tourism industry, which is highly fragmented. It is noteworthy that all current payment agreements with water users are in watersheds where there is a single dominant user (Pagiola, 2002).<sup>11</sup> Moreover, some aspects of current PSA Program policies tend to discourage user payments. In the absence of direct agreements, users can count on some degree of conservation of their areas of interest through the payments made possible by government financing. When a direct agreement is reached, however, FONAFIFO generally charges *all* conservation payments in the area of interest to the user, which effectively increases the net cost of any incremental conservation (Tattenbach, pers. comm., 2005).

The proportion of the program financed by direct payments is set to increase dramatically as the new water tariff is implemented. Although this latter payment is not voluntary, it has features which help it retain some of the desirable characteristics of voluntary payments.

The program's own costs are financed from a levy of 7% of the flow of funds it handles, an amount that is fixed by law. In addition, however, some transaction costs are borne by participating land users.

### **How are service providers paid?**

The PSA program targets private land users, with the aim of integrating environmental considerations in landscapes outside protected areas.<sup>12</sup> Landowners were initially contracted by the national conservation area system (Sistema Nacional de Areas de Conservación, SINAC) and by NGOs such as FUNDECOR. FONAFIFO took over this task in 2003, establishing eight regional offices to handle applications, sign contracts, and monitor implementation.

To participate, landowners must present a sustainable forest management plan prepared by a licensed forester ('regente'). These plans describe the proposed land use, and include information on land tenure and physical access; topography, soils, climate, drainage, actual land use, and carrying capacity with respect to land use; plans for preventing forest fires, illegal hunting, and illegal harvesting; and monitoring schedules.<sup>13</sup> Once their plans have been approved, landowners begin adopting the specified practices, and receive payments. The initial payment can be requested at contract signing, but subsequent annual payments are made after verification of compliance (by the regentes, with a sample being audited).

Payment amounts were inherited from the earlier CAF system. For the forest conservation contract, they were about US\$43/ha/year, while the timber plantation contract paid US\$550/ha over five years.<sup>14</sup> Substantial increases in payment levels were announced in 2006, in the midst of a presidential election. Payments for forest conservation increased to

---

<sup>11</sup> The sole exception to this is the Río Segundo watershed, where Florida Ice & Farm and the town of Heredia both contribute to conservation payments, as discussed below.

<sup>12</sup> Private landowners in protected areas who have not yet been compensated for their lands are also eligible to participate in the PSA program. At the end of 2005, contracts with such landowners covered 38,700ha.

<sup>13</sup> Applicants must also comply with a variety of other conditions, such as not being in arrears with social security payments.

<sup>14</sup> Payment amounts are set annually, typically by adjusting the previous amounts for inflation. Annual payments for forest conservation thus gradually increased from US\$40/ha in 1997 to US\$43 in 2005. To reduce the impact of inflation, contracts are now denominated in US dollars rather than Costa Rican colones.



US\$64/ha/year, and for plantations to US\$816/ha over 10 years. Coming well before new funding sources are scheduled to be available, these increases are forcing a substantial reduction in area contracted. The net value of the payment is lower than its face value, as landowners must pay the regentes for the initial management plan and for monitoring; these fees take about 15% of payments. Complying with the provisions of their management plans (such as building firebreaks) further reduces the net value of payments. Payments offered under each contract are the same everywhere in the country.<sup>15</sup>

Forest conservation contracts provide for equal annual payments over the five year lifetime of the contract. These contracts are renewable by mutual agreement. In contrast, timber plantation contracts front-load most of the payment into the early years of the contract: 50% of the 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. These contracts call for participants to continue with the agreed land use for 15 years, a restriction that is written into the land title so that it transfers to the new buyer should the land be sold.

The establishment of trustworthy contract monitoring and verification systems is an important part of any system of payments. Monitoring is undertaken primarily by the agencies responsible for contracting with farmers, including SINAC, FUNDECOR, and the regentes, with regular audits to verify the accuracy of monitoring. With the financial support of the Ecomarkets Project, FONAFIFO has established a state-of-the-art database to track compliance. Non-complying participants forfeit further payments. Regentes who incorrectly certify compliance can lose their license.

There are no specific contract conditions to prevent participants from clearing one area even as they enroll another in the PSA Program, though the ban on clearing would apply. The risk of indirect leakage seems limited. Despite the size of the PSA Program, it does not appear to have had significant economy-wide impacts (Ross *et al.*, 2006).

### **Impact of the PSA program**

The PSA program has been very popular with landowners, with requests to participate far outstripping available financing. Figure 1 shows the area enrolled under each contract type since 1998. At the end of 2005, about 270,000ha were enrolled in the program. Forest conservation has consistently been the most popular contract, accounting for 91% of the area covered since 1998, and for 95% of enrolled area at the end of 2005. Forest plantation accounts for 5% of total area (4% at end 2005) and sustainable forest management (now discontinued) for 4% of total area (1% at end 2005). The new agroforestry contract does not yet account for a significant area.

PES programs can suffer from various kinds of inefficiency (Pagiola, forthcoming):  
 Offering payments that are insufficient to induce adoption of socially-desirable land uses, thus causing socially-undesirable land uses to remain in use.  
 Inducing the adoption of socially-undesirable land uses, that supply environmental services, but at a cost higher than the value of the services.  
 Paying for adoption of practices that would have been adopted anyway.

The first two problems result in social inefficiency: in either the failure to adopt practices whose social benefits exceed their costs, or in the adoption of practices whose benefits are smaller than

---

<sup>15</sup> There are two minor exceptions to this: a higher payment in the Río Segundo watershed, and a lower payment to landowners without title in the Río Platanar watershed (see notes to Table 1).

their costs. In both cases, social welfare is reduced over what it might have been. The third problem is not one of social inefficiency: the practices adopted are in fact socially efficient. Rather, this problem is one of financial efficiency for the program, which is generating less environmental services per dollar spent than if the problem was avoided. It can result in social inefficiency, however, in cases where funds for PES are limited: payments to land uses that would have been adopted anyway reduce funds available to induce socially-efficient land use change elsewhere. It can also result in social inefficiency if transaction costs are high, as these costs are not offset by any benefits.

The type and size of payments provided by a PES program affect the likelihood of these problems arising. Costa Rica's PSA program offers a relatively low, undifferentiated, and mostly un-targeted payment. Thus it will only tend to attract participants whose opportunity cost of participation is low, or negative. Such a program is very likely to experience the first type of problem, in which socially-desirable land use practices are not adopted because the payment offered is insufficient. Being undifferentiated and untargeted, the program will also attract many land users who would have adopted the desired practices anyway (third problem). The relatively low payments mean, however, that the program is unlikely to induce the adoption of socially-inefficient land uses on a significant scale (second problem).

### **Has the program affected forest cover?**

The forest area enrolled in the PSA program at the end of 2005 represented about 10% of the country's forest area. This high percentage, coupled with the country's success at reversing deforestation trends, makes it tempting to attribute the one to the other.

In principle, increasing the returns to forest<sup>16</sup> should induce a greater supply of forest. At the margin, landowners with forest areas will be less likely to clear it while landowners without forest will be more inclined to allow forest to regenerate.<sup>17</sup> Thus the forest conservation contract could either help avoid deforestation, or help induce (or accelerate) forest regeneration. Indeed, it can be argued that even non-participants may be induced to change behavior, as the possibility of receiving a payment in the future in itself makes forest more attractive (FONAFIFO, 2005), though this effect is clearly smaller than that on direct participants. Similarly, the timber plantation contract works by making plantations more profitable, and in particular by providing financing for initial costs and a revenue stream during part of the period prior to harvest.

Disentangling the effect of the PSA Program (and its predecessors) from that of other policy measures and broader economic trends is difficult, however. The PSA program was instituted at the same time as a package of other measures, including a ban on clearing forest land. In a sense, the PSA program was a quid pro quo for legal restrictions on clearing. Without the PSA carrot, opposition to the legal restrictions might have been much higher. Changes in the

---

<sup>16</sup> It should be noted that PSA participants incur additional obligations compared to non-participants who also maintain forest. Although clearing forest is forbidden, up to 40% of standing timber above a certain diameter can be harvested. PSA participants give up this right. Hunting is also prohibited in forests receiving PSA payments. Regentes are the primary monitoring mechanism for these restrictions.

<sup>17</sup> In principle, only standing forests can be enrolled under the forest conservation contract. A regenerating forest would have to be about 5 years old, according to FONAFIFO, to qualify. However, there is anecdotal evidence of regenerating forests as young as 2-3 years being enrolled under this contract. Whatever the precise timing, this delay reduces the present value of payments relative to opportunity costs. Uncertainty over whether one's application will be accepted further reduces the expected value of the payment.

profitability of livestock production had also reduced pressure to convert forests to pasture, particularly in marginal areas (White *et al.*, 2001, Arroyo-Mora *et al.*, 2005).

Studies have generally found that PSA recipients have higher forest cover than non-recipients. Zbinden and Lee (2005) found that PSA recipients in Northern Costa Rica had 61% of their farm under forest, compared to only 21% for non-recipients. Likewise, Sierra and Russman (2006), found that PSA recipients in the Osa Peninsula had over 92% of their farm under forest or bush, compared to 72% for non-recipients. Ortiz and others (2003) find that 36% of a sample of 100 PSA participants indicated that forest under conservation contracts had previously been used for pasture. These results are not conclusive, however, as they may be due to sample selection bias (Sills *et al.*, 2006).

Ortiz *et al.* (2003) and Miranda *et al.* (2003) both found that many PSA participants stated they would have protected their forest even in the absence of the PSA Program. That FONAFIFO has a long waiting list of applicants willing to enroll at current prices suggests that clearing forest is not very profitable in many areas (typically, about three times as much land is offered as funds allow for). At the very least, it suggests that FONAFIFO could have enrolled a much larger area with the same budget.

Formal tests of the extent to which the PSA program has affected forest cover have given mixed results. Tattenbach *et al.* (2006) develop an econometric model of gross deforestation during the period 1996-2000 using district-level data from the Cordillera Volcanica Central Conservation Area (ACCVC). Using their model, they estimate that primary forest cover nationwide in 2005 was about 10% greater than it would have been without the PSA Program.<sup>18</sup> Sills *et al.* (2006) use a propensity score matching method with farm-level data from Sarapiquí from 1997 to 2000 and find evidence that PSA has encouraged protection of mature native forest. A separate test using nationwide district-level data gives inconclusive results, however. Finally, Pfaff *et al.* (2006) find that the PSA Program is likely to have had a minimal impact on deforestation during the period 1997-1999. It is difficult to compare these results, however, as they apply to different areas, different time periods, different dependent variables, and use different methodologies.

In assessing the incremental land use impact of the PSA program, it should be borne in mind that FONAFIFO never set incrementality as an objective. On the contrary, their approach is to ‘recognize’ the environmental services of whoever is providing them. If their budget was sufficient they would pay any forest owner, as all forests are thought to provide environmental services.<sup>19</sup>

### **Have environmental services been generated?**

The PSA Program seeks to generate environmental services solely through forest land uses. Indeed, the very definition of environmental services in Forest Law No.7575 is “those that forests and plantations provide” (art.3). This is clearly a very blunt approach to environmental

---

<sup>18</sup> A comparison of their estimates of avoided deforestation (108,000ha) to area under contract (270,000 ha) suggests that about 38% of forest conservation contracts actually resulted in avoided deforestation. This ratio is lowest (13%) in areas of low deforestation risk, and highest (47%) in areas of high deforestation risk.

<sup>19</sup> This is clearly a very blunt approach to environmental services. The Silvopastoral Project, for example, is demonstrating that the extent of benefits can vary widely from one land use to another (Ibrahim *et al.*, 2006). The MMBIEM will assist FONAFIFO to develop a more differentiated program, with contract terms more closely tailored to specific requirements in particular areas.

services. The Silvopastoral Project, for example, is demonstrating that the extent of benefits can vary widely from one land use to another (Ibrahim *et al.*, 2006). The introduction of an agroforestry contract marks a small move away from pure forest land uses. The MMBIEM will assist FONAFIFO to further expand the range of contracts, with supported land use practices more closely tailored to specific requirements in particular areas.

It is unfortunately impossible to determine the extent to which the PSA program has successfully generated environmental services. Although the PSA program has established a strong system to monitor land user compliance with payment contracts, the program remains weak in monitoring its effectiveness in generating the desired services.

#### *Water services*

Expectations that the PSA program's would improve water services are based on the view, well entrenched in Costa Rica as in most of Central America, that forests are always beneficial to water services (Pagiola, 2002; Kaimowitz, 2000). In fact, the evidence on the links between land use and water services is far from clear (Bruijnzeel, 2004; Calder, 1999; Chomitz and Kumari, 1998; Hamilton and King, 1983), and monitoring has not been undertaken on the impact of PSA-supported land uses on the desired water services. The primary concern in Costa Rica is over water quality, as quantity is seldom a constraint in a country that receives an estimated 170 km<sup>3</sup> of water annually, but consumes about 6 km<sup>3</sup> (AyA and OPS/OMS, 2000; FAO, 2000). Quality is particularly important as only 33 of Costa Rica's 2,069 aqueducts have treatment plants, and a further 416 have disinfection plants. Thus the majority of the 1,000 aqueducts that provide potable water do so because of the quality of the water they are drawing upon (Espinoza and others, 2003). Fortunately, the link between forest cover and water quality is much better established than that between forest cover and quantity or dry season flow (Bruijnzeel, 2004).

The growing number of contracts with water users (Table 1) indicates that many share the common perception of the benefits of forests. Most of these contracts are in watersheds that are providing satisfactory levels of water services and where forest cover is still substantially intact. Under these conditions, even if the precise link between forests and water services is unknown, a strong precautionary principle argument can be made to avoid changes that might threaten the situation. Thus the town of Heredia, which does not have a treatment plant, is paying to preserve forest cover in its watershed (Castro, 2001).

It is noteworthy that both the water service contracts that have come up for renewal have been renewed (see Table 1). That two private companies, after five years of experience paying to protect the watershed from which they draw their water, have chosen to continue the arrangement indicates that they, at least, perceive the program as working.<sup>20</sup> It is also significant that more recent contracts with water users have them paying the full cost of conservation in their watersheds, plus covering FONAFIFO's administrative costs, as opposed to the much lower contribution that early contracts involved.

To examine the degree to which existing PSA contracts are likely to contribute to the provision of water services, the number of contracts found in hydrologic ally important areas was examined. Tattenbach *et al.* (2006), using data on water use from Fallas (2006), find that 35% of the area under forest conservation contracts is in watersheds with downstream surface water

---

<sup>20</sup> Water users may also derive other benefits from participating in the PSA program, such as social peace with upstream land users (I. Porras, pers. comm., 2005).

users. Using their estimates of avoided deforestation, they find that 644 million m<sup>3</sup>/year of water for consumptive uses and 7,224 million m<sup>3</sup>/year of water for hydropower production are being protected from a deterioration in quality. Thus a substantial part of the program's resources were spent in areas where few water services were likely to be generated. Moreover, only a small part of the hydrologic ally important areas was being reached. It should be recalled, however, that with the exception of payments based on contracts with individual water users (which only cover 18,000 ha, see Table 1), hydrological importance has not been a targeting criterion for the PSA program to date.

The water service agreements also indicate that the PSA program is often failing to conserve areas that could potentially generate environmental services. As can be seen in Table 1, areas conserved tend to fall short of targets—even in watersheds that have now been targeted for over five years. Although at the national scale FONAFIFO has more applicants than it can pay for, in these watersheds it is unable to find enough applicants, at the current price, to spend the budget that water buyers provide. In the Río Segundo area, to overcome high local opportunity costs, the PSA program is offering a higher price (US\$67/ha, compared to the usual US\$45) by cumulating payments from two local water users, the municipal water supply company of the town of Heredia, and bottler Florida Ice & Farm.<sup>21</sup>

The pending implementation of the water tariff will result in explicit targeting of hydrologic ally important areas, as the decree establishing it specifies that the resources it generates must be spent within the same watershed. This will be accompanied by a substantial increase in the attention paid to monitoring water impacts. Political support for the tariff could quickly evaporate if it comes to be perceived as a tax rather than a means to finance benefits to water users. To avoid this, the MMBIEM Project will assist FONAFIFO to develop operational guidelines for use of water tariff funds that seek to maximize their impact on water services, including identification of priority watersheds and critical areas within these watersheds, and specific interventions required to generate the needed services (which are likely to require the introduction of new contract forms). The project will also support the establishment of a monitoring system that will allow FONAFIFO to demonstrate to water users the benefits they are receiving, or to adjust responses in the watershed, in the event results fall short.

#### *Biodiversity conservation services*

As with water services, the percentage of enrolled area located in biodiversity conservation priority area provides a crude indicator of effectiveness at providing biodiversity services. Table 2 shows the area under conservation contracts located in biodiversity conservation priority areas.<sup>22</sup> The results here depend on the definition of biodiversity priority area used. Using the narrower definition of the original GRUAS report, about 30% of active contracts at the end of 2005 were in biodiversity priority areas. Using the expanded definition adopted in 2003, about 59% of active contracted area at the end of 2005 was in biodiversity priority areas. An additional 39,000 ha (3% of active contracted area) was inside protected areas,

<sup>21</sup> This joint payment also demonstrates that PES agreements can be reached in watersheds with multiple water users. Securing payments from water users is particularly difficult in such cases, as each individual user has an incentive to free-ride. For another example of multiple water users sharing the cost of a PES program, see Echevarría (2002).

<sup>22</sup> A 1996 evaluation (the "GRUAS Report") defined biodiversity conservation priorities on a countrywide basis; it was later updated. It provides the primary basis for defining priority areas in the PSA Program. In addition, priority biodiversity corridors were defined under the Ecomarkets Project, and others by SINAC. They are also considered priority areas for the PSA Program, as are remaining private lands within protected areas.

and thus also in biodiversity priority areas. The proportion of contracted areas within the expanded definition has increased markedly since 2003, when FONAFIFO took over the application process from SINAC and made concerted efforts to target contract allocation. Using a slightly different definition of biodiversity priority areas, Tattenbach *et al.* (2006) get a similar result: in 2005, about 65% of PSA conservation contracts were in biodiversity priority areas.

With most contracts being for forest conservation, incremental impacts on biodiversity in enrolled areas depend largely on whether the program is achieving an incremental change in land cover. Using their model of avoided deforestation, Tattenbach *et al.* (2006) estimate that the PSA Program prevented the loss of 72,000 ha of forests in biodiversity priority areas between 1999 and 2005. The new agroforestry modality, though it only represents a small area to date, looks likely to have a significant impact on biodiversity in agricultural landscapes. The Silvopastoral Project has been documenting that land use practices with significant tree cover harbor higher levels of biodiversity than current tree-less pastures (Ibrahim *et al.*, 2006). The number of observed diversity of bird species, as well as the number of individuals, is higher in land uses with trees, and higher yet when the tree density is higher.

#### *Carbon sequestration services*

The extent of carbon sequestration services the PSA Program has generated is driven primarily by avoided deforestation, and so cannot be estimated without better estimates of actual land use impact. Tattenbach *et al.* (2006), using their model of avoided deforestation and an estimate of 100tC/ha, estimate that the PSA Program avoided the emission of 11 million tC between 1999 and 2005.

#### **How permanent are the benefits?**

The long-term sustainability of land use changes promoted by the PSA program, and of any environmental services they generate, is hard to assess at present, because only the earliest contracts undertaken under the PSA have expired. In the case of forest conservation contracts—the vast majority of contracts agreed with landowners—there is no expectation of sustainability unless the contracts are renewed. Without continuing payments, landowners would clearly no longer have additional incentives to continue conserving forests.<sup>23</sup> FONAFIFO does intend to renew these contracts, to the extent that resources allow, except in cases where contracts were outside priority areas. In the case of plantation contracts, the expectation is that landowners will continue with the agreed land use even after payments cease. Indeed, this is a legal requirement under the contract. The reasoning here is that the PSA payment helped landowners finance the initial costs of establishing plantations, converting what would have been an unprofitable investment into a profitable one. However, reports from the field indicate that most landowners find it very difficult to maintain plantations because they do not generate any revenue in the interval between the end of the PES (in year 5) and the harvest of the timber (typically in year 20). In attempt to address this problem, both the amount and the duration of payments (to 10 years) under the forest plantation contracts were increased beginning in 2006.

The more important factor in the sustainability of the program is the sustainability of the income streams that FONAFIFO receives to make payments to land users. In this regard, it is

---

<sup>23</sup> It is important to stress that what matters is the duration of the payment, not the duration of the contract. A contract that last relatively few years before being renewed is in many ways attractive as it permits a periodic adjustment of the terms of the contract and a re-assessment of the usefulness of contracting in specific areas. It should also be recalled that clearing forest is illegal.

worrying that the energy tax revenue is FONAFIFO's only substantial long-term income stream, as this may be threatened in the future if rising energy prices lead to pressure to reduce the tax. Individual agreements with water users are a sustainable income stream, and in this sense it is particularly encouraging that both contracts that came up for renewal to date have in fact been renewed. These payments, however, so far only represent a small portion of total funding.

The new water tariff will change this outlook, by providing a substantial additional income stream—an income stream that, moreover, is likely to be highly sustainable over time as long as the PSA program can demonstrate that it is indeed generating water services. Once fully implemented, the water tariff will provide about US\$5 million a year to FONAFIFO. Carbon financing will also provide a reasonably long-term income stream for activities eligible under the Kyoto Protocol's Clean Development Mechanism.<sup>24</sup> As noted, an initial sale of 0.61 million tCO<sub>2</sub>e has been made to World Bank's BioCarbon Fund. FONAFIFO hopes to generate about US\$1 million a year from carbon sales by 2012.

The missing element in the long-term funding picture is biodiversity-specific funding. Both water fee revenues and carbon funding sources have restrictions (water fees can only be used in the watersheds where they are generated, carbon funding can only be used for reforestation), which would leave many areas that are important for biodiversity conservation with insufficient financing. The GEF grant under the Ecomarkets Project provided biodiversity-specific funding, but that funding has now ceased. Likewise, funds from contracts with CI are finite in time. To help assure sustainable, long-term financing of its activities in areas where water and carbon payments will be insufficient, FONAFIFO established a Biodiversity Conservation Trust Fund (Fondo para la Biodiversidad Sostenible, FBS) with the assistance of the Ecomarkets Project. This fund will receive initial capitalization from a GEF grant under the MMBIEM Project, and also serve as the repository of other grants, and of income from sales of conservation certificates in the voluntary market.<sup>25</sup>

### **Does the PSA program benefit the poor?**

Although PES programs like Costa Rica's PSA are not designed to be a poverty reduction program, the frequently high spatial correlation between areas that supply environmental services and poor areas create opportunities for PES to contribute to this objective (Pagiola *et al.*, 2005). 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). In recent years,

---

<sup>24</sup> That is, for reforestation and afforestation in areas deforested prior to 1990. FONAFIFO has identified about 1.1 million ha of 'Kyoto Lands' in Costa Rica.

<sup>25</sup> There is a small but growing market for voluntary contributions to conservation. This market does not depend on either legal obligation (as in the case of firms needing to buy carbon emissions to comply with obligations, or water users being obligated to pay the new water fees) nor self-interest (as in the case of the water users that have signed contracts with FONAFIFO to finance the conservation of the watersheds from which they draw their water). Rather, this market depends largely on the personal ethical/moral choices or individual tastes, or on the desire for favorable publicity. Thus, many individuals and firms seek to offset the impact of their own carbon emissions even when they are under no obligation to do so. See Tipper (2002) for an example of a conservation project financed by sales of carbon emissions reductions to the 'retail' (non-Kyoto) market. This is not a huge market, but neither is it negligible. Costa Rica's strong 'brand name' in environmental conservation and FONAFIFO's track record mean that FONAFIFO is well positioned to tap into this market. As noted, FONAFIFO has already made some forays into selling carbon emission reductions to the 'retail' market. It is also exploring options for selling 'biodiversity conservation' in this market.

FONAFIFO has sought to maximize their poverty impact by adding particularly disadvantaged districts to the priority areas for the PSA Program. The MMBIEM Project will also include a component specifically targeted at supporting the participation of poorer landholders in the program.

The evidence on the impact of the PSA Program on the poor to date has been mixed. Several studies (Ortiz *et al.*, 2003; Miranda *et al.*, 2003; Zbinden and Lee, 2005) have found that the bulk of program benefits tend to go to larger and relatively better-off farmers. Conversely, Muñoz (2004) finds that the PSA Program plays an important role in the livelihood of poor land holders in the Osa Peninsula.

A specific problem that affected the participation of the poor early in the PSA program was lack of titles. In general, titles may not be necessary for participation in a PES program as long as tenure is secure (Pagiola and Platais, forthcoming). Titles did emerge as an issue in Costa Rica, 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 by restricting participation in several important areas (Pagiola, 2002). When FONAFIFO is administering private funds, however, the legal restrictions do not apply. The solution, therefore, was to create parallel contracts, similar in all respects to the PSA contract, but financed entirely with funds provided by the service buyers, as was done Río Platanar (see Table 1). More recently, the law was changed to allow participation of landowners that lack titles.

Transaction costs are often an important impediment to participation of the poor, as working with many small, dispersed farmers imposes high transaction costs. Initially, the PSA program imposed very high transaction costs on participants, requiring applicants to fulfill eleven 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—had nothing to do with their ability to provide environmental services (Miranda *et al.*, 2003). These requirements have since been substantially reduced, by linking FONAFIFO's databases to those of other government agencies. Being current on social security payments is still a requirement, but this is now checked automatically. The PSA program also developed mechanisms to overcome the obstacles that transaction costs can create to participation by the poor. A system of collective contracting (*contratos globales*) was developed through which groups of small farmers joined the PSA program collectively rather than individually, thus spreading transaction costs over a large group (FONAFIFO, 2000). This approach ran into problems, however, as non-compliance by a single group member resulted in payments being halted to all members. The approach has thus been revised to process the applications of such groups together, but then issue individual contracts; this avoids the partial compliance problem, but has much smaller savings in transaction costs.

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 and 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).



## Conclusions

Costa Rica's PSA program has been one of the conservation success stories of the last decade. Its approach has been widely studied, and to an increasing degree imitated. FONAFIFO has hosted dozens of official delegations from countries throughout the world who have come to study the PSA program. Mexico has established a formal PSA programs inspired, in part, by Costa Rica's example (Muñoz *et al.*, forthcoming). As this paper has noted, however, the PSA program has many weaknesses, and it is as important to learn from its mistakes as it is to learn from its successes.

By building on the basis of previous forest subsidy schemes, Costa Rica was able to develop an elaborate, nationwide system of payments for environmental services relatively rapidly. As discussed, however, this was not without drawbacks. Many of the details of the previous schemes which were carried over into the PSA program were sub-optimal from the perspective of generating services—notably the lack of targeting and the use of undifferentiated payments. With experience, many of these weaknesses are being gradually corrected. The PSA program is evolving towards a much more targeted program, a trend that will be accelerated by the introduction of the new water tariff and by efforts to secure carbon financing. These same trends are also forcing the development of new approaches and the use of more differentiated payments, to allow for differences in both the level of service provision and the opportunity cost of providing services.

The other major weakness in the PSA program is its lack of data on the extent to which its activities are, in fact, generating environmental services. Only the GEF-supported silvopastoral project has monitored its impact on biodiversity conservation and carbon sequestration. The efficiency and long-term sustainability of the program demand that understanding of how different land use practices contribute to generating environmental services be substantially improved. In particular, demonstrating carbon sequestration is a sine qua non of participation in the emerging global carbon market. Work is currently underway in this area, including one-time studies of the impact of different land uses on services and the establishment of long-term monitoring systems.

As the first effort to develop a large-scale PES program in a developing country,<sup>26</sup> it was inevitable that there would be mistakes in Costa Rica's PSA program. There was no instruction manual, and many of the issues involved were only dimly perceived. Even today, with much more experience in this area, there remains much to learn before we can confidently make recommendations on how such programs should be designed. We do not yet have all the answers, but we believe we have most of the questions (Pagiola and Platais, forthcoming). Perhaps the most important lesson that might be learned from the Costa Rica experience is the need to be flexible and to adapt to lessons learned and to changing circumstances.

---

<sup>26</sup> There are earlier examples of PES approaches, notably in Colombia's Cauca Valley (Pagiola and Platais, forthcoming; Echevarría, 2002) but they were on a much smaller scale.

## Acknowledgments

The opinions expressed in this paper are the author's own and do not necessarily represent those of the World Bank Group. The author would like to thank Ina Porras, the participants of the ZEF-CIFOR workshop, and two anonymous reviewers for useful comments. The author also benefited from discussions with Gunars Platais, John Kellenberg, Ken Chomitz, Carlos Manuel Rodríguez, Jorge Mario Rodríguez, Edgar Ortiz, Oscar Sánchez, and many others—none of whom should be held responsible for any interpretations or errors in this paper. I would also like to thank Alberto Méndez and Ericka Herrera for their assistance in obtaining data from the FONAFIFO database.

## References

- Arroyo-Mora, J.P., Sánchez-Azofeifa, G.A. Rivard, B., Calvo, J.C., and Janzen, D.H., 2005. Dynamics in landscape structure and composition for the Chorotega region, Costa Rica from 1960 to 2000. *Agriculture, Ecosystems & Environment*, 106:27-39.
- Instituto Costarricense de Acueductos y Alcantarillados (AyA) and Organización Panamericana de la Salud/Organización Mundial de la Salud (OPS/OMS), 2000. Agua potable y saneamiento de Costa Rica: Análisis sectorial. San José, AyA and OPS/OMS.
- Bruijnzeel, L.A., 2004. Hydrological functions of moist tropical forests: not seeing the soil for the trees? *Agriculture, Ecosystems and Environments*, 104:185-228.
- Calder, I. 1999. *The Blue Revolution: Land Use and Integrated Water Resource Management*. Earthscan, London.
- Castro, E., 2001. Costarrican experience in the charge for hydro environmental services of the biodiversity to finance conservation and recuperation of hillside ecosystems. Paper presented at the International Workshop on Market Creation for Biodiversity Products and Services, OECD, Paris, 25-26 January 2001.
- Castro, R., and Tattenbach, F., with Olson, N., and Gamez, L., 1997. The Costa Rican experience with market instruments to mitigate climate change and conserve biodiversity. Paper presented at the Global Conference on Knowledge for Development in the Information Age, Toronto, Canada, 24 June 1997.
- Chomitz, K.M., Brenes, E., and Constantino, L., 1999. Financing environmental services: The Costa Rican experience and its implications. *Science of the Total Environment*, 240:157-169.
- Chomitz, K., and Kumari, K., 1998. The Domestic Benefits of Tropical Forests: A Critical Review. *World Bank Research Observer*, 13:13-35.
- Echevarría, M., 2002. Water user associations in the Cauca valley: A voluntary mechanism to promote upstream-downstream cooperation in the protection of rural watersheds. *Land-Water Linkages in Rural Watersheds Case Study Series*. FAO, Rome.
- Espinoza, A., Morera, A., Mora, D., and Torres, R., 2003. Calidad del agua potable en Costa Rica: Situación actual y perspectivas. *Análisis de Situación de Salud Series*, Report No.13. Organización Panamericana de la Salud, San José.
- Fallas, J. 2006. Identificación de zonas de importancia hídrica y estimación de ingresos por canon de aguas para cada zona. FONAFIFO, San José.
- Fondo Nacional de Financiamiento Forestal (FONAFIFO), 2000. El desarrollo del sistema de pago de servicios ambientales en Costa Rica. FONAFIFO, San José (in Spanish).
- Fondo Nacional de Financiamiento Forestal (FONAFIFO), 2005. FONAFIFO: Más de una década de acción. FONAFIFO, San José (in Spanish).
- Food and Agriculture Organisation (FAO), 2000. Costa Rica. *Aquastat country profile*. FAO, Rome.

- Hamilton, L.S., and King, P.N., 1983. *Tropical Forest Watersheds: Hydrologic and Soils Response to Major Uses and Conversions*. Westview Press, Boulder.
- Ibrahim, M., Gobbi, J., Casasola, F., Chacón, M., Ríos, N., Tobar, D., Villanueva, C., and Sepúlveda, C., 2006. *Enfoques alternativos de pagos por servicios ambientales: Experiencia del proyecto Silvopastoril*. Paper presented at the Workshop on Costa Rica's Experience with Payments for Environmental Services. San José, 25-26 September 2006.
- Kaimowitz, D., 2000. *Useful myths and intractable truths: The politics of the link between forests and water in Central America*. CIFOR, San José.
- Landell-Mills, N., and Porras, I., 2002. *Silver bullet or fools' gold? A global review of markets for forest environmental services and their impact on the poor*. IIED, London.
- Miranda, M., Porras, I.T., and Moreno, M.L., 2003. *The social impacts of payments for environmental services in Costa Rica: A quantitative field survey and analysis of the Virilla watershed*. *Markets for Environmental Services Paper No.1*, IIED, London.
- Muñoz, R., 2004. *Efectos del programas de Pagos por Servicios Ambientales en las condiciones de vida de los campesinos de la Península de Osa*. Unpublished MA thesis. Universidad de Costa Rica, San José (in Spanish).
- Muñoz, C., Guevara, A., Bulás, J.M., Torres, J.M., and Braña, J., Forthcoming. *Los pagos por los servicios hidrológicos del bosque en México*. In: S. Pagiola, J. Bishop, and N. Landell-Mills, (Editors), *La Venta de Servicios Ambientales Forestales*, 2nd edition. Instituto Nacional de Ecología, México (in Spanish).
- Oficina Costarricense de Implementación Conjunta (OCIC), 1999. *National report on Activities Implemented Jointly during the pilot phase*. OCIC, San José.
- Ortiz Malavasi, R., Sage Mora, L.F., and Borge Carvajal, C., 2002. *Impacto del Programa de Pago por Servicios Ambientales en Costa Rica como medio de reducción de pobreza en los medios rurales*. RUTA, San José (in Spanish).
- Pagiola, S., 2002. "Paying for water services in Central America: Learning from Costa Rica." In: S. Pagiola, J. Bishop, and N. Landell-Mills (Editors), *Selling Forest Environmental Services: Market-based Mechanisms for Conservation*. Earthscan, London, pp.37-61.
- Pagiola, S., forthcoming. *Assessing the efficiency of payments for environmental services programs*. World Bank, Washington.
- Pagiola, S., Agostini, P., Gobbi, J., de Haan, C., Ibrahim, M., Murgueitio, E., Ramírez, E., Rosales, M., and Ruíz, J.P., 2004. *Paying for biodiversity conservation services in agricultural landscapes*. Environment Department Paper No.96, World Bank, Washington.
- Pagiola, S., Arcenas, A., and Platais, G., 2005. *Can payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date from Latin America*. *World Development*, 33:237–253.
- Pagiola, S., and Platais, G., Forthcoming. *Payments for Environmental Services: From Theory to Practice*. World Bank, Washington.
- Pagiola, S., Platais, G., and Ducassi, L., 2006. *Paying for biodiversity: The Trust Fund for Sustainable Biodiversity Conservation*. Paper presented at the Workshop on Costa Rica's Experience with Payments for Environmental Services. San José, 25-26 September 2006.
- Pfaff, A., Robalino, J.A., and Sanchez-Azofeifa, G.A., 2006. *Payments for Environmental Services: Empirical analysis for Costa Rica*. Columbia University, New York.
- Ross, M., Depro, B., and Pattanayak, S.K., 2006. *Assessing the economy-wide effects of the PSA Program*. Paper presented at the Workshop on Costa Rica's Experience with Payments for Environmental Services. San José, 25-26 September 2006.
- Sierra, R., and Russman, E., 2006. *On the efficiency of environmental service payments: A forest conservation assessment in the Osa Peninsula, Costa Rica*. *Ecological Economics*, 59:131-141.

- Sills, E., Arriagada, R., Pattanayak, S., Ferraro, P., Carrasco, L., Ortiz, E., and Cordero, S., 2006. Impact of the PSA Program on land use. Paper presented at the Workshop on Costa Rica's Experience with Payments for Environmental Services. San José, 25-26 September 2006.
- Tattenbach, F., Obando, G., and Rodríguez, J. 2006. Mejora del excedente nacional del pago de Servicios Ambientales. FONAFIFO, San José (in Spanish).
- White, D., Holmann, F., Fijusaka, S., Reategui, K., and Lascano, C., 2001. Will intensifying pasture management in Latin America protect forests—or is it the other way round? In: A. Angelsen and D. Kaimowitz (Editors), *Agricultural Technologies and Tropical Deforestation*. CABI Publishing, Wallingford
- World Bank. 2000. Costa Rica Ecomarkets Project: Project Appraisal Document. Report No.20434-CR, World Bank, Washington.
- Zbinden, S., and Lee, D., 2005. Paying for environmental services: An analysis of participation in Costa Rica's PSA Program. *World Development*, 33:255–272.

**Table 1: Contracts for provision of water services in Costa Rica's PSA program**

<i>Company</i>	<i>Type of user</i>	<i>Watershed / Area</i>	<i>Area covered by contract (ha)</i>	<i>Actual area enrolled as of end 2004 (ha)</i>	<i>Contribution to payment to participating land users<sup>a,b</sup> (US\$/ha/yr)</i>	<i>Contribution to FONAFIFO administrative costs</i>	<i>Comments</i>
Energía Global	Hydropower producer	Río Volcán and Río San Fernando	2,000	1,493	12	0	Signed 1997, renewed 2002
Platanar S.A.	Hydropower producer	Río Platanar	750	396 354	15 30 <sup>c</sup>	5% of payment	Signed 1999, renewed 2004; addendum on non-titled land users signed 2000 for 10 yrs
CNFL	Hydropower producer	Río Aranjuez	4,000	2,424	40	\$13/ha yr 1	Umbrella agreement signed 2000, with addendums covering specific watersheds
		Río Balsa	6,000	4,567	40	\$7/ha yrs 2-5	
		Río Laguna Cote	900	501	40		
Florida Ice & Farm	Bottler	Río Segundo	1,000	440	45 <sup>d</sup>	\$29/ha yr 1	Signed 2001, later modified to use CSA
Heredia ESPH	Municipal water supply	Río Segundo			22 <sup>d</sup>	\$4/ha yr 1	
Azucarera El Viejo	Agribusiness (irrigated)	Acuífero El Tempisque	550	0	45	7%	Signed 2004 using CSA
La Costeña SA	Agribusiness (irrigated)	Acuífero de Guanacaste	100	0	45	7%	Signed 2004 using CSA
Olefinas	Agricultural supplies	Acuífero de Guanacaste	40	40	45	7%	Signed 2004 using CSA
Exporpac	Agribusiness (irrigated)	Acuífero de Guanacaste	100	0	45	7%	Signed 2005 using CSA
Hidroeléctrica Aguas Zarcas	Hydropower producer	Río Aguas Zarcas	1,666	0	30	7%	Signed 2005 using CSA
Desarrollos Hoteleros Guanacaste	Tourism	Acuífero de Guanacaste	925	0	45	7%	Signed 2005 using CSA

Notes: a. In cases where contracts have been renewed, information shown on area covered and payment is that under the latest contract.  
b. Participating land users receive the standard PSA contract payments (currently US\$42/ha/yr) except in Río Segundo (see below)  
c. Platanar pays US\$15/ha/yr for contracts with landowners with land titles (285ha at end 2004), with FONAFIFO paying the rest; It pays US\$30/ha/yr for contracts with landowners without land titles (385ha at end 2004), who are not otherwise eligible for PSA contracts  
d. To overcome high local opportunity costs, payments by Florida Ice & Farm and Heredia ESPH are cumulated, so that land users are paid US\$67/ha/yr

Source: FONAFIFO data

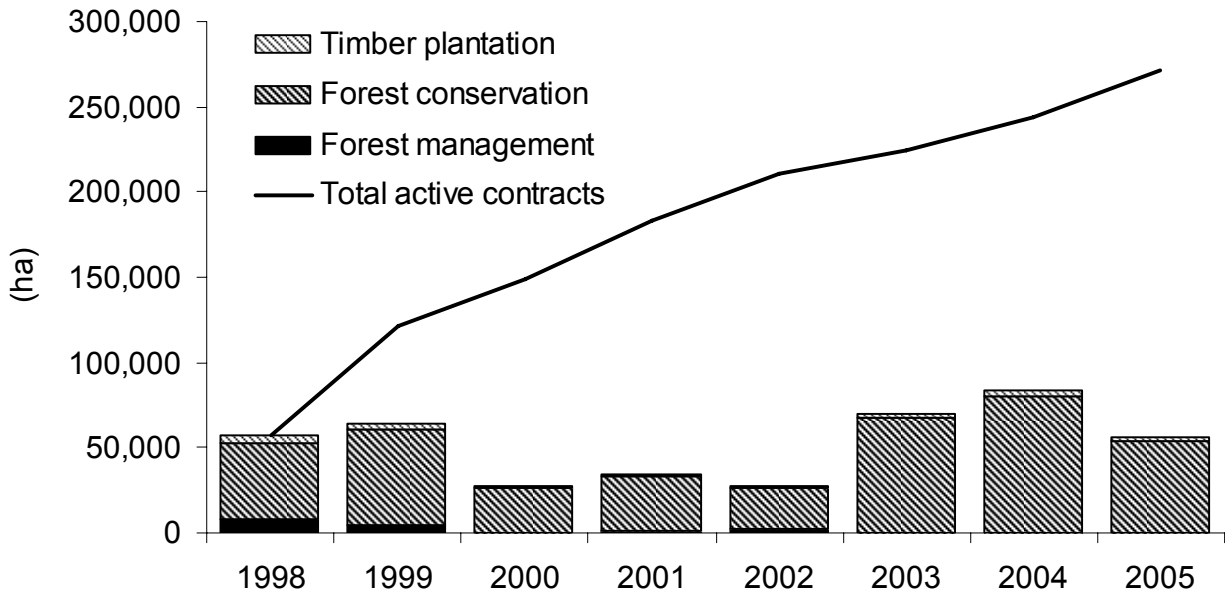
**Table 2: PSA contracts in biodiversity conservation priority areas, by year of signing**

	<i>Area in new contracts (ha)</i>				<i>% of total area in all new contracts</i>	<i>% of priority area covered</i>
	<i>Forest conservation</i>	<i>Timber plantation</i>	<i>Forest management</i>	<i>Total</i>		
<b>Contracts inside GRUAS areas</b>						
1999	13,560	159	1,181	14,900	<b>23.4</b>	1.7
2000	7,400	185	0	7,585	<b>27.2</b>	0.9
2001	6,604	212	394	7,211	<b>20.8</b>	0.8
2002	3,136	145	563	3,844	<b>13.9</b>	0.4
2003	27,664	541	0	28,205	<b>40.3</b>	3.2
2004	24,243	550	0	24,793	<b>29.8</b>	2.8
2005	15,369	447	0	15,817	<b>28.4</b>	1.8
<b>Total</b>	<b>97,977</b>	<b>2,240</b>	<b>2,138</b>	<b>102,355</b>		
<b>Current</b>	957	77,017	1,896	79,870	29.5	9.0
<b>Contracts inside GRUAS areas, plus Ecomarkets and SINAC corridors</b>						
1999	2,844	25,385	464	28,693	<b>45.1</b>	1.5
2000	43	12,373	777	13,193	<b>47.3</b>	0.7
2001	666	13,958	452	15,076	<b>43.4</b>	0.8
2002	1,760	7,432	533	9,726	<b>35.2</b>	0.5
2003	0	45,356	1,379	46,735	<b>66.7</b>	2.4
2004	0	52,332	1,473	53,804	<b>64.8</b>	2.8
2005	0	33,199	932	34,131	<b>61.3</b>	1.8
<b>Total</b>	<b>5,313</b>	<b>190,034</b>	<b>6,011</b>	<b>201,359</b>		
<b>Current</b>	2,426	152,277	4,770	159,473	58.8	8.2

*Notes:* Current contracts are active contracts at end of 2005.

*Source:* FONAFIFO data.

**Figure 1. Total area contracted in the PSA program, by modality**



Source: FONAFIFO data