LEARNING FROM 20 YEARS OF PAYMENTS FOR ECOSYSTEM SERVICES IN COSTA RICA

INA PORRAS, DAVID N. BARTON, ADRIANA CHACÓN-CASCANTE AND MIRIAM MIRANDA – 2013

SHAPING SUSTAINABLE MARKETS

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LEARNING FROM 20 YEARS OF PAYMENTS FOR ECOSYSTEM SERVICES IN COSTA RICA

Ina Porras, David N. Barton, Adriana Chacón-Cascante and Miriam Miranda

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FOREWORD

The 1990s brought us the Rio Convention and a global recognition of our dependence on ecosystems, both managed and natural, to ensure our own livelihoods and future. As easy as it may be to think that we live in a digital world ruled by smart phones and iPads, the truth is that we live on a biological planet. We depend on its biology not only for the food we eat, the water we drink, and the air we breathe, but also for many other aspects of our health and cultural identity. Biodiversity is the Earth's operating system. Like our computers' operating systems, which allow us to run programmes and perform operations, the global operating system provides us with critical services and operations that are the result of species' interactions over millennia. The increasing human footprint on this operating system threatens the very source of our wellbeing.

The year 2012 – 20 years after Rio – was an opportunity to look back and take stock of the progress we have made. Unfortunately, the 2010 biodiversity targets of the Convention on Biological Diversity were not met, and biodiversity continues to be threatened globally. On the positive side, the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) was born in April 2012, just in time for the annual 'Earth Day' celebration of the global environmental movement. The IPBES, sister to the Intergovernmental Panel on Climate Change (IPCC), will bring about greater global collaboration on biodiversity and ecosystem conservation. The second major development of the past 20 years is that connections between biodiversity conservation and development goals are now clear and commonly understood. We recognise that we cannot talk about biodiversity conservation without discussing poverty alleviation; and that we cannot discuss food security without taking into account agriculture's footprint on the environment. Or, even more fundamentally, that agriculture is wholly dependent on biodiversity in order to be sustainable. We also recognise that food production can no longer be the sole objective of human-dominated landscapes; rather, these landscapes must be managed for multiple objectives and services including (but not limited to) capturing and storing atmospheric carbon dioxide, water quality and quantity, scenic values, and biodiversity conservation.

In 1996, the tiny country of Costa Rica took bold steps to initiate one of the first nationalised 'payments for ecosystem services' (PES) programmes. The programme has grown tremendously, as the first chapter of this paper will show. It has been the envy of many – as well as the target of often undue criticism, as is frequently the case for pioneers. This paper serves to highlight the difficulties in managing a national, multi-objective programme. The authors beautifully illustrate the experiences of the National Forestry Fund (FONAFIFO) and Costa Rica's PES programme by discussing its history, its contributions to conservation, and the hurdles it has met. They also provide clear and concise recommendations of how the programme could be improved to balance conservation goals, development goals, and the provision of ecosystem services. The authors discuss critical questions of fairness, and the need for programmes that are subsidised by the federal government to provide tangible social benefits, including access by the rural poor.

Crucially, this report also considers how the programme can be improved in terms of managing the multiple 'trade-offs' – such as between social and environmental objectives – and proposes 'policymixes' that combine ecological, economic, and sociological information in targeting PES to increase its effectiveness at meeting multiple goals. The examples given serve to not only provide some guidance to Costa Rica in particular, but also offer invaluable insights into how far PES has come as a concept which is applicable internationally. They show how we can use lessons learnt from the past to map the use of financial tools to promote conservation and provision of ecosystem services in the future.

Dr Fabrice DeClerck, Bioversity International

SUMMARY

Costa Rica's Payments for Ecosystems Services (PES) programme has become something of an icon in the world of conservation. Its innovative blend of economic and regulatory instruments – and its hitches and successes – provide a valuable source of inspiration for other countries that are looking for effective ways to conserve and regenerate ecosystems. Since 1997, nearly one million hectares of forest in Costa Rica have been part of the PES programme at one time or another, and forest cover has now returned to over 50 per cent of the country's land area, from a low of just 20 per cent in the 1980s. What lessons can be learnt from the 20 years since it was founded? Also published in Spanish, this paper is for local practitioners, international researchers and donors who are interested in the Costa Rican experience.

Since 1997 the programme has helped to conserve nearly one million hectares of forest by payments for protection (90 per cent), reforestation (6 per cent), sustainable management (3 per cent) and more recently regeneration (1 per cent). Initially, PES contracts were granted on a first-come, first-served basis, and payments ended up going to areas with low risk of deforestation. More recently, priority access has been given to areas which are more critical to conservation. A national-level conservation strategy, GRUAS II, is expected to complete this process of environmental targeting. The programme is structured around four ecosystem services: capturing and storing atmospheric carbon, protecting water sources, and conserving biodiversity and scenic beauty. However there is little to no evidence that these services (with the potential exception of carbon) have increased due to the effects of the programme: most efforts to quantify are limited to monitoring actions expected to lead to better ecosystem services; and obtaining evidence of actual impact on these services is potentially very expensive. On the other hand, its lack is not a particular limitation of the Costa Rican PES. Most environmental programmes around the world focus on relatively easy-to-measure indicators, like hectares of land, rather than assessing one type of ecosystem service.

The PES programme benefits people directly, through direct payments and potentially new jobs, and indirectly, for instance by promoting healthier ecosystems. Better provision of ecosystem services are essential to improving resilience to climate change, as well as being inputs to agriculture, generation of hydroelectricity, and the ecotourism industry. Until now, there have been few efforts to account for all impacts on people beyond the direct financial benefits of those participating directly. Participation in the programme has increased for both indigenous communities (from 3 to 26 per cent of budget allocation between 1997 and 2012) and female-headed properties (from 16 to 23 per cent in the same period). It appears that PES has also helped to gradually regularise property ownership among smaller landowners, and encouraged compliance with farm employees' social security obligations. A critique of the PES programme has been its bias towards larger properties. However, the recent introduction of agroforestry contracts has been a successful way to engage with smaller properties, whose participation has significantly increased. On the other hand it has become clear that using the Social Development Index (SDI) as a criterion to give priority access to low-income areas has not been effective; in fact this gives indiscriminate priority to relatively well-off landowners in these areas.

As the PES scheme enters a more mature phase it can no longer afford to 'learn by doing'. There are four main areas in which it can improve its current approach:

- Use simple indicators for environmental impact. Rather than spending its budget on monitoring separate impacts – such as the amount of carbon captured – the programme should continue to use land as a unit for 'bundled' ecosystem services; a healthy ecosystem is more likely to deliver these services. The current holistic landscape-based approach should be more effective, targeting geographical areas on the basis of their vulnerability and significance. Efforts should be directed to ensuring these areas are effectively engaged in the programme.
- Target a specific social group. The current practice of targeting areas with a low social development indicator is not effective for prioritising access for the poor. A better indicator to assign social priority, and measure the programme's equity of access, could combine:
  - properties belonging to individuals (rather than legal entities)
  - areas with a low Social Development Index
  - small properties (less than 50 hectares).
- Consider approaches to increase cost-effectiveness. Payment levels should be better tuned to local costs – especially 'opportunity costs' – to avoid the current over-payments for some and rejected applications for others. To do this the programme needs more understanding of the economic context, local regulations regarding land use, the profitability of alternative land uses, and their capacity to provide the necessary ecosystem services. A mix of instruments may be necessary to achieve the potentially conflicting objectives of efficiency and fairness.
- Define an impact evaluation tool for continuous monitoring. This is essential to avoid duplication in data collection. An information system could link information from the different steps of the pre-application and application process to awarded contracts, payment information, monitoring data, and contract renewal information. This integration of databases can then be taken advantage of for periodic strategic programme evaluation.
- Proposals for increased effectiveness through spatial and social targeting of PES must be balanced against institutional set-up and transaction costs. We suggest that a natural scepticism to PES allocation schemes that increase management costs has been a consistent feature of PES under FONAFIFO management. When changes have been made, such as with new criteria and points-based scoring of applications, they have been tested incrementally.

GLOSSARY OF PES TERMS

ADDITIONALITY	Environmental additionality is the change in land use generated by the PES payment, which can be compared with what would have happened if no scheme were in place – see 'counterfactual' below.
CADASTRE	Costa Rica's official register of land property records.
COHORT	In statistics, a group of subjects who have shared a particular event together during a particular time span (for instance landowners who accessed PES between 1997 and 2005).
CONSERVATION GAPS (*VACÍOS DE CONSERVACIÓN*)	The areas identified as a priority for conservation efforts in Costa Rica not adequately represented in the present network of protected areas (PAs) and PES.
CONTRACT COMPLIANCE	The degree to which recipients of PES comply with the terms agreed in the contracts. Monitoring usually includes farm visits and/or satellite imagery.
COST-EFFECTIVENESS	The unit cost of producing a well-defined objective, such as the total cost of protecting one hectare of forest (including 'opportunity cost' – see below). It is a useful concept when deciding how to achieve an agreed outcome at the lowest cost.
COUNTERFACTUAL	A study of what would have happened in the absence of the programme or policy, in order to measure 'additionality' (see above).
ECOSYSTEM SERVICES	The PES scheme recognises four main services that ecosystems provide to people: 1. Carbon sequestration: the capture and long-term storage of atmospheric carbon dioxide, a greenhouse gas 2. Hydrological services: protecting watersheds or 'recharge' areas, 3. Biodiversity conservation: protecting a wide variety of coexisting plant and animal species 4. Preservation of scenic beauty.
EFFICIENCY	Refers to the benefit-cost ratio, in this case of a conservation decision, when all 'externalities', including ecosystem services benefits and transaction costs have been considered (strictly speaking, valued monetarily).

JUSTICE (PARTICIPATORY, DISTRIBUTIVE/ FAIRNESS/ LEGITIMACY)	A focus on justice in conservation looks beyond impacts on wellbeing, into how outcomes are reached (procedural justice in the process of design and implementation of the PES programme), and on how the benefits and costs of these outcomes are distributed among different stakeholders (distributive justice). Fairness, or sense of justice, is how the people affected perceive and judge the process and outcomes (Svarstad *et al.*, 2011; Grieg-Gran *et al.*, 2013).
ENVIRONMENTAL EFFECTIVENESS	The degree to which a policy achieves specific environmental goals, without taking costs into account. It can be expressed in terms of impact on the ecosystem service (e.g. tonnes of carbon) or in terms of actions expected to generate an outcome (e.g. hectares of protected forest).
IMPACT EVALUATION (IE)	Monitors whether the programme is effective in promoting the protection of ecosystem services (or an indicator such as forest cover). IE methodologies take into account selection bias (the statistical error that arises in choosing the individuals or groups to take part in the evaluation), and establish methods to clarify attribution of the PES. The best way to evaluate is a random selection of farms participating in the PES compared with randomly selected farms that do not participate in the scheme. 'Matching' is used to improve the accuracy of the evaluation, which takes into account the characteristics of the area, farm or household that influences the probability of participation in the PES scheme. The '*before-after: control-intervention*' method is used to understand the link between cause and effect. Here evaluators use baseline data for a control group (farms without PES) and an intervention group (farms with PES), and evaluation is done before the intervention (i.e. payments are made) and evaluated at a later date, using econometric techniques to isolate the specific effect of PES on a determined variable (e.g. conservation). These two groups can also be used to measure how other economic and/or social characteristics affect conservation, for example by isolating the effect of legal status (indigenous group, companies), or economic group (small producer, landowner) on conservation.
INPUT-BASED, OUTPUT-BASED	Input-based schemes work on the assumption that a given land-based activity, such as protecting forest cover, will deliver ecosystem services. Output-based schemes try to measure the actual ecosystem services provided, such as tons of carbon captured or quality of water.
LANDSCAPE APPROACH	A holistic approach to conservation, looking at local economies and agriculture, eco-tourism and other benefits of the environment beyond biodiversity alone.
LEAKAGE, NEIGHBOURHOOD EFFECTS	'Leakage' refers to the displacement of environmentally damaging land uses; for instance the farmer agrees to protect the forest under contract but deforests another part of his farm. 'Neighbourhood effects' may be positive or negative links between a farm's land-use and land-use on a neighbouring property.

LEGAL ENTITIES (AND *SOCIEDADES ANÓNIMAS* (S.A.))	Some PES contracts are signed with legal entities (*personas jurídicas*) established through a registration process, with legal rights and liabilities that are distinct from their employees and/or shareholders. Many of these are *sociedades anónimas* – which directly translated means 'anonymous society' – designating a type of corporation in countries that mostly employ civil law. It is roughly equivalent to public limited company in common law jurisdictions and is different from partnerships and private limited companies.
OPPORTUNITY COSTS	The income or benefits foregone by a landowner when choosing to participate in PES, such as revenue from growing crops. It is the difference in income between the most profitable land use (before PES) and forest conservation.
POLICYMIX	A combination of policy instruments, which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors.
PROTECTED AREAS (PA)	Legally protected (to various degrees), government owned/ managed areas of importance for flora and fauna in Costa Rica. Includes national parks, biological reserves, forest reserves, protected zones, wildlife refuges and biological corridors.
REDD, REDD+	REDD-type projects refer to performance-based payments or incentives to developing countries that result in Reduced Emissions from Deforestation and forest Degradation (REDD). Projects that also enhance forest carbon stores through forest conservation and reforestation are known as REDD+.
SPATIAL OR ENVIRONMENTAL TARGETING	Spatial targeting means prioritising areas for PES deemed important for conservation. This goes beyond voluntary participation, when landowners self-select for the scheme. Spatial targeting can be achieved in different ways; either by directly engaging with landowners on the site on a one-to-one basis, or by providing tailored-made incentives like priority access and/or differentiated payments.

ONE
INTRODUCTION

Costa Rica's PES programme is one of the best known examples of its kind. It was conceived during the early 1990s as an experimental instrument to help reverse the country's rapid deforestation. After significant consultation with key stakeholders, the programme was created in 1996, along with the initial governance structure allocating responsibilities and funding. The programme became operational in 1997. The way the programme is implemented has changed since then, adapting to changes in Costa Rica's economy, new technologies and the expectations that have grown with the programme's higher profile.

The PES programme has become something of an icon in the world of payments for ecosystem services, with other countries looking to learn from it, especially as water markets and schemes to reward forest conservation and reduced deforestation become more popular (such as REDD – see glossary). Within Costa Rica too, there is a need to reflect on how the contexts and challenges facing PES have changed; and to use this reflection to continue building a robust programme.

In this report we explore how the governance of the PES programme has evolved over time and how it is prepared to face future challenges. Based on previous and ongoing research, discussions with local stakeholders and the authors' long-term experience in the Costa Rican PES, we propose ways by which the programme's approach can be strengthened to provide a balance of ecosystem and social benefits. Also published in Spanish, this report is aimed at local practitioners, international researchers and donors interested in the Costa Rican experience and the lessons that emerge from it.

We first review how the PES programme has evolved through time, as part of a series of experimental instruments trying to tackle the high deforestation rates in the country; and how it has adapted through time to respond to new challenges (Section 2). Next we look at the components that together make the programme: its rules, roles, and rewards (Section 3). Then we focus our attention on the programme's impacts: on the ecosystem services it is meant to provide (Section 4); on the people affected directly and indirectly (Section 5); and on how balancing these two issues affect the PES's value for money (Section 6). Our conclusions and recommendations are presented in Section 7.

TWO
THE EVOLUTION OF PES IN COSTA RICA

Costa Rica's PES programme did not emerge fully formed. It was part of a process seeking to address conservation (or the lack of it) in Costa Rica's private lands. This section presents a brief discussion of the processes leading to the emergence of the PES programme, including the context and policies affecting forest conservation (see Figure 1).

2.1 BUILDING UP TO PES

Forest cover in Costa Rica has undergone dramatic changes, with a fast declining trajectory until the mid 1980s (Sánchez-Azofeifa *et al.*, 2007). From covering 70 per cent of the country in 1950, forests declined to just 20 per cent by 1987. This was one of the fastest deforestation rates in Latin America. At the end of the 1980s however, forests began to recover and reforestation and afforestation have shown a steady upward trend – recently flattening out at around 52 per cent of the country's land area.

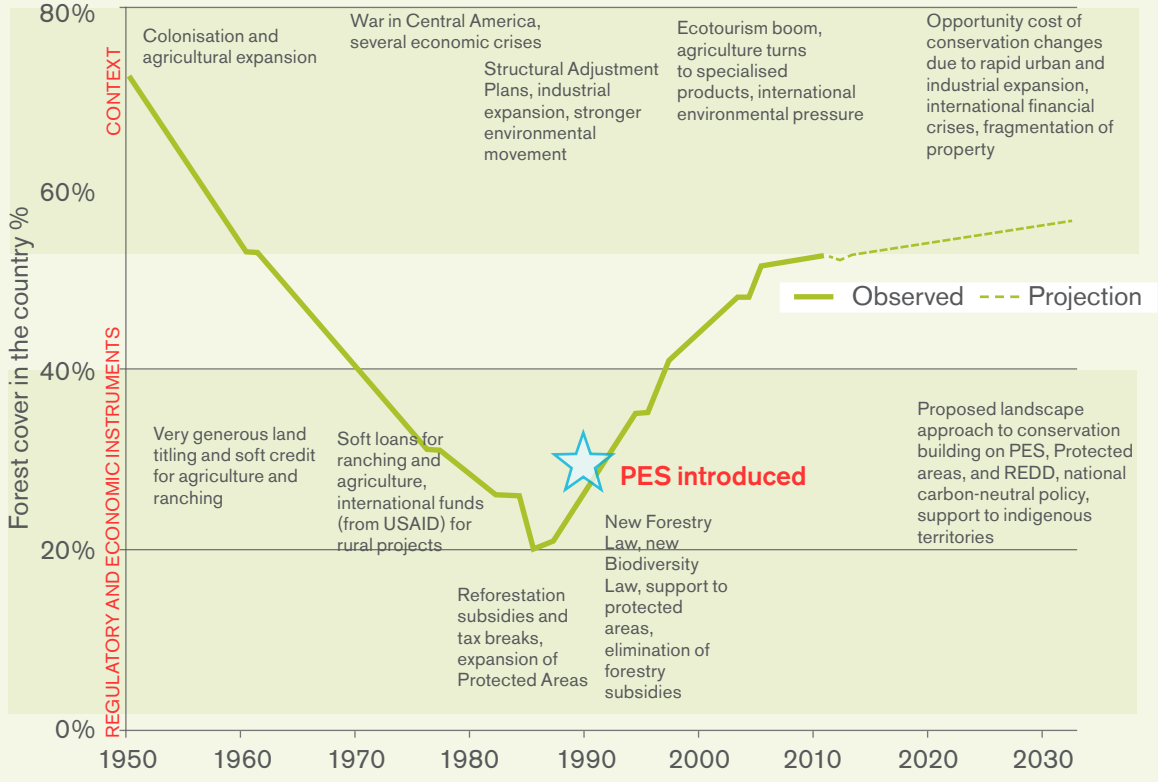
These massive transformations in the landscape result from a combination of policies affecting land use, as well as international market and political pressure. The early period of deforestation saw forest rapidly converted into agricultural and cattle ranching areas, which benefited from generous land titling and cheap bank loans as part of the Government's efforts to colonise new land. High international prices for beef and other expansive crops such as coffee and bananas exacerbated these policies' effects on deforestation. The trend was only stopped by new pressures which emerged in the 1980s. Political and economic instability created by the wars in Central America, and the collapse in global meat, sugar and coffee markets, lead to abandonment of a significant proportion of agricultural land. At the same time, early voices of an emerging conservation movement began to call for change. The creation of several national parks across the country was an important first step.

The early 1990s saw the strengthening of a re-greening process,[1] although it was impossible to know at the time whether the reversal in the deforestation trend was permanent or temporary. Outdated and ineffective laws and policies had to change. For example, at the time forests were a liability, open to expropriation and squatters rather than to viable economic activities. Reforestation incentives were considered a risky business; in many cases people deforested areas in order to make lands eligible for reforestation incentives later. Although a wide variety of incentives were implemented, they had limited success in stopping deforestation and encouraging reforestation (Watson *et al.*, 1998). Nonetheless, those early incentives partially paved the way for the creation of the PES programme.

The PES programme was introduced by the new Forestry Law 7575 in 1996, following wide-reaching consultation with multiple stakeholders (Le Coq *et al.*, 2010; Watson *et al.*, 1998). This law formed the foundation for two main instruments. First, it banned all conversion of established forests punishable by prison sentences rather than fines, effectively lowering the 'opportunity cost' of converting existing forests (see Section 6.2 for a discussion of opportunity cost). Second, it introduced the offer of payments for reforesting, protecting forest,

1. The first national park was created in the 1950s, but it was the 1980s that saw the expansion and consolidation of the National Parks and PA system.

FIGURE 1. CHANGES IN FOREST COVER IN COSTA RICA IN RELATION TO CONTEXT, ECONOMIC AND REGULATORY INSTRUMENTS



Source: Authors' own, based on Watson *et al.* (1998), Kleinn *et al.* (2002) and Daniels *et al.* (2010)

or managing existing forest in private properties outside national parks: the PES programme was born.

The PES approach has been widely criticised and debated. Given the ban on deforestation, some consider the PES either 'redundant', or that it 'overlaps' the ban; others, a 'rebranding' of previous subsidies (Matulis, 2012); or a necessary incentive for keeping forests standing, given low capacity for enforcement (Barton *et al.*, 2013); and a quid pro quo or pre-condition for popular acceptability of the ban (Pagiola, 2008; Daniels *et al.*, 2010; Pfaff *et al.*, 2008; Sánchez-Azofeifa *et al.*, 2007). The Forestry Law also provided the institutional framework required to implement the PES, as well as the initial funds to kick-start the process (see Section 3 for a description of the programme).

The programme has had concrete positive impacts since its inception. Between 1997 and 2012, it has protected more than 860,000 hectares of forest, reforested 60,000 hectares and supported sustainable forest management in almost 30,000 hectares. More recently, it promoted natural regeneration of almost 10,000 hectares. This totals nearly one million hectares under the PES scheme at one time or another, as well as 4.4 million trees[2] planted

2. Agroforestry contracts are reported in terms of trees per contract, rather than hectares.

under agroforestry systems since 2003. This is a substantial achievement for a developing country of just 51,100km^2. By 2010, roughly 52 per cent of the territory was under some sort of forest cover: a great victory for the environmental movement, especially considering the 1983 low of 21 per cent (Kleinn *et al.*, 2002).

Looking forward, the programme managers expect to increase its environmental effectiveness by defining and using 'priority criteria' for allocating payments, targeting the areas that most need protection and/or regeneration. The socio-economic benefits of the programme are also important, especially where the PES is the main permanent source of cash, for example in indigenous communities and remote rural areas (see Section 5). As the programme matures, a clearer approach to overall governance emerges, with more focused efforts to reduce transaction costs, the creation of local offices in areas of high risk of deforestation, a clearer institutional structure that promotes inter-sectorial cooperation (for example, between government ministries), legal and technical capacity building for programme managers, and simplified contracts with clear guidelines. The administrative flexibility of the programme has been key to the development of monitoring, evaluation and feedback systems that facilitate continuous innovation and adaptation.

2.2 LONG-TERM OBJECTIVES AND CHALLENGES

One of the main challenges is to align PES with the overall conservation policy in Costa Rica. Until now, PES has been used as the main instrument to target private landowners, and complements the public system of Wildlife Protected Areas (WPA) – also referred as Protected Areas (PAs) which includes National Parks – covering 26 per cent of the country's total land area.

But the focus of conservation efforts is now shifting from quantity to quality, and the need to specifically look into pressures, priorities and species not adequately represented in the present network of PAs and PES. These are known as 'conservation gaps', or *vacíos de conservación* in Spanish (SINAC and MINAE, 2007). A recent study and consultation process (known as GRUAS II) suggests that in order to address these conservation gaps, the country needs a 'landscape' approach to conservation: a holistic approach, looking at local economies and agriculture, eco-tourism and other benefits of the environment beyond biodiversity alone. It also calls for a mix of instruments that includes a) enforcing current legal restrictions (for example development planning and prohibitions); b) administrative mechanisms like changes in categories of PAs and/or biological corridors and c) expansion of voluntary approaches like PES and Reducing Emissions from Deforestation and Degradation (REDD) (Sáenz-Faerrón *et al.*, 2010; Rodríquez and Obando, 2012).

Within the wider strategy addressing conservation gaps, the PES programme has established two concrete environmental objectives:

1. Protect existing forests: eliminate 'conservation gaps' (forests with no protection status at risk of change) in about 14 per cent of the country, increasing protection of existing forests in private lands to reach a target of 256,000 hectares by 2030, and promoting connectivity between forests through biological corridors to facilitate the movements of flora and fauna.

2. Regenerate degraded areas and secondary forests: to begin regenerating forest in 8500 hectares of degraded areas through agroforestry systems; and support 20,000 hectares of 'secondary' forests (re-grown after deforestation).

But in order to achieve these objectives, the programme needs to address several issues. First, a clear understanding is needed of how the programme operates within a wider mix of policies affecting conservation (Section 3). As a matter of urgency, it needs to look at how effective it is in terms of achieving its environmental objectives – beyond simple indicators like 'hectares under contracts' (see Section 4). It also needs to find, and demonstrate, a balance between ecosystem and social co-benefits, such that it meets policy obligations/social contracts (like improving wellbeing in rural areas) and complies with legal restrictions on the use of public funds and requirements to support small and medium farmers[3] (Section 5). Increasing environmental effectiveness will need a clearer understanding of context (see Section 6). Programme managers need a clearer understanding of the 'opportunity costs' of forest activities – the revenue and benefits which the landowner foregoes by choosing to sign up to PES. This requires an understanding of profits from forest activities, regulations regarding land use, and the drivers of changes in land use. Better targeting (see glossary) can help improve cost-effectiveness and reduce the budget required to meet the programme's objectives, which is currently estimated at US$35 million per year (Sáenz-Fearron *et al.*, 2010) – about twice as much as the current budget allocated to PES.

Because the PES programme depends heavily on state funds, it has to both ensure environmental effectiveness and cultivate the necessary political support to receive financing. For example, it needs to respond to requests from institutions governing disbursement and the transparency of public funds on such questions as the use of possession rights versus formal property rights (see the recent audit in *Contraloría de la República*[4], 2011). Communication channels also need to be widened to include other institutions whose policies directly or indirectly influence the provision of ecosystem services (such as the agricultural and urban sectors), and those institutions and groups which may help to improve the cost-effectiveness of the programme and its evaluation and monitoring.

Other challenges include managing trade-offs, which are unavoidable: for example, attempts at using better indicators for ecosystem services are likely to result in more expensive monitoring systems. PES programme managers need to keep the purpose of the programme in mind at all times – the provision of ecosystem services and strengthening of small- and medium-sized landowners – and be ready to evaluate whether the PES programme is always the best instrument for the purpose.

3. Article 46, Law 7575, on the objectives for the creation of FONAFIFO actually refers to small and medium 'producers', a term which is not further explained. In theory at least, it probably refers to landowners whose livelihoods are derived (partly or as a whole) from the forest or forest plantation.

4. This audit was commissioned by the Comptroller General of the Republic (*Contraloría General de la República*) in 2011.

THREE
STRUCTURE AND DESIGN OF COSTA RICA'S PES

Costa Rica's PES programme acknowledges that owners of forests are entitled to apply for payments for the vital services that these ecosystems provide. A detailed framework defines these ecosystem services[5], which come under four main categories:

- Carbon sequestration: the capture and long-term storage of atmospheric carbon dioxide.
- Water ('hydrological services'): the protection of water catchment areas.
- Protection of biodiversity: for conservation and sustainable use[6].
- Scenic beauty.

The programme is a mix of rules, regulations and rewards that invite stakeholders to respond to incentives and disincentives. The legal underpinning establishes the structure by which the PES programme secures funding, how it is managed, and who is eligible to participate.

The National Forestry Fund (FONAFIFO) is the primary intermediary charged with administrating the PES programme. It signs legal contracts agreeing land use with forest owners, and monitors their compliance through local forestry technical facilitators (*regentes forestales*). In exchange for the payments, the landowners transfer the 'rights' to the ecosystem services to FONAFIFO, where they make up the wider portfolio of approved ecosystem services (ES) credits. FONAFIFO then sells some of these credits to its buyers. Figure 2 presents the overall structure of the programme, which is discussed in more detail below.

3.1 DEMAND FOR ECOSYSTEM SERVICES: THE BUYERS

The sources of demand, and therefore funding, for ecosystem services are:

- **Government funds**, mainly through earmarked tax revenues from water and fossil fuels, as well as (in lesser amounts) from forestry and conservation trusts.
- **The private sector**, through voluntary deals with private and semi-public companies (such as hydroelectric companies), as well as international sales of carbon credits and biodiversity-protection credits (which are planned for, but not yet available).
- **International banks and bilateral agencies** through loans and agreements.

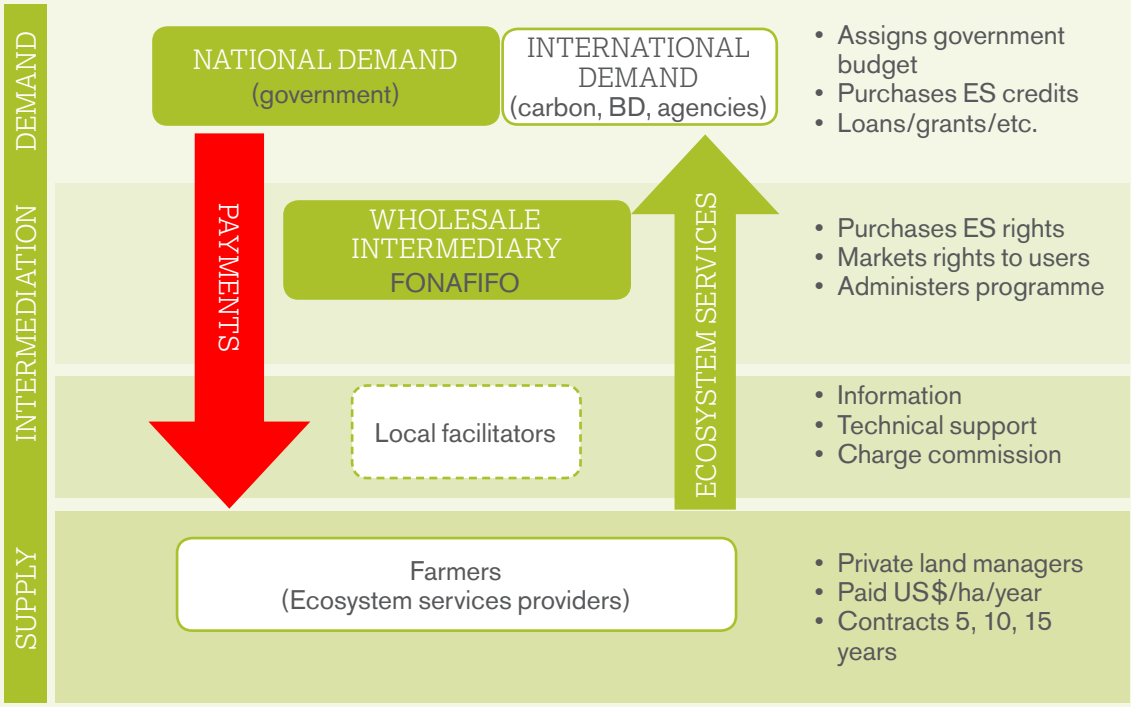
Government funds. The main funding for PES comes from the government and is established by law. The initial PES allocation in 1997 came partly from former forestry trusts,[7] but mostly from an earmarked tax on fossil fuels collection. The year 2006 saw a significant boost to the PES budget

5. The Forest (7575) and Biodiversity (7788) laws actually use the term 'environmental services'. While the definition of ecosystem services has been the subject of many research papers recently, it is an interesting policy footnote that the transition to the term 'ecosystem services' in the policy discourse in Costa Rica's PES has been carried out without any changes to legislation.

6. Biodiversity protection as an objective of PES foreshadowed the Millennium Ecosystem Assessments definition of 'supporting services' as a precondition for other services. Law 7575 links biodiversity protection 'for sustainable use, scientific and pharmaceutical, research, genetic improvement and protection of ecosystems and life forms'.

7. These trusts include (Rodríguez, 2005): Trust 178 (AID), Trust 04-87 (forestry tax), Trust FDF (Holland and Sweden), Trust 19-91 (ordinary budget), and FDF-Multidonor (diverse funds).

FIGURE 2. THE STRUCTURE OF COSTA RICA'S PES PROGRAMME



Source: authors' own

when water taxes were increased[8] with 25 per cent of collections destined for PES in strategic water catchment areas. The actual amount transferred to PES varies annually, affected both by the amount of tax collected and the political will influencing how this money is ultimately spent. On average, PES revenues from fuel tax are US$11.3 million per year (Murillo *et al.*, 2011; Ross *et al.*, 2007), and the accumulated income from the water tax between 2007 and the first 6 months of 2010 was approximately US$3.6 million (Astorga Espeleta, 2011). Water tax revenues are expected to increase with increasing political pressure from interest groups, subsidies and improvements in tax collection systems.

Voluntary agreements with local users

According to Blackman and Woodward (2010), less than 3 per cent of the programme area is financed by private funds – and of these, hydroelectric plants are the principal clients. FONAFIFO signed ground-breaking voluntary agreements with three hydroelectric companies (Energía Global, Platanar, and the CNFL) and the beverage company Florida Ice & Farm between 1997 and 2004. These agreements paved the way not only to further deals with the private sector – amounting to 80 contracts by 2012 (Sánchez, 2013) – but also to the government's decision to allocate a percentage of the water tax to PES. The basic form of these deals is through 'over-the-counter' transactions. Buyers purchase Certificates of Ecosystem Services (CSA, in Spanish), and choose the ecosystem service they wish to pay for, whether watershed services (Agua Viva CSA), biodiversity, landscape beauty (Bosque Vivo CSA) or carbon sequestration (Viaje Limpio CSA). These tax-deductible, over-the-counter transactions are promoted as a corporate environmental and social responsibility

8. The water tax increased significantly from 2006 when MINAE Decree N° 32868 came into force. Prior to that date, tariffs were extremely low and subsidised. The revision of tariffs generated a significant income for the national budget.

investment, with low transaction costs compared to 'one-to-one' (e.g. individual) agreements. They also offer transparency and convenience, allowing the investor their preferred ecosystem service and/or geographical area. CSA mostly targets the national market, especially hydroelectric companies, and the new market niche opened by the announcement of the Carbon Neutral Policy. The marketing possibilities opened up by CSA may be restricted by FONAFIFO's current internal capacity, which will require further specialisation to upscale and tap into other sources (Murillo *et al*., 2011).

International sales of ecosystem services

The first international transaction for ecosystem services took place in 1997 with the sale of carbon credits to Norway. These were known as 'Certified Tradable Offsets' (CTO) and certificates were sold through the Chicago Climate Exchange. However, the initially high expectations for carbon markets for forest protection were not met. Global demand was directed towards energy projects in places like India instead of forestry and agroforestry; and defining the baselines for forest carbon was difficult, although this metrics-related problem is not limited to forests (Murillo *et al*., 2011). To date the country has targeted voluntary carbon markets that generate social and ecosystem co-benefits. The average Costa Rican price for carbon was roughly US$8 per tonne of equivalent carbon dioxide (CO_{2e}) – a price considered too high for global carbon markets, where average prices were about US$4.6 per tonne. Global prices looked slightly more promising in 2012, with a boost bringing average prices to US$9.2 per tonne. Most of these prices however correspond to afforestation and reforestation, rather than REDD-type transactions (e.g. carbon plus co-benefits, which are the type that Costa Rica offers, see glossary) which actually decreased in volume of participation (Peters-Stanley *et al*., 2012).

International loans, grants and other agreements

Loans and international agreements were mostly used at the beginning to finance the programme. The World Bank provided a loan to strengthen the PES programme, focusing on forest protection (with a strong social issues component) along the Mesoamerican biological corridor. The project, named Ecomarkets (2000–06),[9] was co-funded with a US$40 million grant from the Global Environmental Facility and national government funds for US$9 million. It led to another project; Mainstreaming Market-Based Instruments for Environmental Management (Ecomarkets II, 2006–14)[10] aimed at securing long-term financing for the programme.

For reforestation, FONAFIFO's experience suggests that a combination of PES and affordable credit works best to encourage small- and medium-scale farmers to participate. It therefore signed an agreement for approximately US$12 million with the German Cooperation Bank (KfW) for the protection of forests and recovery of deforested lands in the northern region of Huetar Norte. FONAFIFO also reached an agreement with the government of Japan and the World Bank to co-fund the REFORESTA project[11] targeting the promotion of sustainable

9. See www.worldbank.org/projects/P052009/ecomarkets-project?lang=en.

10. See www.worldbank.org/projects/P093384/mainstreaming-market-based-instruments-environmental-management-project?lang=en.

11. *Reactivación de la Reforestación Comercial en Costa Rica* (REFORESTA).

forestry amongst small- and medium-scale farmers through a combination of PES and accessible credit. The Biodiversity Trust Fund is a relatively new fund that plans to promote long-term PES for forest protection in the Osa Peninsula (see Box 1).

3.2 PAYMENT LEVELS

The PES programme focuses on five uses of private land: 1) forest protection, 2) commercial reforestation, 3) agroforestry, 4) sustainable forest management, and 5) regeneration of degraded areas.

These types of land use serve as a proxy for providing the four ecosystem services. Sub-categories target the activities which are expected to provide specific ecosystem services, for example the protection of water when land is located in important 'hydrological recharge areas' (where water collects to recharge natural or man-made reservoirs). Likewise, reforestation and agroforestry have subcategories that further reward the use of native species, in recognition of the additional biodiversity protection services they provide (see Table 1 for 2012 levels).

Figure 3 compares purchasing power adjusted average annual payment levels for different PES subcategories since the start of the programme (controlling for varying contract length). Payment levels for the 'protection' PES have fallen in real terms by more than 50 per cent since their high in 1998.

With the 2013 presidential decree on PES (no. 37660) a 'forest plantations' pilot scheme was launched. It differs from the reforestation PES currently in place in that owners will not require permits to harvest plantation trees.

BOX 1. THE BIODIVERSITY FUND

The Biodiversity Trust Fund (BTF)[12] aims to solve two of the main PES problems: first, the lack of long-term funding for biodiversity contracts, and second, the fact that forested areas are isolated from one another, restricting biodiversity. The BTF plans to secure biodiversity contracts of up to 99 years, and safeguards forests on continuous stretches of forest on private land. An initial phase is taking place on the Osa Peninsula on the Southern Pacific coast of Costa Rica. 'Biological corridors' connect at least 70,000 hectares of forests in two national parks. The BTF combines PES with other financial and legal mechanisms to strengthen conservation in the Osa Peninsula; these include 'conservation easements', 'in-kind payments' and the promotion of 'added-value' activities. The fund works with the FONAFIFO platform to implement conservation contracts, and with CEDARENA (a legal NGO) as a partner to support the process in Osa. The Trust Fund will operate as a private fund, with public financial support: funding will be earmarked directly for the Trust Fund rather than going through general government coffers as is the case for FONAFIFO's PES budget.

Existing funds currently amount to US$17.8 million. This includes seed capital from the German bank KfW, the Global Environmental Facility (GEF) and other groups like Conservation International; but 90 per cent still comes from state funds. The BTF plans to provide one-to-one matching funds for private investors in the Osa portfolio and other priority areas defined by FONAFIFO. Two instruments to promote private investment in the Fund are the Green Card (*tarjeta verde*) and the *Ecomarchamo*. The Green Card[13] is backed by the Banco Nacional, and between October 2010 and March 2012 it generated US$64,594 through the agreed 10 per cent commission. Voluntary payments to offset car emissions[14] through the *Ecomarchamo* generated cash revenues of US$9504 between November 2011 and April 2012.

Source: Virginia Reyes, CEDARENA. vreyes@cedarena.org.

12. Saenz Faerrón and Brenes Roldán, 2012.
13. See www.bncr.fi.cr/BNCR/Conozcanos/RSE.aspx.
14. See www.bncr.fi.cr/BNCR/Conozcanos/RSE.aspx.

TABLE 1. PAYMENT LEVELS AND CATEGORIES, 2012

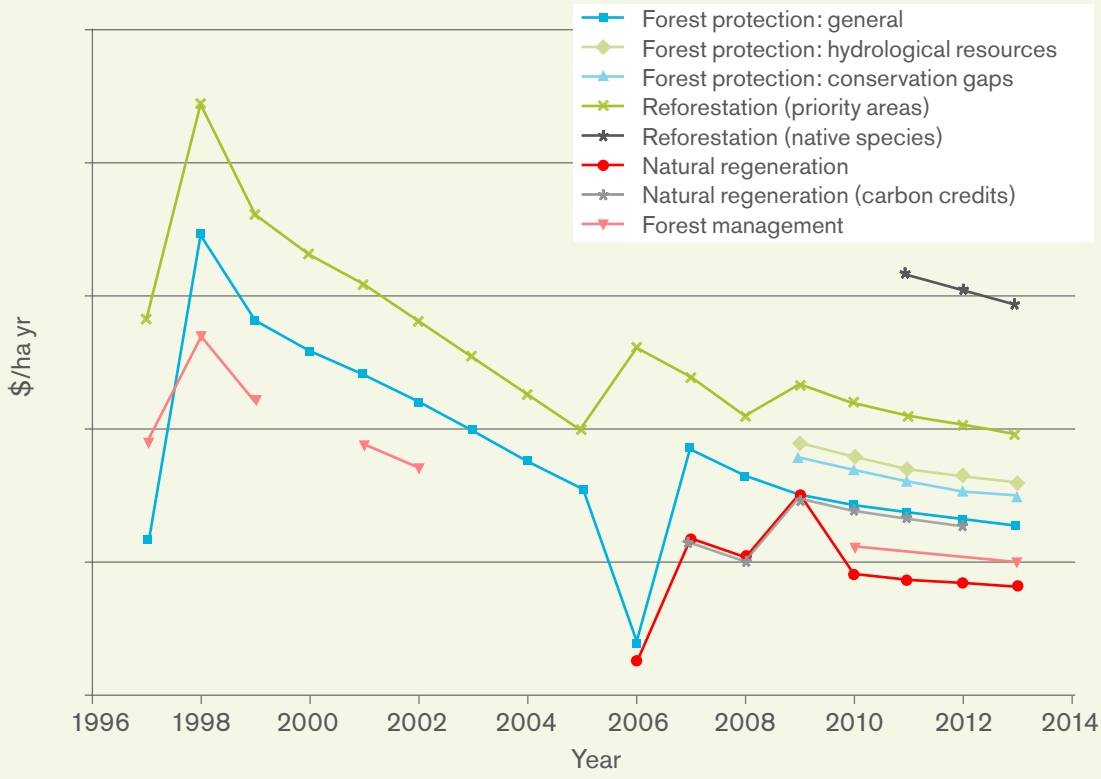
ACTIVITY	SUBCATEGORIES	US$/HA/ CONTRACT	ANNUAL PAYMENT (US$) PER HECTARE
Protection (2–300 ha); contract and payments for 10 years	Forest protection (general)	US$640	US$64
	In conservation gaps	US$750	US$75
	In zones of importance for water	US$800	US$80
Reforestation (1–300 ha); contract for 15 years and payments for 5 years	Reforestation	US$980	US$196
	With native species and species in danger of extinction	US$1470	US$294
Regeneration (2–300 ha); contract and payments for 10 years	In degraded areas with forestry potential	US$410	US$41
	In areas that qualify for 'additionality' under Kyoto standards (*CDM)* dropped for 2013*	US$640	US$64
Forest management (2–300 ha); contract and payment for 10 years		US$500	US$50
Agroforestry (350–5000 trees); contract for 5 years, payment for 3 years	Agroforestry services	US$1.30/tree	US$0.43/tree
	With native species and species in danger of extinction	US$1.95/tree	US$0.65/tree

Source: MINAET, 2011

The aims of the pilot scheme are to generate forest sector employment as well as contribute to carbon sequestration. In its 2013 pilot phase the scheme is part of the 'agroforestry system' PES.

Payment levels can be influenced by three factors: 1) administrative decisions on the available budget; 2) the estimated value of the ecosystem service provided by the forest; and 3) the 'opportunity costs' to the landowner associated with participating. The vast majority of PES schemes in developing countries use a fixed payment per hectare. This means 'bundling' all ecosystem services into the 'hectare' measurement, multiplied by an estimated land use

FIGURE 3. AVERAGE ANNUAL AND PURCHASING POWER ADJUSTED PES



Note: Average payments over the contract lifetime are also determined by contract length. The initial spike is due to a reduction in the contract length from 15 to 5 years in 1998. In 2006 contracts in dollars (rather than local currency) were introduced and contract amounts adjusted. Readjustments to raise payments for protection were made the year after. Despite short-term fluctuation, PES purchasing power has fallen by more than 50 per cent per hectare per year since its high point in 1998.
Source: Barton *et al.*, 2013.

contribution to the services in question, rather than measuring actual ecosystem service flows. In some cases outside Costa Rica extra payments are made for special types of ecosystems on top of the basic payment per hectare – in Mexico, for example, cloud forests receive a higher payment.

Although some initial studies and literature reviews assessed the value of forest ecosystem services, as part of the general consultation process before the introduction of the PES programme (Le Coq *et al.*, 2010), the final level of the payments was a somewhat arbitrary decision. Payments for reforestation reflected subsidy levels prior to the introduction of the programme, and payments for forest protection were based on the price of renting land as pasture, as an approximation of the opportunity cost of forested land (about US$50/ha/year in 1995). Studies abound on the value of different ecosystem services – comparing fog interception in cloud forests versus pastures, for instance (Aylward *et al.*, 1999; Porras, 2008) – but so far only one study has tried to link the actual value of ecosystem services to payments, as described in Box 2.

Although differentiated payments – and auctions – have been suggested to increase the programme's effectiveness (see Section 6.3), fixed payments (or very slightly differentiated payments) are simpler to understand and manage; they can also be more transparent and cheaper to implement. This is the approach currently taken by the PES managers in Costa Rica.

BOX 2. MONITORING LEVELS OF ECOSYSTEM SERVICES TO DETERMINE PAYMENTS – AN EXPERIMENT

To date, the most significant effort to link payment level to provision of ecosystem service comes from the RIMSEC 'silvopastoral' project (silvopastoral systems combine trees, pasture and livestock), executed by CATIE in Colombia, Nicaragua and Costa Rica. This project focused directly on the biodiversity and carbon benefits from the regeneration of cattle ranching sites (Ibrahim *et al.*, 2010; Villanueva *et al.*, 2011). The project developed an ecological index for carbon and biodiversity at the level of individual farms using secondary information (databases, scientific and technical publications) and approximate calculations by experts. The rate of compensation was defined so that farmers received a payment based on annual improvements of the environmental index established as a baseline for every ranch. The project succeeded in reducing degraded pastures by 14.2 per cent, increased the use of improved pastures by 40 per cent and had a moderate impact on the forestry area (Casasola *et al.*, 2009).

Despite simplified procedures, the project costs – including so-called 'transaction costs' – were high (see Table 2). Besides payments to the farmers, transaction costs included the cost of satellite imagery, farm-level maps, verification of information, digitisation and processing of data, and preparation of reports. These costs depended on the size of the property and the activity that was being monitored. Average costs were US$4.18 per hectare, ranging from as high as US$10/ha in 1 hectare properties down to US$2/ha in properties with more than 40 hectares. This could result in a bias towards monitoring larger properties in order to keep costs down. Although these costs are still too high for a national-level programme, advances in technology could help to reduce them in the future. Lessons from the RIMSEC project may be useful in designing a tool which provides an approximation of biodiversity within participating farms, and use it to determine both the level of payments and to monitor ecosystem service impacts, as required by the Treasury.

TABLE 2. ECOLOGICAL INDEX, MONITORING COSTS AND PERFORMANCE-BASED PES IN THE RIMSEC PROJECT

		MONITORING COSTS (US$/HA)	ECOLOGICAL INDEX	PES (US$/HA)
Secondary forests		1.3	1.9	142.5
Improved pastures	Without trees	1.3	0.5	37.5
	Low density of trees	1.3	0.9	67.5
	High density of trees	1.3	1.3	97.5
Natural pastures	Without trees	1.3	0.2	15
	Low density of trees	1.3	0.6	45
	High density of trees	1.3	1	75
Fodder banks		1.3	0.8	60
Intensive forest grazing systems		1.3	1.6	120
Riverine forests		1.7	1.5	112.5
Live fences (trees as hedges)	Multi-strata	3.9	1.1	82.5
	Simple	6.6	0.6	45

Note: Payments were made based on expected performance in terms of biodiversity protection and carbon capture. The amount of PES payment is determined by multiplying the base rate of US$75/hectare by the ecological index.

Source: Villanueva *et al*., 2011.

3.3 THE PROVIDERS OF ECOSYSTEM SERVICES

The PES programme is accessible to any private landowner who has a property title or possession rights, with a minimum land area of one hectare. There are four main categories of participants (Porras, 2010; Paniagua, 2011):

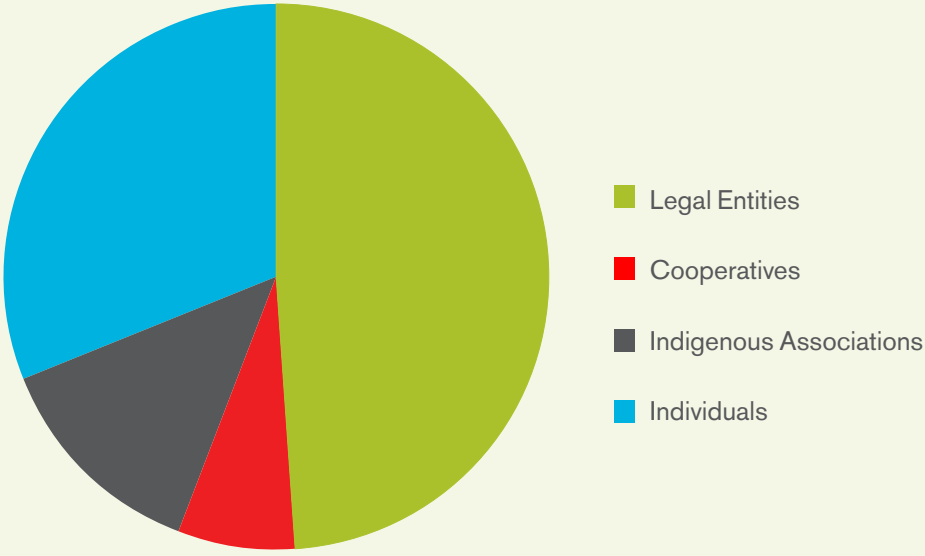
- Individuals (*personas físicas*, in Spanish).
- Legal entities,[15] many of them *sociedades anónimas* (a Spanish term roughly equivalent to 'publicly limited companies') including micro-enterprises, family businesses, small and medium enterprises (SME), large companies and their subsidiaries.
- Development or conservation cooperatives.
- Indigenous communities.

Between 1997 and 2012, FONAFIFO distributed approximately US$340 million. The greatest part of these funds went to legal entities (49 per cent), followed by individuals (31 per cent), indigenous groups (13 per cent) and cooperatives (7 per cent) – see Figure 4.

During the first years of the programme (1998–2002) many contracts were handled as group contracts. These 'umbrella' projects pooled together groups of (usually small-scale) farmers in one collective contract, with the aim of minimising transaction costs. In practice, problems emerged such as the inability to enforce compliance among all members of a group. This led to the abolition of a single collective contract in favour of individually signed contracts with group monitoring.

15. Legal entities are those established through a registration process, with legal rights and liabilities that are distinct from their employees and shareholders.

FIGURE 4. TOTAL FUNDS DISTRIBUTED, BY TYPE OF PARTICIPANT (1997–2012)



Source: Authors' own, using data supplied by FONAFIFO

As well as receiving direct payments, private forest owners who manage their forests through PES or in PAs are also exempt from property taxes. Property taxes were recently reviewed and raised throughout the country, so the benefits of the exemption have increased. Participation in PES also provides a guarantee of squatter eviction, a further benefit for land tenure. Section 5 discusses the programme's participants in more detail.

3.4 EVOLUTION OF THE PROGRAMME'S TARGETING STRATEGY

On its introduction in 1997, requests for payments were allocated on a first-come, first-served basis. However, it soon became clear that interest in participating in the scheme far outweighed the funds available and different strategies had to be found to prioritise contract allocation. A new strategy was formed based on mixtures of landowner and land-use characteristics. The

criteria used to prioritise inclusion in the scheme then changed over the years, which can be roughly grouped into three major phases since 1998 (see Table 3):

1. **1998 to 2002:** FONAFIFO shared management of the PES programme with the National System of Conservation Areas (SINAC). There was no national-level strategy and the criteria for receiving payments varied according to each of SINAC's ten regional offices. This wide range of criteria was not an effective way of targeting priority areas for conservation, since it covered most types of land use. Applications that met any of the criteria were selected on a first-come, first-served basis.
2. **2003 to 2010:** FONAFIFO assumed management of the PES programme and directed the setting of priorities at a regional level. The number of different spatial criteria were reduced. Applications were selected on a first-come-first-evaluated-basis and then prioritised if they met any of the priority criteria (see Table 3). Each of the FONAFIFO regional offices was assigned a quota per contract type per year.
3. **2011 to present:** In 2011, the system of first-come-first-evaluated and regional quotas was dropped in favour of national level priority-setting across all 'pre-applications' using a revised matrix of priority weights. For example, an application from forest in an area defined as a 'conservation gap' receives 85 points. If it is a small property (less than 50 hectares) it will receive 25 additional points, making a total of 110 points. A similar sized property with forest located in a non-priority area will receive 55 initial points and an additional 25 points for its size, making a total of 80 points (Table 3). These weighting criteria can be interpreted as a form of implicit valuation of these property characteristics. The additional points given to smaller properties on social grounds (e.g. promoting participation of smaller-scale farmers) can have direct trade-offs in terms of ecosystem service provision. Smaller properties often result in higher fragmentation of the landscape, and therefore a potentially lower level of ecosystem services if thresholds are not met (e.g. landscape too fragmented to provide a sufficient buffer for roaming species). The first year of this approach saw quite large shifts in allocation of contracts towards regions with high scores such as the Osa Peninsula, and away from the Caribbean, for example. The scoring method and allocation at national level is expected to lead to a longer-term dynamic of periodic shifting of contract supply from one region to another.

The priority criteria highlighted in Table 3 applies only to forest protection. So far all applications for reforestation projects have been awarded, provided they were technically correct. Applications will be prioritised that use native species or genetically improved material,[16] or that reforest degraded areas with high forestry potential – this last category in particular complies with FONAFIFO's call to boost the forestry sector. Agroforestry systems are designed for land suitable for agriculture, excluding high slopes, for instance. As for reforestation, the use of native species and agroforestry in degraded areas is encouraged; native species improve impacts on biodiversity, and agroforestry complies with the Kyoto Protocol[17] requirements for carbon.

16. There has been insufficient research in Costa Rica on how genetically modified species affect biodiversity. Giving priority to 'genetically improved material' may have more potential for carbon sequestration, but may also have a negative impact on biodiversity.

17. For example see http://unfccc.int/kyoto_protocol/items/2830.php.

TABLE 3. EVOLUTION OF FOREST PROTECTION PRIORITY CRITERIA, 1998–2013

PRESIDENTIAL DECREE #		FIRST PERIOD				
	1997	1998	1999	2000	2001	2002
	25828	26977	27808	28610	29394	30090
	26141					
Criteria:						
Conservation area (CA) specific criteria	Whole country / no spatial priorities	See Note below				
Non-priority Forest						
Indigenous territories						
Conservation gaps (GRUAS II)						
Protected areas (PA)						
Forest protecting water resources						
Biological corridor (GRUAS, CBM)						
Ecomercados#, KfWproject areas						
Non-expropriated properties						
Expiring forest management PES						
Expiring contract this year						
Expired PES contract						
Expired CAFMA >10yrs						
Low SDI (<40%)						
Contracts[1], properties[2] <50 ha						

Notes: Shading indicates when a criterion is used. Different shading corresponds to the main periods of priority criteria. Only the last period uses points. *when not in combination with other criteria, **mutually exclusive criteria, § order of priority in combination with conservation gaps / or alone; # Ecomercado biological corridors (GRUAS: Tortuguero, Amistad-Caribe and Osa; KfW: Huertar Norte, Sarapiqui; Tortuguero, Barbilla, Fila Costena and Corcovado. CA: conservation area specific targeting criteria (e.g. ACOSA divided into 9 areas with different priority criteria); Reg. Points system with regional quotas; Natl. Points system with no regional quotas. ASP: protected areas which include PN: national parks; and RB: biological reserves.

SINAC criteria (1998–2002) were multiple and often overlapping. It provided priority to applications of forests located in indigenous territories, protected areas, biological corridors and buffer areas around these sites, *Ecomercados* sites, forest protecting water resources, endangered species, land use categories over VI and areas prone to soil degradation, any forest succession stanges, abandoned pastures, areas with regeneration protential, forest located in areas prone to fire risk, landslides, flooding, arqueological sites at risk, areas of high scenic beauty, foresty potential, coastal marine zone forest, and forest managed by successful forest organisations.

Source: Authors' own, based on Barton *et al.* (2013)

SECOND PERIOD								THIRD PERIOD		
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
31081	31767	32226	33226	33852	34371	35119	35762	36516	36935	
								60	55	55
						6.	6.	80/75*	85	85
						§ /3.	§ /3.	80/75*	85	85
						1.§ /4.	1§ /4.	80/75*	75	75
								80	80	80
						2.§ / 5.	2§ /5.	80/70*	80**	80**
						9. PA	9.PN/ RB	AP	AP	AP
						8.	8.	65		
								+5	+10	+10
						7.	7.	+5		
						10.	10.	+5	+10	+10
								+10[1]	+25[2]	+25[2]

3.5 A RULES, REGULATIONS AND REWARDS FRAMEWORK

The PES programme has been described as not just a single economic instrument, but rather a 'policy mix' (Barton *et al*., 2013). A policy mix is a combination of policy instruments, which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors (Ring and Schröter-Schlaack, 2011). The policy mix in this case includes the Forest Law that created the PES (Law 7575, 1996), annual presidential decrees determining PES priorities, the PES *Operational Manual*, and other 'soft' instruments like regulatory plans and the determination of buffer and conservation areas. The Institutional Analysis and Design (IAD) framework developed by Ostrom (2005), can be used to describe PES in terms of its 'rules-in-use' (see Table 4). Rules-in-use are both formal – created by legislation and regulation – and informal, created over time by communities to govern landuse practices. 'Rules-in-use' provides an analytical framework for characterising the institutional characteristics of PES, extending the analysis of incentives for land use management beyond only payment levels and sanctions (Barton *et al*., 2013).

TABLE 4. PES MIX OF 'RULES-IN-USE' ACCORDING TO THE INSTITUTIONAL ANALYSIS AND DESIGN (IAD) FRAMEWORK

IAD RULE-IN-USE	APPLICATION TO GENERAL PES EXAMPLE	EXAMPLES OF RULES-IN-USE IN PES IN COSTA RICA
Pay-off rules *Rewards and sanctions for particular outcomes*	Conditionality, mode of payment, payment principle, payment schedule by PES modality, timing of payment, transaction costs or intermediaries' fees, fines and other sanctions	• Payments allocated according to land activity • Properties receiving PES are exempt from property taxes[(a)] • Eviction of squatters[(b)] • Sanctions: clearing established forest with intent is illegal and punishable by prison sentences of up to 3 years[(c)]
Choice rules *Allowed, required or forbidden actions at a particular time*	Length of contract, permitted land uses (proxies for ecosystem services – ES), contractual management measures	• Permitted land uses: forest protection, reforestation, forest management and agroforestry • Prohibition to change land use in established forests[(d)] • Passive regulation through buffer zone regulations that restrict land use in and around natural springs, along rivers and streams, around lakes, and in recharge zones[(e)]
Scope rules *Outcomes to observe that may/ may not be affected by action*	Proxy indicators for biodiversity and ecosystem services (land-use/service link), baseline scenario, conservation target, budget	• Budget allocation to different modalities (annual presidential decrees) • Forest cover, number of trees, at farm level

IAD RULE-IN-USE	APPLICATION TO GENERAL PES EXAMPLE	EXAMPLES OF RULES-IN-USE IN PES IN COSTA RICA
Aggregation rules *single/ multiple participation, agreement rules*	Consensus or majority rules on priority setting, selection criteria etc., agglomeration bonuses or minimum contiguous area requirements for collective PES contracts	• Voting rules of FONAFIFO board in determining priority-setting criteria and weights (sector representation) • Regional versus national annual PES allocation quotas • Rules for group contracts(previously)
Information rules *(level of Information, transparency*	Free prior informed consent (FPIC), public hearing processes, freedom of information, monitoring, reportingand verification (MRV) requirements, application process rights and obligations	• Application procedures online and by telephone • Grace periods for obtaining necessary documentation for application process
Boundary rules *eligibility and exit rules that define holder and non-holder positions*	Rules defining: landowner eligibility, contract selection, administration area, priority areas/locations, application fees, contract renewal criteria, contract cancellation criteria, min/max PES contract area	• Priority land uses, landowners and eligibility set by annual presidential decrees • Official requirement for FONAFIFO to support small and medium-sized forestry producers and rural development (work and wellbeing)(f) • System of points-based scoring and ranking of proposals (annual presidential decrees) • Property titles correctly registered in the National Register[18] or uncontested possessory rights in order
Position rules *decision-making positions for actors at a particular time*	Rules defining: actions of instrument initiator, financing institution, external donors, priority-setting, ES buyers (tax contributors, utilities users, certificate purchasers), ES beneficiaries, PES applicants, participants / ES seller, intermediary/facilitator, monitoring authority, reporter, verifier, evaluator	• Responsibility of the state to guarantee a balanced use of its ecosystems(g) • FONAFIFO board determines priority-setting criteria and weights (sector representation) • FONAFIFO is mandated to manage the PES(h), allocated state funding and has the authority (but not a monopoly)[19] to search for alternative sources of national and international funding for PES • *Regente forestal* (forest engineer) as contract intermediary

Notes: (a) Law 7575, art 23. (b) Law 7575, art 36. (c) Law 7575, art 19. (d) Law 7575, art 19. (e) Law 7575, art. 33: 100 metres around natural springs, 10–15m along rivers and streams, 50m around lakes, variable distance in recharge zones. (f) Law 7575, art 3(k), and executive decrees N° 31633-MINAE and N° 31081-MINAE. (g) National Constitution and Law 7575, art 1. (h)Law 7575, art 46. (i) (Law 7575, art 69; for tax simplification and efficiency N° 8114, article. 50. (j) Decree N° 32868-MINAE, Article 14. *Source*: Barton *et al.* (2013).

18. There are many reported inconsistencies with the national property cadastre (register), which is currently under development.

19. The PES programme does not operate as a monopoly, and co-exists with independent local schemes. One example is the private hydroelectric company La Esperanza (see www.eea.europa.eu/atlas/teeb/pes-as-a-strategy-to/view) which makes direct payments to a private reserve protecting cloud forest in their catchment area. The water utility ESPH (see www.watershedmarkets.org/casestudies/Costa_Rica_ESPH.html) also entered a voluntary agreement with landowners in their catchment area, and although it operated independently for several years it has recently joined efforts with FONAFIFO. Even more recently, the local NGO FUNDECOR introduced a direct carbon payment (PSA Solidario) targeting small and medium farmers who do not qualify under the national PES scheme (for instance those without property titles).

FOUR
ASSESSING THE PROGRAMME'S IMPACTS ON ECOSYSTEMS

Costa Rica's PES programme needs to be evaluated for its effectiveness in promoting the protection of ecosystem services. Ideally it should be evaluated for its protection of water and biodiversity, carbon sequestration and landscape beauty, though usually a proxy such as forest cover is used instead. Its intended and unintended secondary impacts on people should also be assessed. The task is not easy. Environmental programmes like Costa Rica's PES are often designed with a weak understanding of causal relationships, which limit how effectively they can be evaluated (Ferraro, 2009). This makes it particularly hard to identify what impacts or outcomes to measure, and which tools to measure with. To explicitly account for multiple conservation and social objectives and indicators, a mix of methods, a theory-based approach, and qualitative evaluation of causality is needed (Ferraro, 2009).

The clarity of the concepts used is key to understanding impacts. This section presents a brief introduction to the main sources of information used to report on the programme's impacts. Much of this information is also used to look at impacts on people, in Section 5.

4.1 EXISTING INFORMATION

In Costa Rica, the PES programme uses an input-based approach, where the amount of forest cover is usually used as a proxy for ecosystem services delivered. Measuring the area under approved land categories (forest protection, forest plantations, natural regeneration, or agroforestry systems) is used for monitoring, without explicit indicators for the quality of the ecosystem service (whether the water is cleaner, for instance). Each land category is expected to affect forest cover in different ways:

LAND CATEGORY	IMPACT ON FOREST COVER
Forest protection	Maintaining existing forest stock, reducing risk of deforestation
Reforestation	Increasing forest cover
Natural regeneration	Increasing forest cover

Evaluations should first take into account whether the agreed form of land management results in changes in forest cover, ensuring that landowners have complied with the agreed PES categories in their contracts. Second, it is important to demonstrate whether these changes are 'additional' – do they add environmental benefits that would not have occurred without this type of land management? This requires constructing a plausible 'counterfactual', or study of what would have happened in the absence of the programme, for each PES contract. To assess programme impacts, we look at the following information:

- A review of existing studies and evaluations of Costa Rica's PES impacts on ecosystem services and social impacts;
- FONAFIFO's database containing information on all PES contracts for the 1997–2012 period;
- Demographic statistics at the district level supplied by the Ministry of Planning (MIDEPLAN).

Table 5 presents the main studies looking at both ecosystem and socio-economic impacts, with and without control groups, as well as at different scales. Other studies are also referenced throughout the document.

TABLE 5. MAIN STUDIES EVALUATING THE IMPACT OF THE PES PROGRAMME IN COSTA RICA

LEVEL	WITHOUT CONTROL GROUPS	COMPARED WITH CONTROL GROUPS (WITHOUT PES)
Regional	Participation in PES. Protection and reforestation in Virilla (Miranda *et al*., 2003) PES, all modalities 1999–2003 in the Osa Peninsula (Barton *et al*., 2009)	Participation in PES in Los Chiles, San Carlos, Sarapiquí (Zbinden and Lee, 2005) Participation in PES in the Osa Peninsula in 2003 (Sierra and Russman, 2006) Participation in PES in the San Juan-La Selva biological corridor (Morse *et al*., 2009) PES agroforestry in Buenos Aires (Cole, 2010) PES protection in Sarapiquí (Arriagada *et al*., 2010) using matching*
National	Participation in PES protection 1997–2002 (Ortiz *et al*., 2003)	PES protection 1999–2005 (Tattenbach *et al.,* 2008) All PES modalities 1997–2000 (Sánchez-Azofiefa *et al*., 2007) PES protection 2000–2005 (Robalino *et al*., 2008) using matching PES protection (Arriagada, 2008; Sills *et al*., 2008) using matching PES protection evaluated by region (Robalino *et al*., 2011) using matching

Note: (*) *'Matching'* is a technique of econometrics widely used in project evaluation. It is based on the comparison of results of an individual who participates in an event with an individual with comparable characteristics ('matched') who does not participate.

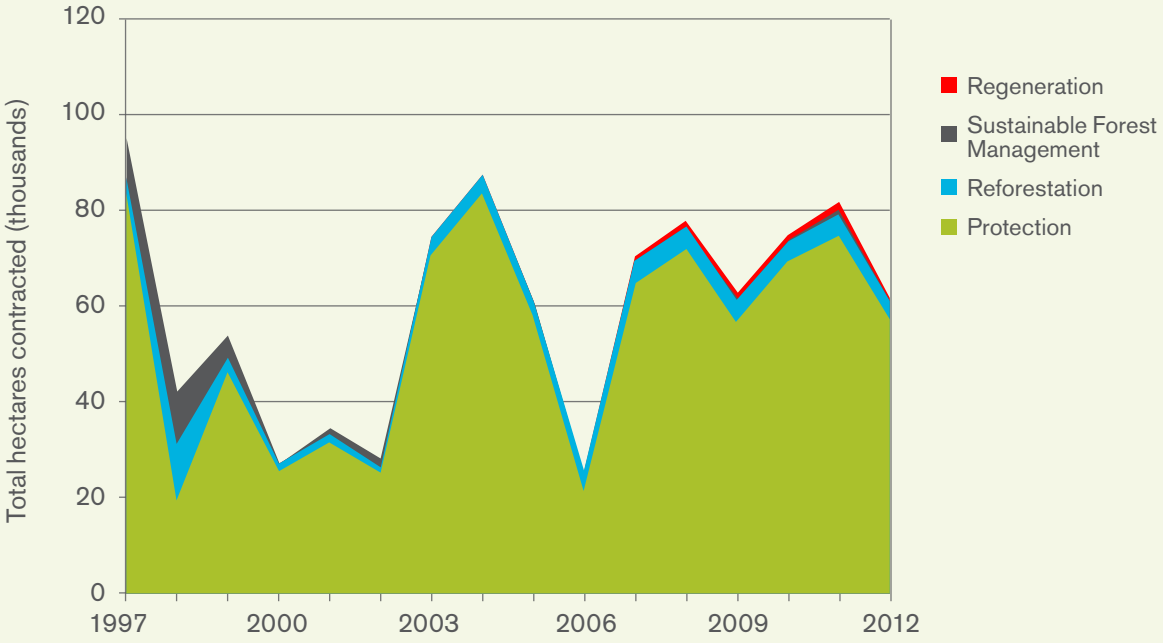
4.2 REPORTED IMPACTS

This section presents the programme's impacts in terms of forest area covered by PES contracts, and results from the main impact evaluation studies.

Since its inception in 1997, the PES programme has promoted conservation in private properties at an average of 60,000 hectares per year. Cumulatively over the period, this represents 961,000 hectares of forests, and nearly 4.4 million trees as part of its agroforestry scheme. Forest protection dominates the programme: it makes up 67 per cent of the total number of contracts allocated, 90 per cent of the total hectares of forest with PES, and has an 83 per cent share of the total budget (see Figure 5 and Table 6). The programme has also introduced forest plantations across 61,500 hectares, supported sustainable forest management in 27,500 hectares and encouraged natural regeneration in 9600 hectares of abandoned pastures.

These figures are not negligible and give an initial overview of the programme's increasing reach. However, they need to be read with caution. The statistics presented in Figure 5 and Table 6 represent the totals (contracts, hectares and dollars) allocated to date, and include ongoing contracts as well as those that have expired and been renewed. The figure for the total number of hectares therefore includes some double-counting of renewed contracts, especially in forest protection contracts which have the shortest contract time.[20]

FIGURE 5. TOTAL HECTARES UNDER PES, 1997–2012



Source: Authors' own, using data supplied by FONAFIFO.

20. Keeping track of renewed contracts is not straightforward. Properties change ownership and registration numbers, and can be sold and subdivided. Analysis based on GIS (geographical information system) will help but data collected on contracts has used different (not always compatible) systems that make comparisons over time difficult. FONAFIFO is currently working on standardising GIS systems.

Figure 5 shows that annual contracting has experienced large variations, but has been relatively stable since the 2007. The total hectares contracted is determined by the annual budget and does not reveal the number of applicants (supply). However, it is noteworthy that FONAFIFO has been able to maintain as higher level of contracting in 2012 than in 1998 despite the real value of PES having fallen by more than 50 per cent in the same time period (Figure 3). While we do not track the total supply of applicants over time, this is an indirect indication of falling opportunity costs of forest conservation in the same period.

TABLE 6. NUMBER OF CONTRACTS, HECTARES AND BUDGET ALLOCATION BY CATEGORY AND YEAR

	TOTAL BUDGET ALLOCATION (MILLIONS OF US$)					
YEAR	PROTECTION	REFORESTATION	SFM*	AF*	REGENERATION	TOTAL
1997	30.3	1.9	2.7			34.8
1998	4.8	7.3	4.2			16.4
1999	10.3	1.5	1.6			13.5
2000	5.6	0.1	0.0			5.7
2001	7.1	1.2	0.5			8.8
2002	5.7	0.9	0.8			7.4
2003	16.3	2.1		0.1		18.5
2004	19.2	2.0		0.4		21.7
2005	26.8	1.7		0.4		29.0
2006	6.8	2.9		0.5	0.3	10.4
2007	20.9	3.6		0.7	0.2	25.4
2008	23.2	3.5		0.6	0.4	27.6
2009	18.6	3.6		0.5	0.4	23.1
2010	22.7	3.3	0.1	0.7	0.3	27.0
2011	24.4	4.2	0.1	0.8	0.5	30.1
2012	38.1	3.3	0.0	0.6	0.3	42.4
% of total	82%	13%	3%	2%	1%	100%
Total	280.9	43.2	10.1	5.3	2.3	341.8

* SFM: Sustainable Forest Management; AF: agroforestry Note: agroforestry contracts are measured by number of trees per contract, and not by number of hectares, unlike the other categories.

Source: Authors' own, using data supplied by FONAFIFO

TABLE 6. NUMBER OF CONTRACTS, HECTARES AND BUDGET ALLOCATION BY CATEGORY AND YEAR (CONT.)

	TOTAL NUMBER OF CONTRACTS					
YEAR	PROTECTION	REFORESTATION	SFM	AF	REGENERATION	TOTAL
1997	553	55	75			683
1998	485	158	103			746
1999	651	140	74			865
2000	355	83				438
2001	381	99	23			503
2002	344	72	36			452
2003	696	138		78		912
2004	937	213		159		1309
2005	705	178		165		1048
2006	295	202		179	15	691
2007	845	239		252	23	1359
2008	785	205		275	23	1288
2009	593	163		207	18	981
2010	875	187	4	266	16	1348
2011	952	232	6	274	29	1493
2012	843	161	2	232	21	1259
% of total	67%	16%	2%	14%	1%	100%
Total	10,295	2525	323	2087	145	15,375

TABLE 6. NUMBER OF CONTRACTS, HECTARES AND BUDGET ALLOCATION BY CATEGORY AND YEAR (CONT.)

	THOUSANDS OF HECTARES AND TREES IN AGROFORESTRY					
YEAR	PROTECTION	REFORESTATION	SFM	REGENERATION	PES TOTAL HA	TREES IN AF*
1997	84.9	3.4	7.4		95.7	
1997	19.6	11.7	11.0		42.3	
1997	46.6	2.7	4.7		54.0	
2000	25.2	1.9	–		27.1	
2001	31.1	2.1	1.4		34.6	
2002	24.6	1.5	2.2		28.3	
2003	71.0	3.5			74.4	103.4
2004	83.9	3.5			87.4	320.3
2005	58.2	3.0			61.2	452.2
2006	21.3	3.5		0.4	25.3	362.9
2007	65.0	4.5		1.1	70.5	545.2
2008	72.2	4.3		1.8	78.3	596.9
2009	56.8	4.3		1.8	62.9	363.9
2010	69.5	4.0	0.3	1.3	75.2	554.1
2011	74.9	4.3	0.5	2.4	82.0	633.7
2012	57.6	3.4	0.0	0.8	61.9	454.7
% of total	90%	6%	3%	1%	100%	100%
Total	862.5	61.5	27.5	9.5	961.0	4387.2

Evaluation of the programme's outcomes requires looking beyond overall statistics. The ultimate question when evaluating the ecosystem impacts of the programme is whether or not PES protects ecosystem services. Although simple, this question involves looking at:

- Indicators used to measure PES environmental effectiveness (either 'output-based' like water quality, tonnes of carbon sequestered, and so on; or 'input-based', like area of forest cover).
- Impacts on ecosystem services from different land uses, and possible 'trade-offs', for example between ecosystem services from protection of forests in large areas versus agroforestry in relatively smaller areas.
- 'Additionality' (see glossary): including forests at risk of changing in the scheme, or focusing on areas with high quantity or quality of forest but at low risk of change, like forests in indigenous reservations.
- 'Neighbourhood' and spill-over effects (see glossary) induced by the programme interacting with other conservation policies, such as national park management affecting the

probability fo participating in PES in the park buffer zone.

- Understanding the relationship between the voluntary nature of participation and the quality of forests included in the programme; e.g. allowing landowners to self-select under voluntary participation will not target priority areas for conservation.
- Understanding how landowners' characteristics (such as level of education) affect the likelihood of their participation in the programme.

Increments in the target variable (for example, hectares of forest) are considered 'additional' if they would not have happened without PES. Although the requisite of additionality is not explicit in the PES programme design or the law that frames the programme, it is nevertheless important for international carbon projects like REDD, and it also makes economic sense to target actions that have positive outcomes. Finding areas that ensure additionality is increasingly difficult and more expensive. As the 'cheap' conservation of remote areas is exhausted, conservation must focus on areas with stronger competition for land use, like urbanisation or high-value export crops.

Evaluation should ideally include longitudinal analysis (analysing data collected over a long period of time) looking carefully at baselines and a similar set of co-variables that explain the level of ecosystem service or forest cover at the country level. However, the studies presented in Table 5 are highly place and time specific and many of the questions above remain unanswered.

Comparison of results is difficult, as they used different methodologies, information collected by FONAFIFO was not uniform for the different periods as they focus on different regions, use different baselines (or none) and were carried out in different years. As noted by Daniels *et al.* (2010),[21] the heterogeneity of studies and the lack of understanding of PES cohorts[22] make it difficult to provide generalised conclusions about PES impacts. With this in mind, it is still possible to distil a few conclusions from the studies:

- The type of methodology used to assess impacts, and how these are defined, affects the results obtained.
- PES impacts need to be understood and evaluated in relation to other conservation instruments, such as PAs.
- Reported impacts are site-specific, and are also affected by the characteristics of the participant, such as his or her capacity for management contracts.
- Strategies that target priority areas for conservation help environmental effectiveness, but can also help social effectiveness if designed with this in mind.

So far, environmental effectiveness has been measured according to the type of forest cover. Effects are measured as forest gain, forest loss, and net deforestation (Arriagada, 2008). However, recent studies have observed significant errors in classifying forests (Kalacska *et al.*, 2008), for example making it difficult to identify threatened deciduous dryland forests in

21. See Daniels *et al.* (2010) for an in-depth analysis of research methods used in existing impact evaluation studies.

22. A cohort is a group of subjects who have shared a particular event together during a particular time span, such as landowners accessing PES between 1997 and 2005.

high biomass herbaceous areas. Newer studies are trying to use more refined information, including the 2010 EarthSat Geographical Information System (GIS) land cover dataset.[23] This has given an initial error matrix lower than in earlier studies (Kalacska *et al.,* 2008) and a better definition of proxies for ecosystem services other than forest cover. These newer studies use established methodologies to measure the four ecosystem services:

- Carbon storage – forest biomass is measured using optimal remote sensing data and existing forest inventory data (Gibbs *et al.*, 2007).
- Biodiversity complementarity[24] – based on forest types and environmental characteristics (Barton *et al.*, 2009), and biodiversity connectivity index (Morse *et al.*, 2009).
- Hydrological services – priority catchments for drinking water and hydropower[25].
- Landscape aesthetics – for example, proximity to major tourism attractions.

Existing studies suggest that results monitoring the programme's effectiveness depend heavily on what is measured and how. In their study of the San Juan-La Selva biological corridor in the north of Costa Rica, Morse *et al.* (2009) suggest that the PES's effectiveness increases if it is measured as 'protecting existing forest', rather than 'increasing forest cover'. They also report a positive (although small) impact on forest cover. On the other hand, a study of buffer zones around a national park by Schelhas and Sanchez-Azofeifa (2006) finds only a 'slight detectable forest recovery' through PES. Although the difference in tendencies can be attributed to different methodologies, a common agreement from the literature seems to be that better 'environmental targeting' is likely to increase the programme's effectiveness. Targeting seeks out areas of environmental importance, to engage landowners in participation in PES by providing additional incentives, rather than leaving landowners to self-select though voluntary participation. However, this would be more costly to implement. Using weighted criteria as part of the national level approach introduced in 2011 is also expected to increase the programme's outcomes, but it is too soon to measure this.

PES performance is often compared to the performance of PAs. Pfaff *et al.* (2008) found that PAs in Costa Rica had an annual rate of 'avoided deforestation' (deforestation that would have happened without the policy instrument) of 0.18 to 0.35 per cent from 1981–96, depending on assumptions made in their impact analysis method (see Table 7). The lower end of this range compares to the 0.13 to 0.26 per cent estimated by Pfaff *et al.* (2009) for 1986 to 1996 and to the upper range (0.2 per cent) found for PES effectiveness from 1997 to 2005 in the areas of the country most prone to deforestation (Arriagada *et al.*, 2010). Based on this simple comparison of impact evaluation results for forests at different locations and for different periods, PAs appear to be more effective from 1981 to 1996 than PES has been from 1997 to 2005 for protecting standing old growth forest, while PES is more effective for increasing secondary forest cover.

The weakness of impact evaluation studies to date, on PES in Costa Rica and elsewhere; is that studies have focused exclusively on changes in forest cover, mostly deforestation rates, without distinguishing between forest types and their biodiversity conservation value. Furthermore, the 'policymix' question asks where in the mosaic of various land uses (e.g. old growth, regeneration) the different instruments such as PES and PAs are most effective, given that they address somewhat different environmental and social objectives. If PES is seen as just one part of a policymix purposefully targeted to complement multiple-use PAs, impact evaluation should also be designed to look at the combined effect of PES and PA.

23. Developed by the US-EPA and based on Landsat imagery with 90m x 90m resolution.

24. Complementarity describes how different species use resources more effectively by coexisting, since each species has different resource requirements, and hence become more productive. The biodiversity complementarity value of a particular area under consideration within a set of conservation areas is related to its contribution to the increment in biodiversity representation in relation to an overall biodiversity conservation target (Barton *et al.*, 2009).

25. See for example www.sirefor.go.cr (in Spanish).

TABLE 7. IMPACT EVALUATION STUDIES OF PES AND PA ON FOREST COVER IN COSTA RICA

STUDY	PES TYPE/ PROTECTED AREA CATEGORY	PERIOD	AREA	COVARIATE ESTIMATION
NATIONAL				
Andam *et al.*, 2008	ASP: PN, RB, RF, ZP, RSV	1960–1997	National	CVM
Pfaff *et al.*, 2009	ASP: PN, RB	1986–1997	National	CVM
Tattenbach *et al.*, 2008	PES: P, M, R	1999–2005	National	R
Sanchez-Azofeifa *et al.*, 2007	PES: P, M, R	1997–2000	National	R
Robalino *et al.*, 2008	PES: P	2000–2005	National	CVM
Arriagada 2008; Sills *et al.*, 2008	PES: P	1996–2005	National	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	National	CVM
REGIONAL				
Sierra & Russmann 2006	PES: P, M, R	1997–2003	Peninsula Osa	R
Sierra & Russmann 2006	PES: P, M, R	1997–2003	Peninsula Osa	R
Robalino *et al.*, 2011	PeS: P	2000–2005	Palmar Norte #	CVM
Morse *et al.*, 2009	PES: P, M, R (CB)	1996–2001	San Juan La Selva	DP
Morse *et al.*, 2009	PES: P, M, R (CB)	1996–2001	San Juan La Selva	DP
Arriagada *et al.*, 2012	PES: P	1996–2005	Sarapiqui	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	Sarapiqui #	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	San Carlos #	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	San José #	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	Pococí #	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	Nicoya #	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	Limón #	CVM
Robalino *et al.*, 2011	PES: P	2000–2005	Cañas #	CVM

Notes: n.s. (not significant at 10%); Area: # FONAFIFO regional office. Types: PES: P=protection; M=forest management; R=reforestation; Protected Areas: NP=national park; RB=biological reserves; RF=forest reserves, ZP=protected zones; RVS=wildlife refuges; CB=biological corridor. Covariate estimation: DP=difference in means; R=regression; M=matching techniques. *Source*: Authors' own

The study by Pfaff *et al.* (2009) of the 1997–2000 cohorts of PES contracts found that most contracts were located on land with very low probability of deforestation, suggesting low additionality from the payments. It also found that PES prevented loss of forest on only 0.21 per cent of land included in the scheme, compared to expected forest loss without payments. Robalino's study from 2000 to 2005 (Robalino *et al.*, 2008) found that less than 0.4 per cent of the plots enrolled in the programme would have been deforested annually without payments. The main reason cited was ecotourism bringing value to forests, but also the enforcement of other conservation policies, like the ban on land-use change. A study by Blackman and Woodward (2010) shows that by 2005 only a third of the land under PES was located in land important for hydrological services, and between 30 and 65 per cent in areas key for biodiversity.

MEASURE	RESOLUTION	1960	1986	1996/7	1999	2000	2001	2002	2003	2004	2005
deforest.	3ha	0.27–0.35%									
deforest.	28x28m		0.13–0.26%								
deforest.	no data				1.43%(projection)						
deforest.	5x5km			0%(n.s.)							
deforest.	28x28m					0.38–0.42%					
net change	census tract				0.78%–1.2%						
deforest.	28x28m						0.61%			0.69%	
brush	property			positive							
prim.forest	property			negstive							
deforest.	28x28m					0.17%(n.s.)					
net change	1ha			0.11%							
deforest.	1ha			1.33%							
net change	property			1.11%–1.67%							
deforest.	28x28m					0.40%					
deforest.	28x28m					0.77%					
deforest.	28x28m					0.34%					
deforest.	28x28m					0.047%(n.s.)					
deforest.	28x28m					0%					
deforest.	28x28m					0%					
deforest.	28x28m					0%					

According to Estrada and DeClerck (2011) the Costa Rican case illustrates what happens in most existing PES schemes: participation is led by landowners and is greatly influenced by the landowner's management capacity – his ability to cover transaction, legal and information costs, and to satisfy land tenure requirements. This results in payments being highly dispersed (resulting in fragmentation of the landscape) or taking place in areas where the threat to conservation is nil or very low, but the socio-economic conditions are more conducive to PES. A lack of targeting further limits the programme's ability to achieve better outcomes (Pfaff *et al.*, 2008; Robalino *et al.*, 2008).

There have been a number of suggestions as to what criteria to use for targeting. These have included areas that face high deforestation pressures (Robalino *et al.*, 2008); continuous blocks of forests in areas with high probability of natural disasters, like flooding or landslides (Ortiz *et al.*, 2003); forest connectivity (e.g. biological corridors) and potential for biodiversity complementarity (Barton *et al.*, 2009). Ortiz *et al.* (2003) also suggested targeting areas with a low scoring on the SDI to prioritise participation from potentially poorer landowners. The study by Miranda *et al.* (2003) in the Virilla watershed suggested flexible approaches to regeneration on vulnerable hillsides and marginal areas protecting water sources. In their study of the Osa Peninsula, Sierra and Russman (2006) proposed that PES may result in more additionality if used for landscape restoration. Shifting participation in the programme to non-forested areas and forest/agriculture interfaces to increase additionality will require shifting the focus from the currently dominant PES for forest conservation to natural regeneration, agroforestry and silvopastoral systems. Daniels' interpretation of Sierra and Russman's results suggests that 'capturing more landholders already engaged in non-forest land use suggests the possibility of greater PES additionality via limiting agricultural expansion, ensuring forest in an agricultural mosaic, and diversifying farm income in a way that produces land rent from the provision of ecosystem services rather than agriculture alone' (Daniels *et al.*, 2010: 2123).

The second part of the programme (see the three phases in Table 3) saw the beginnings of a shift towards better targeting, taking connectivity into account and following a better landscape-based planning approach (see Daniels *et al.*, 2010), introducing agroforestry contracts, and opening local FONAFIFO offices in areas with high risk of land-use change. As a result, impact studies from the second stage of the programme show improved effectiveness (Robalino *et al.*, 2011; Arriagada, 2010). Arriagada's in-depth econometric study in the northern and Sarapiquí areas show how the scheme has led to increases in forest cover on participating farms over a period of 9 years.

Targeting presumes a better understanding of how local characteristics and other confounding variables affect participation, and comparisons of forest cover on land with and without PES. Some of these factors are explained in Table 8, which shows some of the statistically significant variables used in various models measuring the probability of participating in the programme and the probability of participation leading to increased forest cover. Positive correlations are found in almost all variables linked to *location* (remoteness of the farms, those located in high slopes, at higher elevations, and with higher precipitation levels); *landowners' characteristics* (education; off-farm income; property titles); and access to *programme extension*.

TABLE 8. EXAMPLES OF EXPLANATORY VARIABLES FOR PES PARTICIPATION

	FACTORS DETERMINING THE PROBABILITY OF PARTICIPATION IN PES					FACTORS DETERMINING EFFECTIVENESS ON FOREST COVER OF PES VS. NO PES (FARM LEVEL)		
	CENSUS TRACT LEVEL	FARM LEVEL						
Covariates	Arriagada 2008	Robalino *et al.*, 2011	Zbinden & Lee 2005	Morse *et al.*, 2011	Sills *et al.*, 2008	Sierra & Russmann 2006	Sanchez-Azofeifa *et al.*, 2007	Arriagada *et al.*, 2010
Location								
Distance to San José		–						
Distance to nearest town	–	+					+/0	
Distance to nearest national road		+						
Distance to nearest local road		+						
Distance to nearest sawmill		+						
Distance to Atlantic coast		–						
Distance to Pacific coast		+						
Distance to forestry office								+
Distance to nearest port	–							
Area natural characteristics								
Precipitation/Precipitation^2		+						
High slope	+	–	+		+		+	+
Elevation		+						
Area socio-economic characteristics								
Population density	–							
Priority of ecomercados project	+							
Protected area not eligible for PES	–							
Percentage immigrant households	+							
Percentage households use firewood	+							
Percentage off-farm employment	–							
Farm characteristics								
Farm area			+					+
Property has land title			+					
IDA settlement	+							
Deforestation rate prior to PES							–	
Initial forest cover		+			+			+
High soil land use capacity	–							
Opportunity cost of landuse change						+		
Transport cost						+		
Soil degradation			+					
Farmer characteristics								
Indebtedness			+					
Owner age								
Owner education			+					
Residency on farm since 1996					–			
Off-farm income			+					
Agricultural income				–				
Family labour			–					
Prior participation forestry incentives					+			
Prior recipient of extension services			+					
Owner from Central Valley					+			

Source: Authors' own

FIVE
IMPACTS ON PEOPLE

Ecosystems services are essentially about the benefits that *people* get from nature[26]. Thus PES is as much about people as it is about the environment. This has been continually highlighted at international, national and local levels, through the green economy and social responsibility concepts, social justice in REDD+, and from the Millennium Ecosystem Assessment goals promoted by the United Nations, down to the people who are actually affected. Protection of a healthy ecosystem benefits many, especially beyond those who receive cash for participating in the PES. It is particularly important for poorer people who have fewer options for adapting to deteriorating conditions, and whose livelihoods are more reliant on natural resources.

While recognising the wider benefits to society from PES, this section focuses primarily on the impacts on the people directly participating (or excluded from participation) in the PES programme, and strategies to improve its social outcomes.

Incorporating a social agenda within an environmental programme is not easy – and it involves trade-offs in terms of costs, benefits, winners and losers. It typically leads to higher costs in implementing the programme and can mean reduced ecosystem benefits, especially when working with small-scale, potentially scattered farmers rather than large-scale landowners. But it can also have benefits. Social conflicts can be reduced, long-term contract compliance improves if participants perceive it as fair, and importantly, it can lead to political support and secure funding. However, win-win scenarios for equity, economic efficiency and environmental effectiveness are rare. Although Pfaff *et al.* (2008) find no conclusive evidence for losses or gains in efficiency from including the most vulnerable landowners in carbon projects in Costa Rica, more often the emphasis in national and international literature is on the trade-offs (Ferraro and Simpson, 2002; Grieg-Gran *et al.*, 2005; Zbinden and Lee, 2005).

In cases like the Costa Rica PES programme, a high dependence on state funding makes the programme liable to government regulations on the use of public funds. This means ensuring social benefits – for instance demonstrating that public funds do not only go to the wealthier participants – and that the programme results in better quality of life for society in general. But it also brings stricter regulation linked to procurement, in terms of stricter requirements for participation that may limit the programme's flexibility. For example, the requisites of having legal property titles, being up to date on taxes and social contributions, and having a property free of a mortgage are imposed by state regulations on the PES programme managers (see 'boundary rules' in Table 4, Section 3.5). Specifically, the programme is expected to benefit 'small- and medium-sized producers' and indigenous groups, under the assumption that these people are more vulnerable and in greater need of incentives.

But foolproof indicators to identify small- and medium-sized producers are hard to find. The simplest indicator is property size, such as assigning additional points for properties with less than 50 hectares, as implemented since 2012. But property size itself is not an indicator of vulnerability, or relative wealth, given the large

26. Ecosystem *functions* are independent of people. Ecosystem *services* are measured in relation to how they impact people's production and consumption functions.

disparities in land values throughout the country.[27] Asking directly about the household's or legal entity's income may be the most straightforward way to assess relative wealth, but field experience shows how difficult (though not impossible) it is to obtain reliable and comparable indicators of income. The process is further complicated by the participation of legal entities, like *sociedades anónimas*, that 'hide' the characteristics of those who ultimately own the land.[28]

5.1 INSTRUMENTS FOR PROMOTING POSITIVE SOCIAL IMPACTS

Three main instruments have been used by the PES programme so far to target their social impacts: assigning priority of participation to properties located in areas with a low development index (SDI); reducing transaction costs for landowners, improving outreach and using group contracts; and by encouraging smaller farms to participate through income diversification. We discuss the first two instruments here, and discuss income diversification in Section 5.2.

5.1.1 Priority for areas with low social development

The SDI is an indicator of relative wealth used by Costa Rican government institutions to establish priority for social policy and budget allocation (MIDEPLAN, 2007). Suggested initially by Ortiz *et al.* (2003) to improve the social impact of the scheme, it has been used by the PES programme since 2004. The SDI indicator was introduced to the programme to comply with the aims of Millennium Development Goals, and to prioritise PES assignment in territories with a low SDI, prioritising participants located in boroughs with an SDI of less than 40. The rational for using low SDI to target distribution of PES was roughly based on the following chain of expected impact:

Priority of PES in areas with low SDI → increased participation of vulnerable farmers → increased income in poorer rural households

There are at least three assumptions behind this relationship, which we discuss below:

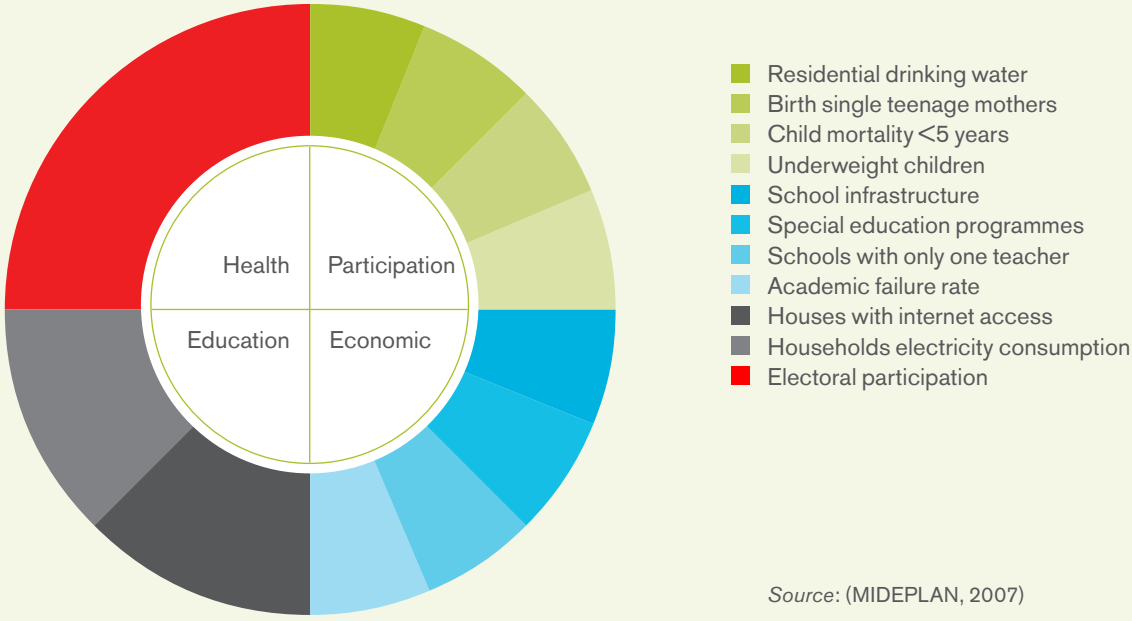
- *Assumption 1:* Lower SDI at the district level is linked to poverty.
- *Assumption 2:* There is a link between local levels of relative poverty measured by the SDI and farms that qualify to enter the PES.
- *Assumption 3:* Higher priority for PES in these areas will be captured by these relatively vulnerable landowners.

Assumption 1: Lower SDI at the district level is linked to poverty. The SDI is centred around the concept of vulnerability and exclusion, resulting in unequal access to and distribution of wealth. It is a composite of 11 indicators grouped under the four main components of health, participation, economics and education (see Figure 6). Their relationship with wealth is described in detail in the MIDEPLAN document. For example, a higher

27. For example, the average value of land in San Pablo de Heredia (near a metropolitan area) is US$120/m^{2,} compared to Sierpe (remote rural area) where the average value is US$1/m^2. Based on land values, a landowner with 50 hectares in Heredia has property worth US$60million, compared to US$0.5 million for the owner of 50 hectares in Sierpe. Equal access in this case does not necessarily mean fairness in priority.

28. One option is to assign extra points to Small and Medium Enterprises (SMEs). However, this could exclude many small family properties registered as *sociedades anónimas* but not as SMEs.

FIGURE 6. MEASUREMENT OF THE SOCIAL DEVELOPMENT INDEX



Source: (MIDEPLAN, 2007)

use of electricity and water corresponds to a higher number of devices (and therefore wealth) in the household. Access to the Internet, and therefore to information, is also linked to potential household wealth. The high levels of abstaining from electoral processes throughout the country make it difficult to establish links to wellbeing, but it is presumed that more motivated people (who feel better off) will be more likely to participate in the electoral process.

Urban areas, with better access to education, economic and health infrastructure, tend to have higher SDI scores than rural areas. The highest SDI scores are located in the centre of the country, around the capital area; the lowest are in the most remote parts of the country, especially along the border with Nicaragua and the Atlantic coast. There are notable exceptions. For example, the boom in the tourism industry, located mostly in rural areas especially along the Central and North Pacific coast, has led to an increase in electricity and water consumption which translates into higher SDI scores – though is not necessarily linked to higher wealth among local inhabitants.

Assumption 2: Link between local levels of relative poverty measured by the SDI and farms that qualify to enter the PES. While wealth and land ownership are clearly related, the relationship

between the SDI components presented in Figure 6 and landowners that qualify to enter the PES programme requires more analysis (landowners need a minimum of 1 hectare for agroforestry, 2 for forest protection, and the average participating farm has 122 hectares).[29] Owning land already gives an advantage of relative wealth compared to those who do not own land, and who proportionally make up the majority of informants for the levels of SDI at the community level. According to MIDEPLAN (2007) some indicators, like low weight in babies and pregnancies in single adolescent mothers, are far more closely linked to vulnerability in marginal urban areas than to farm owners in rural areas. Farm owners that qualify for PES would probably have, generally speaking, the financial ability to seek alternatives for their families, compared to those who do not qualify to participate in PES.

Field studies of participants and non-participants in PES show that the first group is significantly better off than the second; and as Ortiz *et al.* (2003) report, the majority of PES participants across the country are not living in poverty or extreme poverty. The relative wealth of participants varies across regions. The study by Miranda *et al.* (2003) in the Virilla watershed surrounding the capital reports that almost 70 per cent of participating households have a university degree. The study by Zbinden and Lee (2005) in Costa Rica's central and northern areas report that participants of PES are consistently (relatively) wealthier than non-participants: they have considerably larger farms and substantially more years of education, as well as property titles; and about three quarters of participants in forest protection live away from the farm. The thesis by Muñoz-Calvo (2004) in the Osa Peninsula found lower levels of education in participating farmers, with 38 per cent not having completed primary education, but with an average farm size of 138 hectares. He highlights the high levels of social heterogeneity in the area, which includes peasants, indigenous communities, large landowners, and increasingly foreigners.

Assumption 3: Higher priority in these areas will be captured by relatively vulnerable landowners. Since 1997, the PES programme has signed 8,078 contracts (53 per cent of its total until 2012) in areas with an SDI of less than 40, where it has also allocated 53 per cent of its budget (US$187 million). Nearly 20 per cent of the budget allocated in these areas goes to indigenous communities, bringing significant monetary benefits. Very little of the budget goes to contracts with cooperatives.[30] The largest proportion of contracts are equally distributed between individuals and legal entities – 47 per cent each – with the latter also capturing nearly half of all budget allocations (48 per cent) in areas of social priority. Twenty-eight per cent of the budget goes to properties owned by individuals. In terms of property size (see Figure 7, which excludes indigenous groups and cooperatives), although 35 per cent of contracts are with relatively small properties (less than 30 hectares) this group only receives 7 per cent of budget allocations. But the priority criteria seems to benefit larger properties primarily; those over 100 hectares represent 29 per cent of contract allocation and take 65 per cent of the budget.

This analysis suggests that the SDI is biased and too spatially coarse to represent the social impact of the programme at household level. Ideally, priority should be given on the basis of people's characteristics, such as belonging to indigenous groups, gender, income, or land value; or at least a more filtered indicator that combines low SDI and small property size, with larger properties not being prioritised even if they are located in low SDI areas.

5.1.2 Reducing overall transaction costs

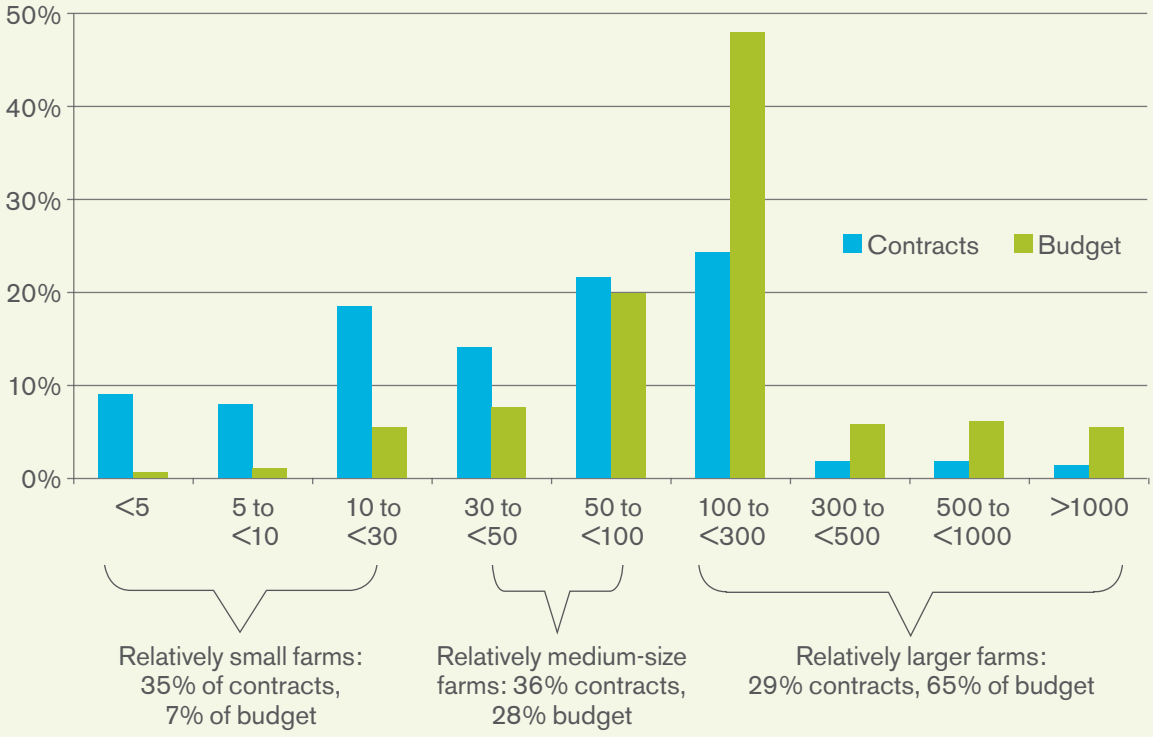
Another strategy to improve social outcomes and programme efficiency (see further discussion in Section 6) is to reduce transaction costs. The PES contracts incur two types of transaction costs: (i) those incurred by FONAFIFO and other scheme actors, that may dissuade the scheme administrators from admitting small landowners (as this will increase the overall number of participants, costs of administration, and reduce economies of scale); (ii) those directly incurred by the participants and which may discourage them from participating in the scheme (Pagiola *et al.*, 2005).

Legrand *et al.* (2013) claim that by 2008, FONAFIFO's transformation into a conventional public institution resulted in the increase of transaction costs reaching 12 per cent of the

29. Average size of participating farms for all observations between 1997–2012, excluding contracts with indigenous groups.

30. Most PES contracts with cooperatives (70 per cent) are in areas with an SDI greater than 40.

FIGURE 7. DISTRIBUTION OF PES CONTRACTS AND BUDGET BY PROPERTY SIZE IN AREAS WITH SDI<40



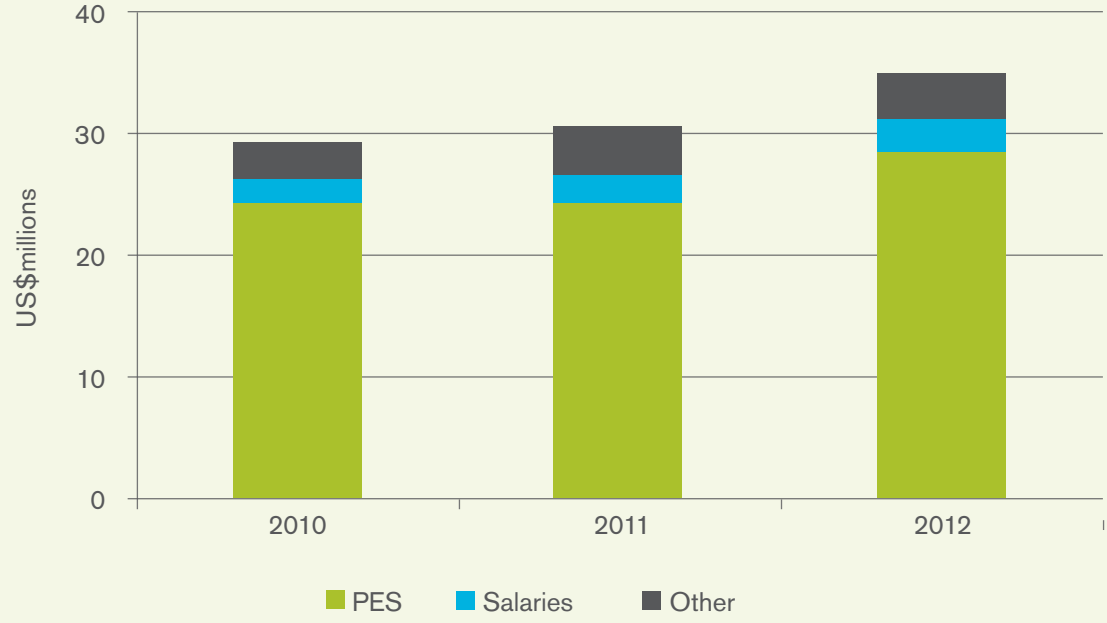
Note: excludes contracts with indigenous groups, cooperatives and associations; total observations 7,619.

Source: Authors' own, using data supplied by FONAFIFO

budget in 2008, according to FONAFIFO in a 2011 interview. From 2010 to 2012, FONAFIFO reports that its annual budget was between US$29 and 35 million per year, of which approximately 80 per cent was transferred to farmers via the PES and 20 per cent kept for administrative costs (see Figure 8). It is unclear whether different accounting methods explain the difference with Legrand *et al.*'s estimates (2013), or whether administration costs are rising – the recent move of central offices to a different building may have contributed to higher administration costs. Administration activities include the costs of revision and correction of applications, and the monitoring and release of payments. Automating some of the processes and linking directly to other public institutions, for example to double check validity of land titles for instance, has substantially reduced the time and costs of recovering information.

The PES transaction costs that fall on farmers are the greatest obstacle to the participation of more vulnerable farmers in developing countries (Grieg-Gran *et al.*, 2005; Pagiola *et al.*, 2005; Villanueva *et al.*, 2011; Rugtveit *et al.*, forthcoming).

FIGURE 8. BUDGET ALLOCATION WITHIN FONAFIFO, 2010–2012



Source: Authors' own, using data supplied by Sanchez (2012)

In Costa Rica the overall application process[31] can be lengthy and tedious, especially for those who are not familiar with the procedure; and technical information is detailed and expensive. Some of the participation requirements exclude the most vulnerable landowners. For example, people receiving social benefits such as housing allowance, or those with mortgages, either cannot participate in the scheme or find it very difficult (Miranda *et al.*, 2004). Fixed costs are high – digital GIS landuse maps of the property must be provided by the applicant irrespective of the size of the contract. Historically, this has been a barrier to small landowners and small agroforestry projects (Rodríguez, 2008; Zbinden and Lee, 2005), emphasising the importance of the 'regente forestals' (forest engineers) role as facilitator for small property holders in particular. Uncontested land titles are a major problem for participation. A recent International Development Bank (IDB) cadastre project uncovered a large number of inconsistencies between cadastral maps (official property register maps) and registered properties (title deeds). Possession rights have been accepted on and off during the lifetime of the programme, but in practice it is difficult for owners of unregistered properties to provide a clear demonstration of uncontested possession rights – resulting in a de facto barrier to these properties.

Rugtveit *et al.* (forthcoming) quantified transaction and compliance costs as a percentage for the payments received for the 'forest protection' and 'reforestation' modalities in the Nicoya Peninsula for PES participants. They found that reforestation contracts have on average transaction and compliance costs of 91.8 per cent of the total payment, suggesting that payments for reforestation are well calibrated as *compensation* for the costs of participation. Transaction and compliance costs of forest protection contracts were on average 24.2 per cent of the PES payment, suggesting higher levels of profit than for reforestation.

FONAFIFO has tried to reduce some of these costs by eliminating superfluous requirements, and by giving more attention to the local level.

31. Every year FONAFIFO publishes a procedural manual indicating priority areas, individual and or group requirements and so on, in its official bulletin *la Gaceta Oficial.*

Apart from FONAFIFO, there are a number of intermediaries who provide services to participating actors for a commission or fee (usually between 12 and 18 per cent of payment) – for example, NGOs FUNDECOR and CODEFORSA and small farmer cooperatives that promote the use of PES. These services include managing applications, and preparing forest management plans. But due to economies of scale, many facilitators prefer to work with larger participants to get a larger percentage as commission.

Group contracts were used successfully to distribute payments in the early years of the PES programme (between 1997 and 2002), especially for small farmers (Ortiz *et al.*, 2003). However, these contracts were discontinued in 2002, due in part to the facilitators inexperience in managing them and in part due to the contracts' design: the noncompliance of one participant would automatically invalidate the whole contract for the rest of the group. Opening local offices filled a gap left by the group contracts, helping to reduce transaction costs, improve access to information and increase individuals' participation in the scheme (Porras 2010; Robalino *et al.*, 2011). The scheme has now reintroduced group contracts for technical assistance, but each contract is signed individually to avoid the problems with the previous contracts.

5.2 DIRECT IMPACTS ON PARTICIPANTS' INCOME

Here we discuss how payments impact directly on participants' income, with special attention to how the PES budget is distributed across types of participants (introduced in Section 3.3) and property sizes. We also discuss the programme's impact in helping to diversify livelihoods through the introduction of agroforestry contracts.

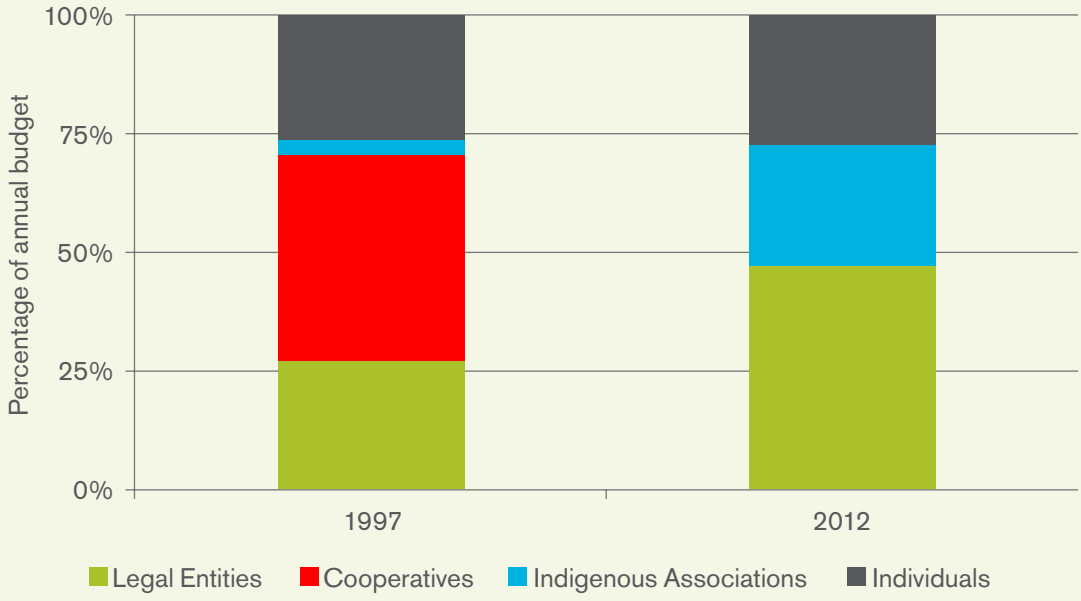
5.2.1 A direct, stable source of cash

The US$340 million distributed between 1997 and 2012 is probably the PES's greatest direct socio-economic benefit. These relatively stable periodic payments are an important income source which diversifies participants' livelihood opportunities, so that revenue comes from the provision of ecosystem services from forests as well as from agriculture. The direct impact is highest in remote rural areas, where PES is one of the principal sources of cash for many participants and a source for income diversification within the farm or group and redistribution within the local communities (for example in cooperatives or indigenous associations). The significance of PES as proportion of household income is less in properties nearer to urban areas, where many landowners do not derive their principal income from their farms (Miranda *et al.*, 2003). However, access to and distribution of these funds has been heavily dependent on the type of participant and their relative wealth, which we discuss in the following sections.

Access and funding distribution by type of participant

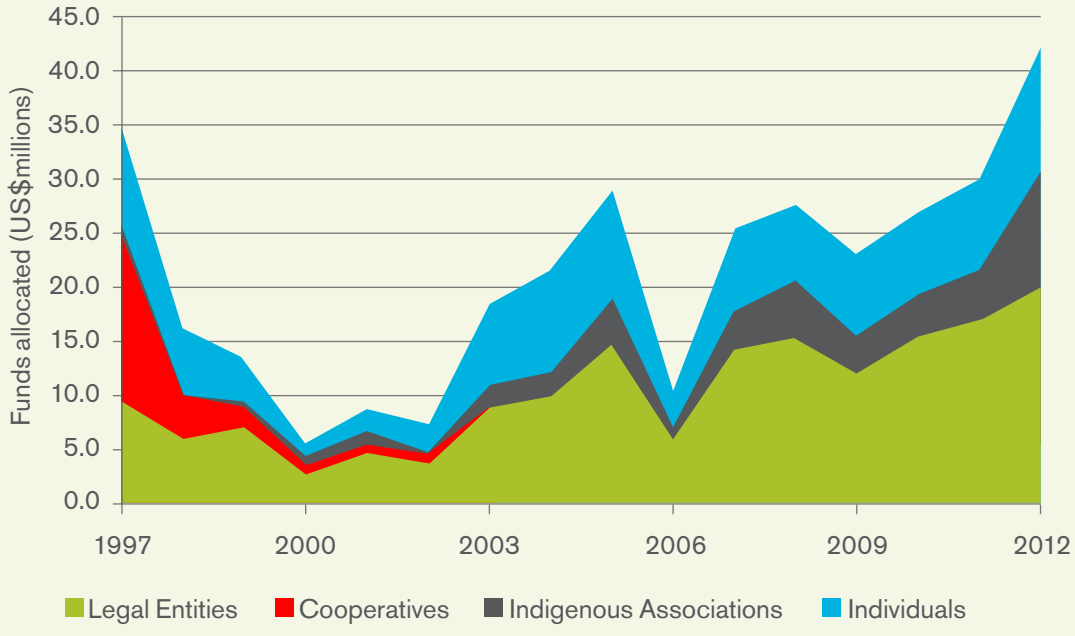
The types of participants have varied enormously since the beginning of the scheme in 1997, when 44 per cent of the funds were allocated to cooperatives and/or associations. Funding for individuals and legal entities were roughly equally distributed (26 and 27 per cent respectively), and indigenous groups received only 3 per cent of funding. By 2012, almost half of the funds were allocated to legal entities; indigenous groups significantly increased their share of the funds; funding allocated to cooperatives significantly decreased (possibly suggesting a general shift from cooperatives to legal entities), and the proportion of individuals roughly remained the same (see Figure 9 and Figure 10).

FIGURE 9. DISTRIBUTION OF FUNDS BY TYPE OF PARTICIPANT IN 1997 AND 2012



Source: Authors' own, using data supplied by FONAFIFO

FIGURE 10. TIMELINE OF FUNDS BY TYPE OF PARTICIPANT, 1997–2012



Source: Authors' own, using data supplied by FONAFIFO

One particular area of positive social impact for the PES is its involvement of indigenous groups: fund allocation to indigenous people grew from 3 to 26 per cent between 1997 and 2012. These territories make up the largest areas of forest cover in Costa Rica outside PAs (Sucre, 2012) and are increasingly involved in decision-making processes regarding forests. They stand to play an even more significant role in future PES and REDD+ negotiations seeking protection for large forest areas. The increased participation of these indigenous territories has provoked mixed reactions. Their low opportunity cost (there are few alternative income sources to PES for these indigenous groups) suggests potential gains in efficiency; but their minimal risk of deforestation also suggests low levels of additionality. Injections of cash from PES are undoubtedly important for local communities, but there are also concerns about potential negative impacts of the so-called 'cash for nature' schemes on indigenous communities, not only in Costa Rica but in the rest of Latin America.

However, from the social point of view, PES has generated important benefits for indigenous communities in Costa Rica. Although the transparency of payment distribution methods within indigenous groups has been questioned (Meland-Rød, 2010), it is unquestionable that the programme is a major source of income for these communities – which has helped them diversify their economic activities, invest in education and local infrastructure, and strengthen local institutions (Borge and Martinez, 2009; see Box 3). Sharing experiences with other indigenous groups in Mexico and Brazil, like the *Bolsa Floresta* carbon scheme – as well as a more targeted approach to local capacity building and contract management – could help improve PES's social outcomes (Borge and Martinez, 2009).

The increasing participation of legal entities partly reflects a general shift in the way properties are registered in Costa Rica; there are benefits to being registered as a limited liability entity, for instance, and this legal form offers anonymity. Legal entities dominate the distribution of payments for reforestation (74 per cent), which partly reflects their ability to invest in technologies and co-funding to guarantee the long-term viability of their forest plantations. It is important however to understand what is behind the changing pattern in the types of the participants in the PES programme – whether it is due to the natural evolution of property titling in the country, or if this happens at the expense of less wealthy landowners (for example, small-scale farmers in cooperatives) who are not able to access payments or lack the capacity to manage them. The anonymity of legal entities as participants[32] also makes it hard to assess the social impact of the PES programme – its real impact on people is obscured by the legal anonymity.

Access and funding distribution by property size

One of the weaker aspects of the programme's social impacts is its de facto bias towards relatively better-off landowners. Various studies report that payments tend to go disproportionately to landowners with higher levels of education, income, and with relatively large farms and diversified income, the majority of whom are not dependent on farming (for example, Miranda *et al*., 2003; Zbinden and Lee, 2005). Excluding

32. Increasingly, contracts are signed using only the entity's registry number (e.g. 3-102-515946 S.R.L.), further obscuring information on whether it is a family business, cooperative, not-for-profit association, real estate investors, or a transnational.

BOX 3. INDIGENOUS WOMEN AND PES: ACOMUITA IN TALAMANCA

ACOMUITA is an indigenous association with 70 women members, mostly heads of households, from the *Bribri* and *Cabecar* communities. According to Justa Romero, leader of ACOMUITA, entering into PES and carbon projects required a lot of discussion within the community. Initially people thought the government was trying to expropriate the land. Other people within the community thought it was an opportunity for them to grab communal forests. After a lot of discussion and clarification of concepts and roles they decided to fully engage in the programme. The money from PES is used to complement community projects. ACOMUITA's activities include improving agricultural practices, developing manufacturing techniques, and enhancing their commercialisation of cocoa products. PES supports the social structure of the community and promotes the work of different base organisations, as well as supporting infrastructure like rural water services, hanging bridges and scholarships to young people. To date, there are many benefits. According to Romero, the main problem with PES stems from the uncertainty of long-term funds. But the association is trying to weave this PES money into their activities, promoting activities that will be self-sustainable in the long term, reducing their dependency on future payments.

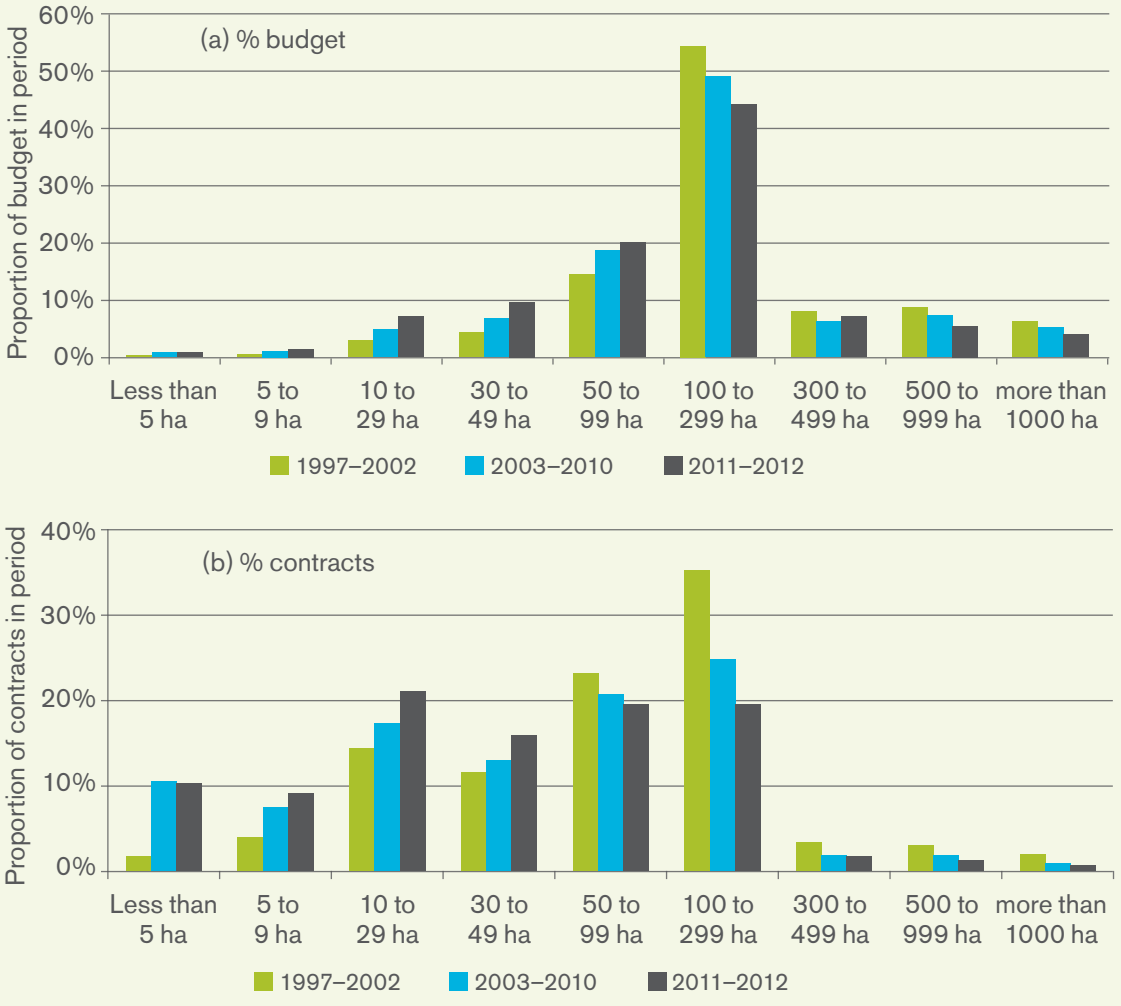
Source: Justa Romero, in Porras (2013)

indigenous and group contracts, the average property size participating in the PES programme between 1997 and 2012 was approximately 115 hectares, with an average size of a little over 70 hectares for individuals, and 160 hectares for legal entities. Matulis (2012) attributes this bias towards large landowners to the fixed cost of transaction and monitoring incurred by *regente forestales* who act as intermediaries.

Larger farms of between 100 and 300 hectares held the greatest share in number of contracts and proportion of the whole PES budget (26 and 49 per cent respectively). Smaller properties (less than 30 hectares) have an increasing proportion since the introduction of agroforestry contracts (34 per cent of all contracts), but their share in the budget remains low (7 per cent). Contracts with larger farms of more than 300 hectares are less common (5 per cent) but they hold a substantial share of the funds distributed at 19 per cent – see Figure 11.

Figure 11 shows the share in budget and number of contracts by property size, in terms of the programme's three main stages (1997–2002; 2003–10; and 2011–13), presented earlier in section 3. Properties of over 100 hectares take the majority, although they have a decreasing proportion of the budget allocation (77 per cent, 68 per cent, and 61 per cent respectively) and therefore a lower proportion of contracts (44 per cent, 30 per cent and 24 per cent respectively). Participation of small properties has been on the rise throughout the three periods, representing 21 per cent, 36 per cent and 41 per cent of contract allocation, and modest but increasing budget shares of 3 per cent, 7 per cent and 9 per cent respectively. Medium-size properties (30 to less than 100 hectares) remain roughly unchanged at 35 per cent of contract allocation throughout the period, although a concentration on the smaller

FIGURE 11. SHARE OF BUDGET AND NUMBER OF CONTRACTS BY FARM SIZE AND MAIN PERIOD



Note: excludes group contracts and those with indigenous groups.

Source: Authors' own, using data supplied by FONAFIFO

FIGURE 12. SHARE OF BUDGET BY LEGAL ENTITIES AND INDIVIDUALS BY FARM SIZE

Note: SA = *sociedades anónimas*, legal entities, roughly equivalent to public limited companies.

Source: Authors' own, using data supplied by FONAFIFO

end of this range is discernible, but their share of the budget has increased (19 per cent, 25 per cent and 30 per cent). The programme has been effective in increasing participation of smaller-sized properties over time, even if their share of the budget is still relatively small; and it has continued to be effective at engaging with small- and medium-scale landowners.

Most of the budget allocated to smaller farms (less than 30 hectares) goes to those belonging to individuals. The distribution of the budget to individuals and legal entities is equally distributed for medium-sized farms, but the greater proportion of the budget allocated to larger farms is captured by legal entities (clearly shown in Figure 12). The majority of payments for very small farms (less than 5 hectares) are captured by individuals in agroforestry and reforestation contracts. Payments in very large farms (1000 to 2000 hectares) go mostly for forest protection and reforestation.

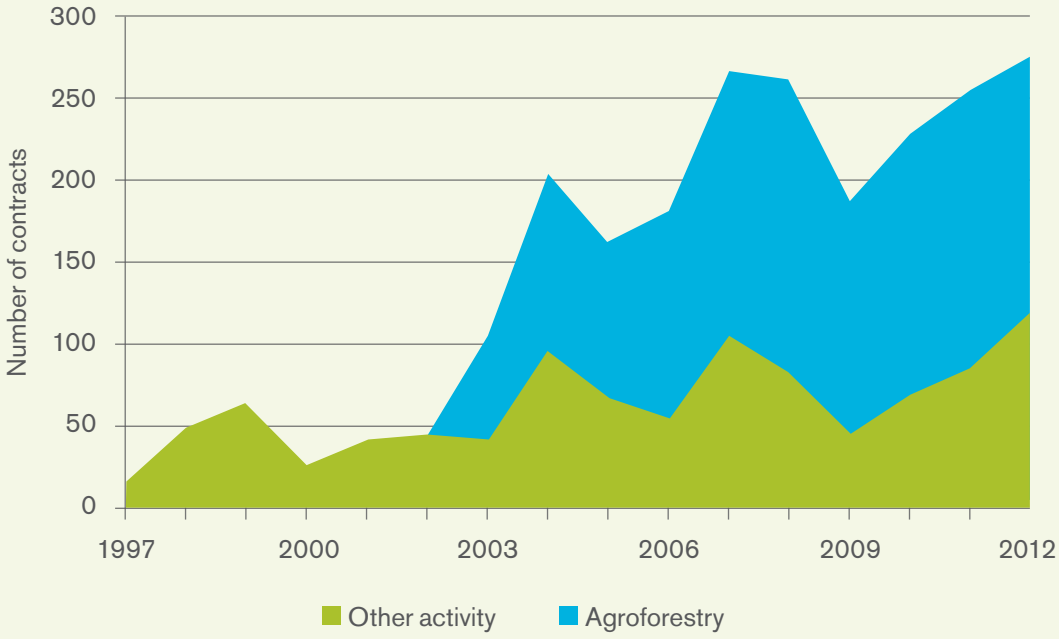
5.2.2 Encouraging income diversification in small farms through agroforestry

The bulk of PES contracts are for forest protection, many of which are farms with a high proportion of forest cover (see for example Zbinden and Lee, 2005), which has restricted landowners from carrying out income-generating activities. This discouraged potential participants who either did not have large properties already covered in forest, did not want or could not afford to dedicate large tracts of their land to forest alone (Miranda *et al.*, 2003, Porras and Bruijnzeel 2006, Casasola *et al.*, 2009, Ibrahim *et al.*, 2010).

FONAFIFO responded by introducing agroforestry contracts, which have proved very popular and increased the participation of smaller properties (see Figure 13). For example, contracts with farms of less than 10 hectares have increased from 15 in 1997 to 276 in 2012, with 82 per cent under individual ownership (rather than legal entities). Co-funding from soft loans and technical assistance have also been important instruments to promote participation and benefits for small-scale landowners.

The money obtained through the PES is regarded as a crucial co-investment for activities like reforestation, forest management and agroforestry, and promotes the economic attraction of forest activities (Morse *et al.*, 2009).

FIGURE 13. PARTICIPATION OF SMALL FARMS (LESS THAN 10 HECTARES)



Note: 'other activity' refers to all the other PES activities, although conservation is the largest share of this 'other'.

Source: Authors' own, using data supplied by FONAFIFO

5.3 INDIRECT SOCIO-ECONOMIC IMPACTS

According to Ross *et al.* (2007) the macroeconomic impact of the PES scheme has been modest. However, much remains to be investigated; its direct effects on family and small business incomes, indirect effects on the tourism industry, and the influence of various ecosystem services (water quality for example) on quality of life in general. Apart from an initial study by Ortiz *et al.* (2003) there has been no comprehensive study of the social impact of PES, taking into account control groups and/or a nationwide analysis. Ross *et al.* (2007) propose the use of new techniques for the valuation of non-market benefits and for securing market feedback in

hypothetical simulations of conservation policies on a large scale. In the absence of such studies, the analysis below describes the results of specific studies and our own analysis of existing distribution of the PES programme funds.

5.3.1 Impacts on jobs

From individual studies we find that outside indigenous areas in Costa Rica, PES have shown a modest impact on the supply chain by generating jobs, promoting infrastructure and microbusinesses for the timber industry through PES for reforestation (Miranda *et al*., 2004, Tacconi *et al*., 2010), and of the ecotourism industry through PES for forest protection – where they provide a stable flow of income that helps to counterbalance the fluctuations of ecotourism markets. On the other hand, potential negative impacts in jobs can take place if forest protection results in the abandonment of agricultural lands that could have generated jobs (Porras *et al*., 2008). Zbinden and Lee (2005), for example, report that farms that do not participate in PES have a greater number of farm workers than those participating in forest protection, which is to be expected since economic activities are not allowed under forest protection contracts. There has still not been a rigorous evaluation of intangible benefits such as perceptions of the scheme, community and group relations, or perceptions of justice. There are, however, studies that stress how these benefits may be key to securing participation, even (or perhaps especially) when the scheme does not totally compensate for opportunity costs (Blackman and Woodward, 2010).

5.3.2 Cross-compliance: PES as incentive for land tenure security

Sorting out possession or tenure rights is one of the most important benefits of the PES scheme (Locatelli *et al*., 2008; Porras, 2010). Barton *et al.* (2013) discuss PES's indirect benefits in terms of cross-compliance with other policy objectives. The PES Operations Manual (FONAFIFO, 2009) specifies legal conditions that must be met regarding property titles: they must be correctly registered in the National Register (i.e. the title deeds) and consistent with the national property cadastre (i.e. the property map), which is currently under development. A number of cadastral inconsistencies can delay or disqualify PES applications (see Table 9). A study carried out in the PESILA-REDD project using IDB cadastre project data from the Osa Peninsular biological corridor found that more than 42 per cent of properties, covering 70.5 per cent of the land area, were affected by 'cadastral inconsistencies' which would limit applicant access to PES. The criteria for determining significant inconsistencies in terms of PES application procedure are given in Table 3. The Operations Manual provides detailed information on grace periods for obtaining necessary documentation to resume the application process (information rules). Applicants may also qualify if they can document possession rights, but the process of documentation and obtaining witnesses is laborious. Smallholder applicants may choose to pay surveyor and legal services to obtain a formal title, sometimes borrowing money in informal credit markets against the first PES payment (Porras *et al*., 2012). It could be argued that PES is a hybrid, or policymix instrument if tenure regularisation is ascribed as one of its formal objectives. FONAFIFO personnel argue that PES is an effective tool for land tenure regularisation (Sánchez, 2012). How important PES is for

TABLE 9. UNDERSTANDING TENURE SECURITY - DO 'CADASTRAL INCONSISTENCIES' AFFECT PES TARGETING?

SITUATION	CADASTRAL INCONSISTENCY	IMPLICATIONS FOR PES APPLICANTS
1	Plot without property map or register information	Cost; time to obtain property map and register may exceed PES annual application deadlines
2	Plot defined by 'posession' information rather than official title	None. Follow procedure in PES *Operation Manual* to quality for PES
3	Property registered without property map	Cost; time to obtain property map may exceed PES annual aplication deadlines
4	Difference due to larger property size relative to register (>10%)	Cost and time for a process of possession on any excess area
5	Discrepancies in registered information	None. Follow simple procedure for rectification of register information
6	Physical overlapping boundary lines of registered property	Subject to negotiation between neighbours – at least one of the affected parties must make a new property map and rectify register information
7	Apparent overlapping boundary linesof registered property with public property (public roads, Coastal Maritime Zone)	Cost and time to make a new property map
8	Property registered with different property map	Simple modification of register information if another property map exists; or cost and time to make a new property map
9	Property registered in a different district	None. Follow simple procedure for rectification of register information
10	Two or more property boundaries not identified	Cost and time to make a new property map and negotiation between neighbours
11	Map incompatibile with physical reality	Cost and time to make a new property map and negotiation between neighbours

Note. Red indicates situation where the cadastral inconsistency results in additional costs for the PES participants.

Source: interpretation by Benavides (2013).

tenure regularisation depends on the causes of tenure insecurity. For example, there are a number of areas in Costa Rica where the agricultural development institute (IDA) has given possession titles to smallholders for land which has been officially described as indigenous reserves or forest reserves (Miranda, 2013). The outcomes from these institutional clashes are emerging. Anecdotal reports suggest that landowners have recently had problems renewing PES contracts in areas previously enrolled, but now find themselves in ambiguous land tenure situation where their land is now argued to be state patrimony (pers. com. Garro Arroyo, 2012).

5.3.3 Cross-compliance: PES as an incentive for social security and tax compliance

Another example of cross-compliance which has not been well documented is the requirement that PES participants have no outstanding debts with the national social security system (FONAFIFO, 2009). This is a direct example of cross-compliance designed to guarantee that farm employees have access to social security financed health services. Another example of unintended cross-compliance may be land taxation. Although land under PES is exempt from property tax, a long-term effect of PES-driven tenure regularisation may be an increase in the tax base once properties leave the PES scheme. This remains to be studied in depth (Barton *et al.*, 2013).

5.3.4 Impacts on gender

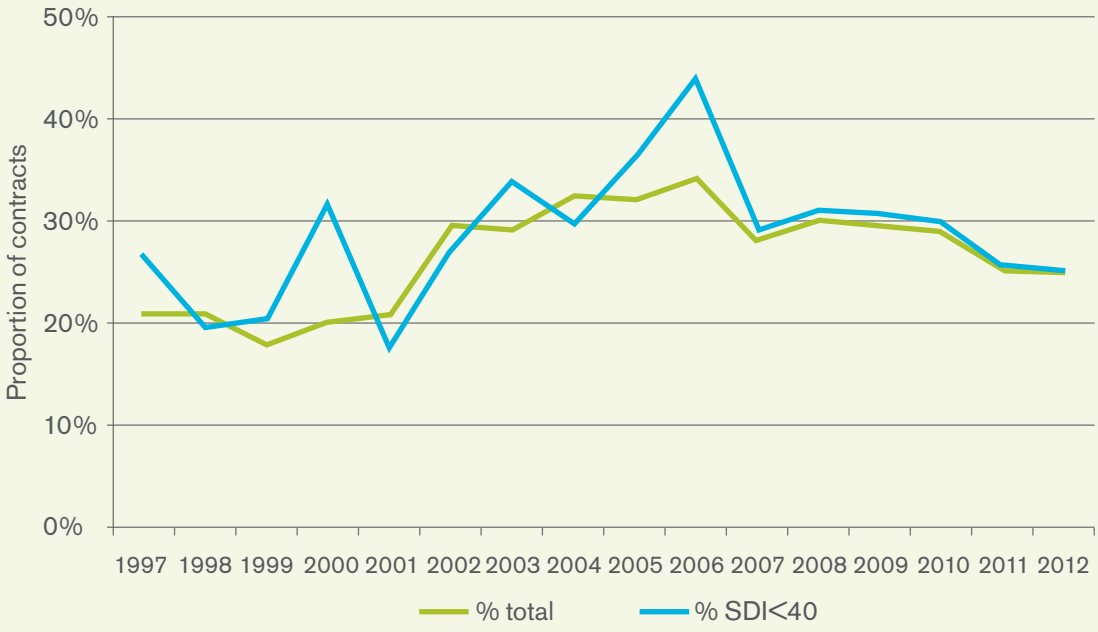
Of all PES contracts with individuals (rather than legal entities or associations), 28 per cent are with women (1988 contracts). Of these, 1,094 (55 per cent) are located in relatively vulnerable parts of the country – boroughs with a SDI of less than 40. Female-headed properties are small to medium size, 66 hectares on average, with 46 per cent properties being less than 30 hectares. Figure 14 shows how female participation has increased in the programme, despite initial low levels of participation reported by Ortiz *et al.* (2003). Although not a national-level strategy, projects like Ecomarkets give priority to women. However, measuring gender in the PES programme is difficult. Culturally, in Costa Rica, land ownership is assigned to a male member of the household, which tends to skew statistics. More importantly, personal indicators like 'gender of landowner' are hidden when properties are registered as companies, associations, cooperatives or those with indigenous communities, which increasingly take the largest share of the contracts.

5.4 SUMMARY

In summary, the PES programme has created an opportunity for smaller properties to participate with the introduction of agroforestry contracts, and has significantly increased the participation of indigenous communities and female-headed households. The SDI has limited usefulness for assigning priority to PES applications. With only a few exceptions, like indigenous areas, low SDI scores are not likely to represent those who are actually eligible to participate in the PES. And of those who have benefited from the social priority criteria of an SDI below 40 to access PES, a significant amount of funds are being captured by relatively large farms. This suggests that although some small and potentially vulnerable landowners have benefited from priority access, given the low SDI in their area, the principal beneficiaries of the social priority criteria have been relatively large landowners. Up to 2012, a significant proportion of the PES programme was captured by larger properties, many of them increasingly held by legal entities. Whether this fulfils the programme's mandate to support small- and medium-scale farmers is debatable. While not all legal entities are necessarily wealthy, and many of them are family enterprises, it is still likely that the owners of legal entities in PES are, on average, wealthier than individual PES contract holders, given the high legal costs of keeping a private company up to date (Viquez, 2013).[33] On the other hand, it is also possible that legal entities are better placed to invest in improved management techniques for reforestation, regeneration, and forest management, as well as having a better grasp of marketing which increases the chances of reinforcing the attractiveness of forestry activities and the creation of more jobs. More information is required to understand how to promote participation of one group without negatively affecting access by another.

33. Registering a property as a *sociedad anónima* has advantages in terms of tax-breaks, resale process, legal liability, etc. However, it incurs relatively high legal expenses compared to individual land ownership. According to Viquez (2013; a local notary with land expertise), although the trend is slowly changing in more rural settings, cash-strapped farmers still register land under their own names.

FIGURE 14. PARTICIPATION OF FEMALE-HEADED HOUSEHOLDS IN PES (1997–2012)



Note: observations only include contracts with individuals, where gender of the landowner is reported. Total valid observations: 7,175, of which 1,989 were signed with females; and 3,816 individual contracts of which 1,094 were signed by women.

Source: Authors' own, using data supplied by FONAFIFO

Although the PES programme is not specifically a poverty-alleviation tool, it has social and economic obligations to fulfil, as required by law. The programme is continually presented nationally as an instrument to promote rural development and redistribution of wealth. Using an appropriate theory of change, it is important to define what the likely socio-economic impacts from PES are, such as increased income or more jobs; how to address participatory justice by specifically targeting providers of ecosystem services who need support, for example more vulnerable farmers or indigenous groups; and what indicators to use to evaluate who wins and who loses, such as income at farm level, or aggregate district data (see Grieg-Gran *et al.,* 2013).

SIX
COST-EFFECTIVENESS

It is difficult to make decisions that balance environmental effectiveness and positive social impacts, while ensuring that a programme continues to be manageable. The country is running out of 'cheap' conservation (e.g. in areas with low opportunity costs) and there is a need to look into non-conventional management systems beyond forest conservation while offering value for money.

In order to better understand the 'value for money' aspect of the programme, this section is divided in three:

1. Approaches to increase environmental effectiveness through spatial targeting, which builds on Section 4.
2. Opportunity costs of participation, which builds on previous discussions on how landowners' characteristics affect potential programme effectiveness.
3. Differentiated payments to increase cost-effectiveness.

Policy makers are continuously under pressure to produce value for money (introducing auctions for example – see Box 5). Nevertheless, a focus on cost-effectiveness alone needs to be treated carefully, with particular attention to the effects of the voluntary nature of participation. If payments are geared towards lower opportunity costs (Sierra and Russman, 2006), focusing on the number of hectares may not necessarily correspond to areas at risk, or take into account issues of distribution and fairness that can be very important in a programme of this nature.

6.1 SPATIAL TARGETING OF KEY ECOSYSTEMS

One of the main concerns about landowners' voluntary participation in PES is the quality of forests enrolled in the programme. Although potentially cheaper than establishing PAs (World Bank, 2000), there is no guarantee that PES will protect forests that are more at risk. The short-term nature of contracts[34] is also a problem. While it satisfies farmers' desire to enter and exit the programme within a reasonable period of time, it clashes with the long-term ideal for biodiversity conservation. A purely voluntary approach does not necessarily create the continuous blocks of protected forest necessary to provide biological corridors, buffer zones to protect key water sources, roaming space for large animals like jaguars, or forest on slopes that help reduce the risk of flooding (see for example Bradshaw *et al.*, 2007). This can only be achieved by spatial targeting, where the PES takes the initiative to prioritise areas it deems to be a conservation priority, through engaging with landowners or providing special incentives.

Spatial targeting using a landscape approach allows programme managers to determine what investments will be required to provide the ecosystem service. This will result in different costs for conservation or for the adoption of practices, depending on the actual ecosystem service provided – whether carbon sequestration, water protection, biodiversity conservation or natural beauty. A more narrow focus on the ecosystem service – such as biodiversity, rather than just forest cover – could lead to a more varied mosaic of land uses that provide positive outcomes, including agroforestry and silvopastoral systems (Rapidel *et al.*, 2011).

34. FONAFIFO has in recent years increased contract length from 5 to 10 year contracts for conservation.

Spatial targeting can be done by directing the payments towards areas more likely to generate ecosystem services. For the Costa Rican PES these areas have been selected following a rigorous consultation that defined the conservation gaps and priorities for conservation strategies outlined in Section 2.2. Although enrolment in the programme continues to be voluntary, the introduction of the priority matrix is expected to result in better spatial targeting. The priority matrix awards higher points to forest protection applications located in pre-selected areas, such as forests in conservation gaps, biological corridors, indigenous territories and those located around important water sources (see Table 3 in Section 3.4).

It is still too early to evaluate whether higher points result in more contracts allocated in the areas of geographic interest, and if this improves the provision of ecosystem services. However, it is expected that this approach will generate better outcomes than the first-come, first-served system used in the early years of the programme. Barton et al. (2009) found that spatial targeting criteria in the ACOSA improved biodiversity complementarity of PES contracts relative to the early first-come-first-served approach. Better new technology, like satellite imagery with higher resolution and GPS at farm-level monitoring, will also facilitate targeting and pursuing better ecosystem outcomes. For example, Estrada and DeClerck (2011) used aerial photos and other methods to show how to best identify sites that contribute to a higher reduction of sediments (as well as biodiversity protection) around hydroelectric projects, which can then be used to target actions at watershed level.

Modelling can also help improve ecosystem outcomes. The study by Barton *et al.* (2009) in the Osa Conservation Area (see Box 4) used biodiversity complementary and opportunity costs as allocation criteria for contract distribution, and found that the cost-efficiency of the programme could be significantly improved. The study by Wünscher *et al.* (2007) in the Guanacaste area highlights the efficiency gains (between 58 to 88 per cent) that could be achieved by targeting payments to landowners based on both service provision (by ranking each parcel's total ecosystem services' score) and the opportunity cost of service provision.

Although it is difficult to see the immediate viability of these data-intense approaches, they highlight the importance of understanding how local characteristics affect programme participation. A purely geographical approach to prioritising areas does not guarantee that farmers living in these areas will participate. A better understanding of opportunity costs, and what affects the likelihood of forest conversion in the context of PES can help improve the programme design, moving towards a more tailormade suite of incentives that improve the quality and quantity of ecosystem services (Robalino *et al.*, 2008). In the next section we discuss these issues in more depth.

6.2 OPPORTUNITY COSTS OF CONSERVATION AND PES PARTICIPATION

In economics, the opportunity cost of an activity such as forest conservation is defined as the highest forgone profits of not putting the land under an available alternative (such as producing palm oil). These costs are spatially explicit, time-specific, and are affected by a wide range of legal and market rules affecting choice (presented in Table 4). They are also affected by the methods chosen for economic valuation (Grieg-Gran, 2008; Olsen and Bishop, 2009; see Table 10).

BOX 4. A PROPOSAL FOR ALLOCATING CONSERVATION PRIORITIES AND EVALUATING THE PES PROGRAMME

The projects POLICYMIX and PESILA-REDD[35] propose using the cadastral maps (which has been recently updated for most of the country) of the property as the basic unit of analysis. Property boundaries can be used as the basis upon which to evaluate the scheme and prioritise participation. Units of (registered) land are also used as the basis for the analysis of social and economic indicators. The main objective of the land register information system is to improve property taxation and tenure security. A collateral benefit is expected to be greater ease in prioritising the additionality of PES, necessary to comply with the carbon sequestration goals of a country's strategy using a base year of reference (i.e. 2012) until the year 2030. GIS and conservation planning software is used with cadastral information together with criteria and weighs for prioritisation of PES applications (for example conservation gaps, wild PAs, biological corridors and protection of hydrological resources), social requirements (for example co-benefits expected under REDD+, or legal regulations), and economic information (for example opportunity and transaction costs). Conservation planning models create simulations of possible distributions of PES contracts that maximise conservation objectives given the priority criteria described above. This spatial allocation may serve as the benchmark for the periodic definition of criteria and weightings to be used during the period of a strategic planning cycle (for example 5 years).

Evaluation studies presented in Section 4 show how impact heterogeneity is linked to land characteristics (such as location and size) and landowners' characteristics (such as education). Understanding how PES varies between sub-groups of the population provides a better understanding of the opportunity costs of participating in PES.

For our discussion, we focus on two factors affecting opportunity costs; regulations and rules, and profitability from alternative land uses:

a) Rules-in-use affecting forests. Table 4 introduced, amongst others, the 'choice rules' allowing or forbidding actions at a particular time, and 'pay-off rules' including sanctions. Forest conservation is directly affected by the prohibition to change land use in established forests, with prison sanctions for those who break the law (Law 7575, art 19); the state's right to expropriate private lands of high conservation importance (Law 7575, art 2); as well as passive regulation of buffer zones that restrict land use in and around natural springs, along rivers and streams, around lakes, and in recharge zones (Law 7575, art 33). For PES specifically, spatial priority-setting for the programme is set out by annual government decrees (Art. 22).

b) Profitability of forest conservation in relation to other uses. Forest activities struggle to be economically attractive in some parts of the country. For example, an analysis of profitability of economic activities (including forest plantations) in the San Juan biological corridor in the north of Costa Rica shows how forestry plantations, even including PES services, find it difficult to compete with other economic activities if and when they are legally and technically viable (Pitacuar, 2010). For example, the rental value of a site suitable for export-grade pineapple is about US$390 per hectare per year, or could be sold for approximately US$5800/ha (Daniels *et al.*, forthcoming); whereas PES conservation would earn US$65/ha/year.

Alternative land uses go beyond agriculture, and any assessments of opportunity costs should include urbanisation and tourism. Uncontrolled urban expansion is currently one of the principal sources of pressure on forests in Costa Rica

35. POLICYMIX: Assessing the role of economic instruments in a policy mix for biodiversity conservation and ecosystem services provision (2010–2014). FP7 European Union. http://policymix.nina.no. PESILA-REDD: Payments for Ecosystem Services in Latin America in the context of REDD integrating methods for evaluating the enabling conditions and cost-effectiveness of PES (2011–2014), Norwegian Research Council.

TABLE 10. VARIABLES AFFECTING OPPORTUNITY COSTS IN FOREST CONSERVATION

ECONOMIC, SOCIAL AND GEOGRAPHICAL/PHYSICAL FACTORS	METHODOLOGICAL CONSIDERATIONS
• Regulations and laws affecting resource use • Primary commodity prices and variations over time • The suitability of particular forest lands for different uses • Soil and climate conditions which affect yields and hence returns for agriculture • Scale of operation – small, medium, large • Inputs and technology • Distance from market and the quality of transport infrastructure	• Measurement of timber harvesting and land clearing costs • What type of forest land use is considered (protection, management, etc.) • How alternative land uses are modelled • Which carbon density estimates are used • Whether cost curves or points for carbon abatement are estimated • Differences in assumptions on discount rate and time horizon • Differences in assumptions about the cost of labour, particularly family labour

Source: Grieg-Gran (2008)

(Hope *et al.* 2005; Daniels *et al.* 2010; Porras and Bruijnzeel, 2006). These pressures include:

- Sub-dividing larger farms into smaller units, making them easier to sell for recreational purposes at higher prices; this results in a more fragmented landscape, which is more difficult to manage for conservation purposes.
- Conversion of forest (e.g. to urban uses) and the potential negative impacts on ecosystem services, such as increased sediments in water, loss of biodiversity.
- Increase in solid wastes from uncontrolled urbanisation of rural areas.

In Table 11 we attempt to summarise the relationship between landowners' statutory rights to deforest, the associated conservation costs that need to be considered, and the potential role that a PES service may play in these situations.

Gregersen *et al.* (2011) discuss the role of statutory rights in determining opportunity costs of conservation. For example, if landowners or users do not have the statutory right to deforest, the relevant conservation cost for the government should be that of improving the enforcement of the law (provided that it is feasible to do so). In this situation, if the profits from alternative economic activities are low (for example, the farm is in a remote location) then PES will be an attractive incentive.

But if landowners have a right to deforest, the associated conservation cost should be a direct market-based study of opportunity costs associated with alternative land uses – and it

TABLE 11. COMPARING THE POTENTIAL VIABILITY OF PES IN DIFFERENT SCENARIOS

		STATUTORY RIGHTS TO DEFOREST		
		YES	NO	UNCERTAIN
ASSOCIATED CONSERVATION COST		Opportunity costs of alternative land use	Costs of monitoring and enforcement	Perceived opportunity costs + costs of imperfect monitoring and enforcement
PROFITS OF ALTERNATIVE ACTIVITIES	HIGH PROFITS	Areas suitable for pineapple production, for example: **PES does not compete**	**PES may help** only if regulation is strongly enforced, but there will be high pressure for forest conversion. May require higher levels of payments	**Uncertain**. PES may not compete if *perceived* benefits are high compared to risks of detection
	LOW PROFITS	PES will help increase viability of conservation but **higher PES levels may be required**	**PES highly competitive**. Lower levels of payments may be acceptable	**Uncertain – PES may help discourage** illegal change; but pressure for change is low

Source: Authors' own, based on Gregersen *et al.* (2011) and Barton *et al.* (2012)

is highly likely that PES will not compete if the alternatives are highly profitable. However, PES may compete if the profitability of alternatives is low, or where landowners of secondary forest with some minimum threshold of off-farm income (or are absentee owners) are faced with the annual or semi-annual decision to clear early successional growth through burning and cutting. In cases like this, PES may help tip the balance toward securing forest regeneration. Without payments, the farmer will likely clear the forest or limit its growth to avoid future restrictions (e.g. prohibition to clear once the forest is established), or engage in the cultural practice of clear-cutting (Daniels *et al.*, 2010). The current economic downturn may also work in favour of PES, making conservation more favourable following abandonment of urban and tourism development along coastal areas (Daniels *et al.*, 2010).

The situation is more complicated when the statutory rights are unclear or there is imperfect monitoring. Final decisions will be affected by the landowner or user's perception of the costs (such as the gamble of deforesting and not being caught, which depends on how risk-averse the landowner is) and the government's cost of monitoring and enforcement. In practice, the viability of any statutory rights is linked to the state's capacity to enforce the regulation, the perceived risks of being caught, and if so, the severity of sanctions; as well as how exemptions to the forest prohibitions are understood.[36] According to Rodríguez and Obando (2012) illegal deforestation in Costa Rica is caused by the state's poor capacity to clarify and enforce land titles, as well as to monitor illegal settlements, logging, hunting and mining.

It is hard to see how PES can compete in areas that are rapidly changing to urban sites or to high-value export crops, when the one-off profit from selling the land can be very high for the landowner – and PES is not likely to make a difference once

36. The same article that prohibits conversion of existing forests also allows for many exemptions, including building homes, offices, stables, roads, and ecotourism projects. Ultimately, conversion of existing forest will take place if the landowner has the legal capacity to justify the proposed change.

the decision to sell has been made. In these cases, stricter regulations on infrastructure development are required, with PES added in as an extra bonus for those complying.

6.3 TARGETING KEY ECOSYSTEMS THROUGH DIFFERENTIATED PAYMENTS

The point systems presented in Table 3 gives priority at the moment of contract allocation, but the payment levels remain the same across the country (as presented in Section 3.2). PES levels in Costa Rica are mostly fixed by hectare, with some small variations for forests located near water sources, or reforestation projects using native species.

Accounting for ecosystem services is done through 'bundling'. Each hectare of forest is assumed to provide the four ecosystem services (carbon sequestration, landscape beauty, biodiversity conservation and water protection) and each hectare of a specific landuse receives a fixed payment level. Recently, payment levels have been differentiated for 'protection' PES of forest in hydrologically important areas and conservation gaps; and for native species in 'reforestation' PES. This simple approach has advantages: it reflects the complementary nature of the ecosystem services, it bypasses the difficulty of measuring and monitoring individual ecosystem services, and it makes the system more manageable at the national level. There are also obvious shortcomings to the design and the following improvements have been suggested:

- *Differentiated payments that reflect the quality of the forest.* For example, higher payments for ecosystems like 'old growth' forest that are poorly represented in the existing reserve system; and that provide higher levels of ecosystem services such as carbon storage than other types of forests (World Bank, 2006; Daniels *et al*., forthcoming).
- *Differentiated payments that reflect different opportunity costs.* The principles of supply and demand suggests that the high volume of applications for payments each year would make a lower payment acceptable for many potential participants, especially those with lower opportunity costs and/or lower risk of deforestation (Sierra and Russman, 2006). Freeing up resources through lower payments in these areas would allow programme managers to raise the competitiveness of PES in areas where opportunity costs and/or the risk of deforestation are higher (Robalino *et al*., 2008). Raising the competitiveness of PES could be achieved through a mix of better targeting and enforcement of regulations regarding land use changes and higher PES services.
- *Differentiated payments over time to incentivise long-term conservation.* Daniels *et al*. (forthcoming) suggest considering different payment levels and contract time scales, differentiated over different term lengths with higher payment rates for longer contracts. This will make forest conservation more viable, even when market conditions make PES a less attractive use of land – especially for those landowners with a cultural and personal inclination to protect their forest.
- *Differentiated payments through auctions.* Designing differentiated payments based on opportunity costs may be technically difficult. One way to overcome this is through 'reverse auctioning' with confidential bidding, where potential landowners confidentially submit the price they would accept to enrol in the PES programme (Daniels *et al*., forthcoming). The individual prices will reveal their personal

opportunity costs. The buyer then accepts bids, up to a budget threshold, service provision level, or cost-benefit ratio. In theory, reverse auctions can prevent collusion and bidding up of prices among landowners; it can reduce, though not eliminate, rent-seeking by reducing the inequality of information between the ecosystem service provider and buyer. They have been used in several countries (see for example Box 5). But there is a danger that because of differences in small and large farmers ability to participate in the more sophisticated auction process it could exacerbate the already unequal distribution among social groups (as discussed in Section 5). A possible solution would be to continue to offer low transaction cost fixed payment PES to small-to medium-sized properties (below a certain size), while requiring auctions for properties above a certain size. This would mean that authorities would seek to minimize contracting costs – and shift rents from the landowner to the state – only on properties with wealthier owners.

The relative merits of different approaches for spatial differentiation of payments compared to the current uniform system have to be balanced against the relative transaction costs of the different approaches. So far, programme managers have not opted for differentiated payments, primarily on the grounds of transparency and fairness. For example, the risk of collusion from large, well-connected landowners in an auction setting could result in even higher payment levels that will unbalance the programme's coffers. Although there are no studies comparing the advantages of differentiated payments for Costa Rica, an economic study of payment models in Mexico shows that flexible or differentiated payments that take into account the risk of deforestation are the most effective from an environmental perspective (Alix-Garcia *et al.*, 2008). They show that fixed payments lead to a more equitable distribution of funds between cooperative groups (ejidos) of different sizes and levels of poverty, but differentiated payments can increase the benefits for the poorest groups. It would be interesting to see whether the higher points proposed in the current system will be enough to promote participation in priority areas, without changing payment levels or entering a new auction system.

BOX 5. AUCTIONS OF PES FOR CONSERVATION

The United States Conservation Reserve Programme (CRP) is a useful example of the relationship between cost-effectiveness and opportunity costs. The programme encourages farmers to convert highly erodible cropland, or other environmentally sensitive acreage, to vegetative cover. Individual opportunity costs are 'revealed' by the participants, by way of auction. Payments for conservation are made on the basis of farmers' proposals, which must satisfy specific landowner and land requirements. Studies show that in comparison with a system of fixed payments (as is the case of the PES in Costa Rica), this auction-based system limits the possibility of farm owners earning excessive rents, and maximises the benefits per dollar invested (Baylis *et al.*, 2008). Auctions can be useful when there are no studies of opportunity costs, although there are additional transaction costs associated with organising an auction. For Costa Rica, Sierra and Russman (2006) and Barton et al. (2009) recommend the use of spatial models and economic and ecological indicators in order to optimise the PES levels and contract offers, through a combination of environmental spatial prioritisation with auction mechanisms.

SEVEN
CONCLUSIONS AND RECOMMENDATIONS

This section is divided in two parts. We first summarise the main findings from our analysis, and then provide four recommendations on how the programme can improve its impacts on the environment and on people.

7.1 A SUMMARY OF THE MAIN MESSAGES

Here we summarise the main discussions presented in this report, focusing on three areas: 1) the governance in which the PES operates; 2) the outcomes for the environment; and 3) access to the programme and outcomes for people.

7.1.1 Changing programme governance

- Twenty years have passed since the idea for PES originated, following the Rio Conference in 1992. The environmental, economic and political context has changed, and with it the demands on the programme's design.
- Set up as an experiment, the PES programme has become rooted in the country's conservation policy. Heavily reliant on public funding – and as such prone to political upheavals – it has nevertheless 'survived' several changes in government, supported strongly by landowners, the conservation movement in civil society, and the population at large.
- The PES programme complements regulatory instruments for conservation, like PAs and prohibitions to change forest cover. While structural shifts in the economy in the 80s–90s can certainly be thanked for part of the forest recovery[37], it is uncertain how strong the forest recovery trend would have been without the payments combined with the ban on landuse change compliance with the law.
- Although still heavily reliant on public funds, the programme has an active approach to engaging with the private sector and seeking funds through voluntary carbon markets at national and international level.
- FONAFIFO has managed to maintain a level of continuity and autonomy since it took over management of PES, which has allowed it to experiment with different types of selection criteria and contract conditions, allowing the design of PES to shift to meet new economic realities, social and environmental priorities. Stability of key staff and an independent board representing the main conservation and economic interests in forests, are important ingredients of sustainable governance of PES.
- The design of PES, although heavily influenced by the conditionality of large funding agencies such as the World Bank Ecomarkets projects, has since its inception been a 'home-grown' policy instrument developed by Costa Rican professionals and academics.

7.1.2 The programme's impacts on the environment

- Since the first payments to private landowners were made in 1997 the programme has contributed to the conservation of nearly 1 million hectares of forest under protection (90 per cent – some of them already under renewed contracts), reforestation (6 per cent), sustainable management (3 per cent) and more recently regeneration (1 per cent).

37. The Spanish version of this report has a detailed historical background to the PES programme. It can be found at http://pubs.iied.org/pdfs/16514SIIED.pdf.

- Initial settings for contract allocation were ineffective, leading to payments going to areas with low risk of deforestation and of low conservation value. Targeting has since improved using, amongst others, conservation gaps identified by a national-level conservation strategy (known as GRUAS II). The PES programme in complements protected areas in the productive landscape. The PES programme will face increasing opportunity costs and challenges to environmental effectiveness as it is expanded to non-forested areas to meet national 'carbon zero' and REDD+ targets.
- The PES programme will face increasing opportunity costs and challenges to environmental effectiveness as it is expanded to non-forested areas to meet national 'carbon zero' and REDD+ targets.
- The programme is structured around four specific ecosystem services: water protection, carbon sequestration, biodiversity conservation and scenic value. While there has been much effort to target the programme towards conservation priorities, little work has been done to prove the impacts of the programme, its targeting, or funding mechanisms to ensure delivery of the four services. Hardly any evidence – in the form of specific metrics like number of species, or impacts on key species – has been gathered to show that these services (with the potential exception of carbon sequestration) have increased due to the effects of the programme, and obtaining this evidence could be very expensive. However, the Costa Rican PES programme is not the only programme of its type that is not measuring changes in ecosystem levels. Like most environmental programmes around the world, the Costa Rican PES focuses on relatively easy-to-measure indicators, like hectares of land, rather than assessing one type of ecosystem service.

7.1.3 Access and impacts on the people

- Impact evaluations have consistently shown that landowners' characteristics (such as educational level) strongly influence the programme's environmental outcomes. This is just as important a factor as aspects of the programme's design, such as environmental targeting.
- People can benefit from the PES programme directly and indirectly. There are direct financial benefits from receiving payments; indirect impacts include job creation by PES and significantly better provision of ecosystem services. This ensures greater resilience to climate change, and inputs to production, for example to agriculture, generation of hydroelectricity, and the ecotourism industry. Most efforts at accounting for the programme's impacts focus on the direct payments. There is little evaluation so far in terms of how PES affects water, carbon, biodiversity (or wildlife), or scenic value; and how this in turn affects people.
- Because of the large tracts of land they manage, indigenous communities stand to play an increasingly important role in the programme, although the additionality from these lands is low because of their low risk of deforestation. By directly targeting indigenous communities participation has significantly increased, from 3 per cent of budget allocation in 1997 to 26 per cent in 2012. These social impacts are very important, as PES is one of the few sources of cash in these communities.
- A positive impact of the programme is the increasing participation of female-headed properties. Considering individual-signed contracts alone (not associations or companies) the proportion of women-headed properties has increased from 16 per cent in 1997 to 23 per cent in 2012 (and as high as 30 per cent in 2008). This is despite the fact that the programme does not give priority on the basis of gender, and that land is traditionally registered under male ownership. Two hypotheses are worth checking: that land is increasingly registered under women's ownership; and that women who own land with forest increasingly find the PES programme an attractive economic activity.
- There is some indication that PES has promoted gradually regularising tenure among smaller landowners, rather than tenure regularisation being a precondition for implementing PES. This has taken place through a combination of eligibility requirements and expected payments being used to obtain informal credit to pay for tenure documentation. Other cross-compliance benefits may include PES's requirements to comply with farm employees' social security obligations. This deserves further empirical study.
- A critique of the PES programme has been its bias towards relatively large properties. However, the introduction of agroforestry

contracts has been a successful way to engage with smaller properties. For example, in 1997 only 15 properties of less than 10 hectares participated in PES. By 2012 the number was 276, the majority of them under agroforestry contracts.

- The SDI has not provided an effective criterion to prioritise access to low-income areas, as it gives indiscriminate priority to relatively large (and wealthy) properties located in these areas. Although it can be argued that some of these resources are re-invested locally, the direct beneficiaries of the priority policy are not always captured by the more vulnerable.
- Participation in PES is increasingly dominated by legal entities, which took 25 per cent of funding in 1997 and nearly 50 per cent in 2012. This is in part due to patterns of land ownership, with landowners favouring company status for tax purposes. These legal entities are on average larger than properties with individual ownership. One hypothesis is that increasing participation of legal entities is happening at the expense of smaller, individually owned (and potentially less wealthy) landowners. A more worrying aspect of legal entities is the difficulty of tracking social impacts, because of the anonymity conferred by their legal status. The PES programme is accountable by law for its social impact, and as an institution FONAFIFO must be able to explain transparently how payments are distributed, who benefits and who loses.

7.2 RECOMMENDATIONS

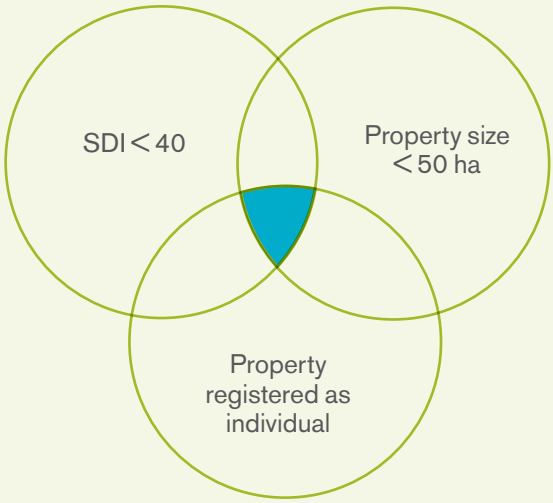
As the PES scheme enters a more mature phase it can no longer afford to 'learn by doing' and is adopting more advanced tools and mechanisms that reflect this institutional maturity and its significant accumulated technical expertise at national and local level. The success of the PES programme has put it on the international radar, and as such, more is expected from it. Internally, the approach to user-oriented sources of funding requires better tools to ensure the provision of the desired ecosystem services, while the dependence on public funding demands the delivery of socially acceptable outcomes.

Our analysis has pointed to four main areas where PES can improve its current approach: by using simple indicators for environmental impact; by targeting a specific social group; by considering approaches to increase cost-effectiveness; and by defining an impact evaluation tool for continuous monitoring that avoids duplication.

7.2.1 Keep indicators simple through careful planning

Simple can be best, especially in PES. The programme uses land as a unit to account for 'bundled' ecosystem services (an input-based approach) rather than accounting for its components, such as particular species or units of carbon captured (an output-based approach). This emphasises that a healthy ecosystem is more likely to deliver ecosystem services. The current landscape approach targets geographical areas on the basis of their risk of conversion, 'hotspots' and interconnecting biological corridors. This approach should result in the delivery of ecosystem services being more likely, rather than spending large proportions of the budget in monitoring separate impacts in detail. However, the programme must identify which ecosystem services it wishes to support, and ensure that the payments support the desired landscape composition needed to provide these services. Not doing so risks programme expenditures failing to deliver the desired national and social benefits.

FIGURE 15. PROPOSED COMBINED INDICATOR FOR SOCIAL PRIORITY



Source: Authors' own.

7.2.2 Re-define the social filter

The use of the SDI as a priority criterion is limited, and confers equal priority of access on small- or large-scale landowners located in these areas. Priority only by property size is equally limited, as it does not reflect landowners' relative wealth and opportunity costs. A proposed indicator to assign social priority in non-indigenous territories could be: properties belonging to individuals (rather than companies or associations); located in areas with a low SDI; and with small properties (less than 50 hectares) – see Figure 15. Even better than using the SDI would be a composite wealth indicator that includes land values. Rather than making differentiated payments following this social criterion, the proposed indicator could be used for 1) assigning priority for contract allocation; and 2) measuring social impacts in terms of equity of access and distribution.

Much of this information can already be obtained through the application forms. Studying what drives the increasing participation of private companies in the programme will be useful to understand whether this is a normal result of the way land is registered in Costa Rica, or if participation of these companies takes place at the expense of more vulnerable farmers. Periodic assessments of the PES programme are needed to guarantee legitimacy as perceived by participants, civil society, donors and purchasers of ecosystem services.

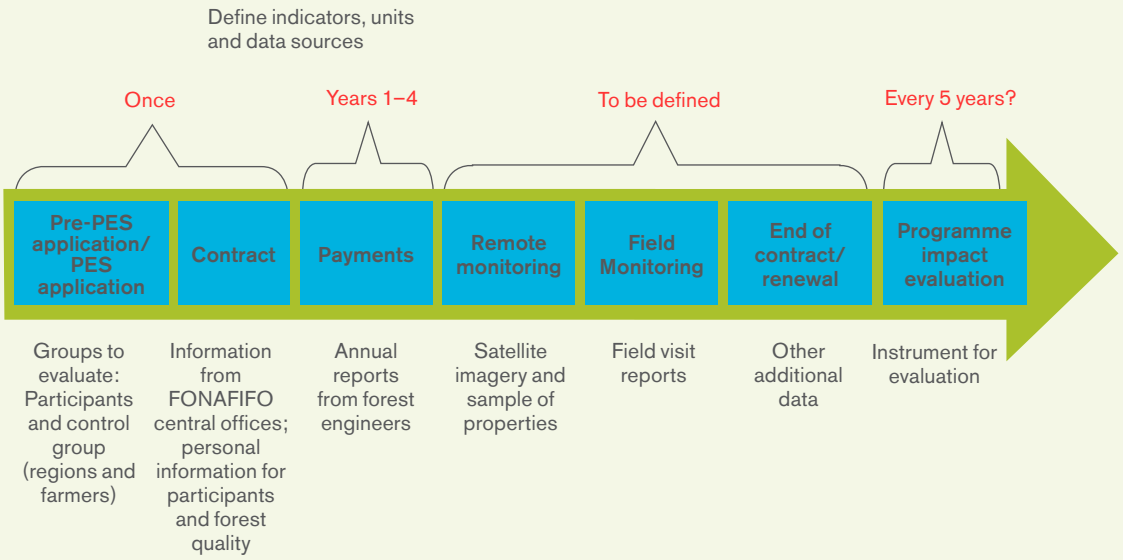
7.2.3 Consider differentiated payment levels to increase cost-effectiveness

The programme already uses differentiated payments to some degree – rewarding, for example, the use of native species or the conservation of old-growth forest. Payments levels, however, do not take into account the opportunity costs of participants, potentially resulting in high levels of surplus for those who participate and a large number of rejected applications. Lowering payments can lead to participation of more landowners, or freeing up resources to increase payments where higher incentives are required to motivate a change. A better understanding is needed of economic context, local regulations regarding land use, the profitability of alternative land uses, and their capacity to provide the ecosystem services of interest; this can help tune payment levels to local costs. It is important to take into account economies of scale that could exclude small properties, and how heterogeneous conditions might affect equity in a more market-based approach (like auctions) to elicit the demand curve and/or to determine contract allocation. A mix of instruments may be necessary to achieve the potentially conflicting objectives of efficiency and fairness.

7.2.4 Data gathering for continuous programme evaluation

Periodic programme evaluation is needed but costly. Obtaining and maintaining the appropriate control groups is extremely difficult, especially with respect to the legal status of participants. Compiling biophysical, economic and social data for both the intervention and control groups involves additional costs, both for landowners and for FONAFIFO. The creation of a periodic evaluation tool must be an integral part of the institution's normal monitoring system, to avoid duplication in data collection and monitoring. For example, an information system should link information from the different steps of the pre-application and application process to awarded contracts, payment information, monitoring data, and contract renewal information. This integration of databases can then be taken advantage of for periodic strategic programme evaluation (see Figure 16).

FIGURE 16. SAMPLING STRATEGY FOR PERIODIC EVALUATION



Source: Authors' own.

All of these suggestions may help increase the programme's impacts, but will also result – especially in the short- and medium-term – in higher programme implementation costs. Evaluation will also be required to gauge the potential benefits versus costs of increased spatial planning and targeting. A careful consideration of the distribution of benefits and costs, access and rejection, will be needed as well.

The success of PES in Costa Rica is ultimately linked to the governance and governability of the programme that guarantees the provision of ecosystem services. This implies a greater application of technical and scientific knowledge that maximises the possibilities of effective provision of ecosystem services. By providing better ecosystem services, all of society – rich and poor – will benefit, directly and indirectly. But the social objectives of the scheme must be accurately targeted, and renewed efforts are needed to guarantee that the scheme is accessible for those who can and who wish to participate.

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LEARNING FROM 20 YEARS OF PAYMENTS FOR ECOSYSTEM SERVICES IN COSTA RICA

Costa Rica's Payments for Ecosystems Services (PES) programme has become something of an icon in the world of PES. Its hitches and successes provide a valuable source of information and inspiration for other countries interested in exploring 'policymixes' of economic and regulatory instruments to promote ecosystems conservation and regeneration. In this paper we explore how the governance of the PES programme has evolved over time, how the context in which it sits has changed, and how it prepares to face future challenges by incorporating new tools and strengthening its alliances with other institutions. We discuss the policies used by the programme to affect the way forests are managed and the reported outcomes on the ecosystem services they are expected to provide. Since PES is for society as much as the environment, we also look in detail at the impacts on those directly receiving PES, and what policies and personal characteristics may affect how PES funding seeps into rural economies. Also published in Spanish, this paper is aimed at local practitioners, international researchers and donors interested in the Costa Rican experience and the lessons that emerge from it.

The success of the PES scheme in Costa Rica ultimately depends on its ability to guarantee the provision and protection of ecosystem services. This requires a greater application of technical and scientific knowledge, while balancing on the tightrope of a limited budget. A healthier ecosystem will benefit all of society; rich and poor, directly and indirectly. But the social and environmental objectives of the scheme must be targeted accurately, and renewed efforts are needed to guarantee that the programme delivers.

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