CHAPTER 25

Are payments for ecosystem services benefiting ecosystems and people?

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25.1 Hopeful views on payments for ecosystem services

I first took notice of the idea of paying people for conservation while working in Madagascar in 1994. A Malagasy colleague had just returned from a study visit to South Africa, where he had visited Richtersveld National Park. Unlike most other parks, Richtersveld was leased from local communities by the government. In other words, the government paid the park's neighbors to help deliver conservation outcomes. Just as I had started to say, "That sounds amazing," my colleague asked, "Doesn't that sound awful?"

He had several objections (objections that many people still have). We should not commodify nature. We should not pay people to do what they ought to be doing anyway. Cash payments will ruin the economies and social fabric of poor rural communities. Payment programs are unsustainable and, worse, will extinguish intrinsic motivations that people have to conserve ecosystems. In sum, private economic interests in ecosystems should be thwarted or re-directed, not encouraged.

In contrast, I was attracted to the simplicity of the idea. I have food because I pay someone to supply it. Why not pay someone to supply ecosystem services and biodiversity? Like protected areas or species protection laws, programs that use payments for ecosystem services (PES) are easily scalable and clearly link conservation investments to conservation objectives. Like alternative livelihood interventions, PES programs materially reward rural households, thereby potentially alleviating poverty and reducing conflict between conservationists and rural communities. Years later, I would start to recognize that the reality was not so simple.

My youthful enthusiasm for PES was, over time, matched by enthusiasm among a growing segment of conservation scientists and practitioners. For example, Google Scholar reports that during the period 1996–1998, fewer than two dozen publications included the term PES. Ten years later, during the period 2006–2008, about two thousand publications included the term. Add another seven years (2013–2015), and well over six thousand publications included it. During the same twenty-year period, the enthusiasm for PES spread to policymakers because PES were perceived as "win-win" investments: a win for the environment and for people (Muradian et al., 2013). By my count, over three dozen countries now have local or national PES programs. The growth in the number of programs and number of participants is often pointed to as evidence of the success of PES.

Unfortunately, neither theory nor empirical evidence supports PES proponents' "win-win" aspirations. Instead, theory yields ambiguous predictions, and the empirical evidence is scant, with few examples of even modest environmental and social impacts. I will argue that these conclusions do *not* imply PES programs should be abandoned. But first let's consider the bad news.

25.2 What could go wrong?

To evaluate PES success, we consider the following question: "Do PES programs deliver more environmental services and better human welfare

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than we would experience in the absence of such programs?" With regard to impacts on the welfare of participants, an affirmative answer is plausible: although participants may make short-term errors and erroneously participate in PES programs that make them worse off, we would not expect those errors to be systematic or to persist in the long-run. Thus, in the absence of coercion, rational participants must generally be better off. Yet theory cannot answer "How much better off?" or "Are non-participants also better off?"

On the environmental side, theory is likewise not so straightforward. PES may have positive effects, no effects, or even negative effects for the following reasons:

1. *Adverse self-selection*. PES programs are voluntary. Thus the enrolled resources tend to be those with the lowest values in alternative uses (Ferraro, 2008). Identifying low-cost conservation suppliers is a virtue of PES, but it is a double-edged sword: the resources enrolled in PES are the least likely to be exploited in the absence of PES. Thus, without a careful focus on enrolling ecosystems threatened with exploitation, PES programs may generate little or no additional ecosystem services beyond what would have been provided without PES.
2. *Poor targeting*. PES programs distribute money and other material benefits. Thus, in addition to conservation objectives, they often have political or social objectives, which may direct payments to households that are not well positioned to cost-effectively achieve conservation objectives (Alix-Garcia and Wolff, 2014).
3. *Substitution.* When participants enroll in a PES program, they likely will reallocate their labor and capital, including lands and resources not enrolled in PES, in ways to make themselves better off. This reallocation may create other negative environmental impacts; for example, through more intensive use of resources outside the PES program.
4. *Credit Constraints*. Rural households often face credit constraints, which prevent them from exploiting ecosystems as much as they would like. Payments help households overcome these constraints, and thus can make the environmental outcomes under PES worse than what would be experienced in the absence of PES.
5. *Non-compliance*. In principle, PES are conditional: no conservation, no payment. In practice, however, monitoring and enforcing compliance can be expensive, both financially and politically.
6. *Paying for the wrong outcomes*. In principle, payments can be tied directly to ecosystem service provision. In practice, however, tying them to actions rather than services can yield better economic outcomes and reduce monitoring costs (Ferraro, 2011). Yet if our models that predict ecosystem services as a function of conservation practices are wrong, PES may simply be "money for nothing."

These six constraints on effectiveness have long been recognized (Ferraro, 2001), but the degree to which they can constrain the benefits of PES is only recently becoming better understood (Ferraro, 2011). The first five constraints also point to an uncomfortable reality for "win-win" proponents of PES. Participants are better off when they can enroll resources with zero opportunity costs, can re-optimize their resources, can relax their credit constraints, and can fail to comply with their contracts. In other words, the more that people gain from PES, the less the environment gains.

In summary, theory offers no clear predictions about the effects of PES on the environment and human welfare. More elaborate theoretical frameworks emphasize that even the question of which humans can benefit from PES is complicated (e.g., landless poor vs. land-holding poor; Zilberman et al., 2008). Once we acknowledge that theory offers no unambiguous predictions about impacts, we should ask what the empirical evidence says.

25.3 Evidence says…

Compared to the extent to which the conservation community has invested in measures of the status and trends of ecosystems and biodiversity, the efforts to evaluate the impacts of conservation programs are limited and suffer from weak empirical designs (Ferraro and Hanauer, 2014; Ferraro and Pattanayak, 2006). In the last six years, four publications have summarized the evidence base for PES

impacts (Alix-Garcia and Wolff, 2014; Börner et al., 2016; Pattanayak et al., 2010; Samii et al., 2014). The over-arching conclusions from these four publications are:

1. Most studies risk attributing to PES impacts that are instead caused by other factors associated with whom or where PES occur. None of the studies measure impacts on ecosystem services directly. About a dozen studies evaluate PES impacts on deforestation or forest cover, nearly all in Costa Rica and Mexico. Only five studies measure impacts on social outcomes.
2. The average effects of PES on deforestation are small and often not statistically different from zero (~0.2%/year). The average effects on forest cover (i.e., avoided deforestation + additional regrowth) are a bit larger, but still quite modest. The underwhelming environmental impacts appear to arise from (a) adverse self-selection, (b) PES sites where the deforestation rate is low and thus the scope for impact is limited, and, in cases where the authors can detect no effect, (c) statistically underpowered designs.
3. The effects of PES on income are small (2%–14%) and no effects can be detected on other dimensions of human welfare. The underwhelming impacts on social outcomes appear to arise from: (a) the high transaction costs of applying to programs and meeting contract obligations, (b) the low rate of participation by poor households, (c) the multi-dimensional nature of human welfare (making measurement difficult), and (d) statistically underpowered designs.
4. The absence of large PES impact estimates is particularly concerning because most of the studies are conducted in a way that biases the impact estimators upward, in the direction of finding impacts that are larger than the true impacts.
5. In general, the more the design is at risk of bias, the larger the estimated effects. The largest environmental effects are claimed by the qualitative studies and quantitative studies with few controls for confounding variables (see Pattanayak et al. (2010) for discussion on qualitative PES case studies). Although qualitative analyses play important roles in impact evaluations (Ferraro and Hanauer, 2014), it is difficult to establish credible claims of causal effects using only qualitative data.
6. Only one study has a design that can credibly estimate both environmental and economic impacts and a sample size large enough to explore the heterogeneity of those impacts (Alix-Garcia et al., 2012). It finds that the environmental impact is highest where poverty is low, but poverty alleviation is highest where the risk of deforestation is low. Similar trade-offs between environmental and social objectives have been observed with protected areas (Ferraro et al., 2011).

In summary, we do not yet have any evidence for transformative "win-win" impacts of PES on human welfare and the environment (Table 25.1).

25.4 Encouraging words from a skeptical agnostic

Before we rush to conclude that PES has failed and the conservation community would be better off focusing on other conservation interventions, let's remember that:

- No empirical study has yet found that PES increased environmental damage.
- No empirical study has yet found that PES decreased human welfare or increased social conflict.
- Compared to alternative voluntary approaches, such as alternative livelihoods or certification, PES still has desirable attributes, such as lower implementation complexity, easier targeting in time and space, and the potential for more directly tying investments to outcomes (Ferraro, 2001).

Moreover, well-understood solutions exist for making PES more likely to achieve its purported environmental benefits. These solutions include better targeting of contracts by weighting them according to value and threat (Wünscher et al., 2008), as well as better pricing of contracts through auctions or menus of different types of contracts for different landowner circumstances (Ferraro, 2008). In addition, these solutions are amenable to experimental and quasi-experimental implementation, which makes learning about their impacts easier (Ferraro,

Table 25.1 PES impacts on environmental and socio-economic outcomes.

Study	Outcome Measure	Country	Units	Treatment	Counterfactual Condition	Threat of Bias	Standardized Effect Size	95% CI Lower	95% CI Upper
Alix-Garcia et al. (2012)	Deforestation	Mexico	Parcels	Under PES contract	Not under PES contract	Low–Medium	−0.08	−0.16	−0.01
Alix-Garcia et al. (2015)	Normalized difference vegetation index (NDVI)	Mexico	Parcels	Under PES contract	Not under PES contract	Low–Medium	0.05	0.01	0.08
Alix-Garcia et al. (2015)	Durables index	Mexico	Households (communal property landowners)	Under PES contract	Not under PES contract	Low–Medium	0.23	−0.12	0.59
Alix-Garcia et al. (2015)	Durables index	Mexico	Households (private property landowners)	Under PES contract	Not under PES contract	Low–Medium	0.22	−0.61	1.03
Alix-Garcia et al. (2015)	Food index	Mexico	Households (communal property landowners)	Under PES contract	Not under PES contract	Low–Medium	0.18	−0.06	0.42
Alix-Garcia et al. (2015)	Food index	Mexico	Households (private property landowners)	Under PES contract	Not under PES contract	Low–Medium	0.06	−0.29	0.41
Alix-Garcia et al. (2015)	Housing index	Mexico	Households (communal property landowners)	Under PES contract	Not under PES contract	Low–Medium	0	−0.35	0.35
Alix-Garcia et al. (2015)	Housing index	Mexico	Households (private property landowners)	Under PES contract	Not under PES contract	Low–Medium	0.28	−0.27	0.82
Arriagada et al. (2012)	Change in forest cover	Costa Rica	Farms	Under PES contract	Not under PES contract	Low–Medium	0.6	0.21	0.99
Arriagada et al. (2015)	Asset index	Costa Rica	Households	Under PES contract	Not under PES contract	Low–Medium	−0.09	−0.55	0.36
Arriagada et al. (2015)	Self-reported quality of life is better	Costa Rica	Households	Under PES contract	Not under PES contract	Low–Medium	−0.35	−1.05	0.36
Costedoat et al. (2015)	Forest conserved (ha)	Mexico	Parcels	Within communities under PES contract	Not within communities under PES contract	Low–Medium	0.25	0.0001	0.5
Hegde and Bull (2011)	Cash income per capita	Mozambique	Households	Under PES contract	Not under PES contract	Medium	0.01	0.001	0.01
Honey-Rosés et al. (2011)	Forest conserved (%)	Mexico	Property polygons	Under legal protection + PES contract	Not under legal protection or PES contract	Low–Medium	0.1	−0.14	0.34
Pagiola et al. (2016)	Environmental service index	Colombia	Farms	Under PES contract	Not under PES contract	Medium	−0.19	−1	0.62
Pagiola et al. (2016)	Environmental service index	Colombia	Farms	Under PES contract + technical assistance	Not under PES contract	Medium	0.24	−0.32	0.8

(continued)

Table 25.1 *(Continued)*

Study	Outcome Measure	Country	Units	Treatment	Counterfactual Condition	Threat of Bias	Standardized Effect Size	95% CI Lower	95% CI Upper
Pagiola et al. (2016)	Environmental service index	Colombia	Farms	Under PES contract (half duration) + technical assistance	Not under PES contract	Medium	0.12	–0.43	0.67
Robalino and Pfaff (2013)	Deforestation	Costa Rica	GIS points where PES contract known to occur	Under PES contract	Not under PES contract	Medium	–0.07	–0.11	–0.02
Robalino et al. (2008)	Deforestation	Costa Rica	1 km^2 grid cells	PES contract present	PES contract not present	Medium	–0.18	–0.79	0.44
Robalino et al. (2015)	Deforestation	Costa Rica	GIS points where PES contract known to occur	Under PES contract	Not under PES contract	Medium	–0.11	–0.77	0.55
Sierra and Russman (2006)	Land cover	Costa Rica	Farms	Under PES contract	Not under PES contract	Medium–High	0.31	–0.79	1.41

1Standardized Effect Size = Estimated Treatment Effect/Standard Deviation of the Outcome Variable in the Comparison Group (when comparison group standard deviation is not available, the standard deviation of the pooled sample is used). Standardized effect sizes allow readers to compare impacts across different outcome measures. For deforestation, negative values indicate lower deforestation. For the other outcomes, positive values indicate environmental or social benefits. For four other studies, we were unable to obtain the standard deviations from the article or the authors.

2012). To date, these solutions have not been widely adopted in PES programs. They are not adopted because of lack of knowledge, lack of rewards for achieving environmental gains compared to achieving high enrolment rates, concerns about administrative costs and treating people differently, and because the solutions explicitly acknowledge environmental and human welfare trade-offs. They are also not adopted because their proponents do not make dramatic claims about their potential impacts on PES effectiveness.

Experience from other policy domains suggests that the conservation community should curb its enthusiasm for finding solutions that have large impacts on the environment, human welfare, or both. When interventions in other fields are evaluated with strong empirical designs, small to modest effect sizes are the norm (<0.20 standard deviations; Lipsey et al., 2012). So instead of being excited by our colleagues' effusive presentations about interventions that are transforming ecosystems and peoples' lives, we should respond skeptically to such presentations. Success in conservation is likely to occur incrementally, through careful testing, to achieve small improvements here and there, which, over time, will yield major impacts if the implementation is persistent and widespread.

Despite the weak evidence of transformative impacts from PES, alternative conservation interventions also suffer from a paucity of evidence for major impacts. These alternative approaches, such as protected areas and certification, have no better evidence of transformative impacts (Geldmann et al., 2013; Pullin et al., 2013; Blackman and Rivera, 2011), or, as in the case of alternative livelihoods programs, are almost completely lacking in credible evidence (Bauch et al., 2014). It would be unwise to abandon PES programs, with their credible evidence for modest positive effects and room for improvement, in favor of programs with no evidence at all. Moreover, compared to alternative conservation approaches, PES may be much more cost-effective. Unfortunately, only one study calculates PES cost-effectiveness (≥$250 for each additional hectare of forest cover induced by PES; Arriagada et al., 2012) and we have no comparative values from other conservation approaches.

The evidence base for PES, however, could be made much stronger. In the analogous context of conditional cash-transfer development programs, a long-standing tradition of experimental and quasi-experimental evaluations has generated important insights on how to improve the programs (Rawlings and Rubio, 2005). Recently, one PES program copied this approach and the early results are promising (Jayachandran et al., 2016). In contrast to all other PES programs, this program: (a) used randomized assignment to assign PES eligibility (60 out of 121 villages in Uganda were chosen); (b) was initiated in an area of high deforestation (about 3.5%/year); and (c) enrolled participants with higher-than-average risks of deforestation. The authors estimate that, two years after initiation, the program cut deforestation in half without shifting tree-clearing to other lands in or outside of the village. Although the evidence for positive effects on household income or borrowing was weak, a cost-benefit analysis of the program suggests the program was cost-effective and could be improved. Because it was deliberately designed to generate evidence about impacts, the Uganda program is an exemplar for future PES programs.

In the absence of experimental PES implementations, we can do a much better job of applying state-of-the-art approaches for estimating impacts from non-experimental data. Compared to the approaches in many earlier studies, these study designs require much more effort to understand selection: why are some areas, households, or communities exposed to PES programs and others are not? In the absence of a deep understanding of selection, credible causal inference about PES impacts is simply not possible. To achieve this understanding, we need clearer and more elaborate theories about PES causal pathways and the potential confounders that make drawing causal inferences from non-experimental data difficult. These theories will allow researchers to apply more modern approaches to identifying causal effects and mechanisms (e.g., conditioning strategies for observed and unobserved confounders; surrogate or instrumental variable designs; for more details, see Ferraro and Hanauer, 2014).

Over the years, I have become a skeptical agnostic regarding environmental programs—willing to believe any approach may work if the causal

theory undergirding its promised benefits is clear, but skeptical of claims that are based on weak or non-existent empirical evidence. A skeptical agnostic is also disappointed when hearing of programs being implemented in ways that are not designed to generate better evidence. Every program that is implemented as a good idea to be applied, rather than a good hypothesis to be evaluated, is a missed opportunity to learn. In conservation science and practice, it's been mostly missed opportunities. We can do better.

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