Conservation Biology

Special Section Essay

The Future of Payments for Environmental Services

PAUL J. FERRARO

Department of Economics, Andrew Young School of Policy Studies, Georgia State University, Atlanta, GA 30302-3992, U.S.A., email pferraro@gsu.edu

In the first 10 years of *Conservation Biology*, only 12 articles referred to economic "incentives" and only two articles (Boza 1993; Mech 1995) mentioned performance payments as potential conservation tools (performance payment in the sense of a variable payment, in cash or in-kind, made conditional on achieving a well-defined action or outcome). In the last 10 years of *Conservation Biology*, however, over 140 articles referred to incentives and more than 24 focused on performance payments (see Note). Of course, conservation biologists and practitioners have long recognized the importance of economics in conservation biology (Meine et al. 2006). Nevertheless, the idea of harnessing private interests for the public good was not well understood or endorsed by conservation biologists when *Conservation Biology* was first launched. Private economic interests had to be thwarted, not encouraged.

This perception, however, has since changed, mirroring a growing receptivity among policy makers globally to use private incentives to achieve social-policy objectives. Two important examples outside conservation policy are cap-and-trade systems in pollution policy and conditional cash transfers in development policy (e.g., conditional payments to women to obtain pre- and postnatal healthcare and send their children to school). In the context of conservation, the growing receptivity to the use of incentives is best reflected in the popularity of payments for environmental services (PES), which comprise contractual arrangements that specify payments conditional on environmental performance.

In the scholarly literature, the rising popularity of PES is easily seen in Google Scholar. During the period 1996–1998, only about a dozen publications included the term *PES* (or terms that substituted *markets* for *payments* or *ecosystem* for *environmental*), whereas during the period 2006–2008, over 500 publications included *PES*. Among practitioners and policy makers, the increased popularity of PES is reflected in myriad donor-funded workshops, publications, and projects. These efforts highlight PES as a tool to achieve conservation outside protected areas and as a component of an international system of payments for carbon sequestration in tropical forests.

In high-income nations, the concept of PES has gained traction largely because it complements ongoing efforts to redirect agricultural subsidies toward public goods through conservation payment schemes. In low- and middle-income nations, PES has become popular for 4 reasons (Pattanayak et al. 2010). First, weak institutions render regulations, indirect development strategies, and incentive-based quantity strategies (e.g., tradable development rights) difficult. Second, governments prefer subsidies to achieve policy objectives and are increasingly receptive to applying conditionality and performance metrics in the distribution of aid and subsidies. Third, policy makers, practitioners, and donors believe PES can achieve both poverty alleviation and ecosystem protection. Fourth, and perhaps most importantly, practitioners and international aid donors believe PES programs can become self-financing with short-term investments in PES start-up costs and ecosystem valuation (how the public-good nature of the services can be resolved by these investments has not been explained clearly). In other words, PES is perceived as more than just a tool for conservation investment. It is also perceived as a tool for conservation financing. Unfortunately, the reasons that motivate the global popularity of PES also constrain its effectiveness in achieving environmental and social objectives.

I describe what is known about the environmental and social effects of PES and I outline new directions for PES research. I emphasize two points. First, greater use of PES is unwarranted unless new or expanded systems are designed explicitly to measure PES's environmental and social effects and to explore competing notions of effective contract design. Second, efforts to value ecosystem services separate from policies designed to deliver them are wasted. Estimates of the benefits of ecosystem services have no policy relevance unless they are estimated in the context of real conservation effects from real conservation programs.

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Effectiveness of PES

The theory underlying PES is quite simple: Performance-based financial transfers from beneficiaries of environmental services, or governments acting on behalf of the beneficiaries, to providers of environmental services will increase the quantity supplied of these services. Some have pushed theory further to argue that, in comparison with conservation by distraction (e.g., alternative livelihood projects, integrated conservation, and development projects), direct conservation approaches such as PES can also be better for residents near endangered ecosystems and more cost-effective and institutionally simpler (Simpson & Sedjo 1996; Ferraro 2001; Ferraro & Simpson 2002).

The simplicity of the theory and the abundance of operating PES programs might lead one to think there is a good answer to the question: Do payments deliver additional environmental services compared with other policy interventions? One might even hope to have answers to the questions: Do payments improve recipients' social welfare? and Under what circumstances does PES most effectively improve environmental and social conditions? Unfortunately, credible answers to these questions are lacking.

Simple PES theory is complicated by four real-world constraints. First, adverse self-selection and poor administrative targeting may direct payments to unthreatened lands or waters or to lands or waters of low environmental value. Adverse self-selection arises because PES is voluntary and suppliers naturally volunteer for PES their resources with the lowest values in alternative uses (Ferraro 2008). For example, in Costa Rica's PES program, 71% of forest-protection contracts were applied to lands with limited or no agricultural potential (Hartshorn et al. 2005). Indeed, the ability to identify low-cost conservation lands is a virtue of PES. However, in many contexts, land use on much of the low-cost land is unlikely to change during the contract period and thus PES may generate little or no additional services beyond what would have been provided without PES. Poor administrative targeting typically arises when politicians or donors have nonenvironmental objectives for the PES program (e.g., poverty reduction, political patronage). Such objectives may steer payments away from households or areas that can achieve conservation objectives most cost-effectively.

Even in the absence of adverse selection or poor targeting, participants may not comply with their contractual obligations. And, changes in land-use practices may not result in changes in environmental services. Displaced production (leakage) from contracted land to uncontracted land may reduce aggregate PES effects. These four constraints shape the environmental and social effects of PES, the latter two of which are also affected by baseline characteristics of the participants themselves. Thus, whether PES is effective is ultimately an empirical question.

Despite the need for empirical evidence, little credible empirical research has evaluated the environmental and social impacts of PES. Impact evaluation is often confused with efforts to monitor PES conditionality and compliance. To identify the causal impacts of PES, one must estimate the counterfactual outcomes: What would have happened in the absence of PES. To estimate the counterfactual, one must rely on comparison groups and causal assumptions that help one differentiate PES impacts from impacts caused by confounding factors that affect both PES assignment and the measured outcomes (Ferraro 2009).

Pattanayak et al. (2010) reviewed the evidence for PES impacts in low- and middle-income nations. They found that eight studies have credible empirical designs and most of them detected few or no environmental impacts. Only one study evaluated social impacts and found only an increase in off-farm labor. Similarly, in high-income nations, fewer than six credible empirical studies have estimated the causal effects of conservation payment schemes, and the results of these studies show mixed evidence of success.

What to Do over the Next 25 Years

Given the weak evidence of the effects of PES and the many constraints on PES effectiveness, expanding the reach of PES makes no sense unless new or expanded programs are designed explicitly to evaluate their impacts. Such evaluations would be best achieved through experimental and quasi-experimental project designs, much like the designs used to estimate the impacts of analogous conditional cash-transfer programs in low- and middle-income nations (Rawlings & Rubio 2005).

The limited empirical evidence suggests that, of the four constraints to PES effectiveness discussed above, adverse self-selection and poor administrative targeting have the greatest effects. A priority for future research is thus improved contract allocation and price setting. When are contracts best allocated by eligibility criteria, screening contracts, or auctions? (Ferraro 2008) When are prices best set uniformly rather than on the basis of observable criteria? Might it be more efficient to use hybrid pricing systems, such as pilot auctions followed by fixed-price contracts? To answer these and other contract-allocation questions, within-program experimentation is critical.

Of course, answers to fundamental questions of contract design are also lacking. How can dynamic contracting issues be addressed? For example, how can incentives be maintained over time when noncompliance penalties often involve no more than cutting off future

payments (often leading suppliers to sign up for PES contracts when economic conditions are poor and to break contracts when conditions improve)? Should payments be tied to actions, outcomes, or both? On the basis of simple economic theory, much has been made of tying payments to outcomes. Yet because suppliers are typically more risk averse than buyers and buyers often have better knowledge of the production function for ecosystem services, tying payments to outcomes may make programs less effective. Should a portion of the total payment be delivered up front, especially when suppliers face credit constraints and start-up costs are high, or should all payments be conditional on observed performance? Should payments be linear or nonlinear functions of outcomes, and, if nonlinear, should they include thresholds (i.e., below a certain level of effort, no payment is made)? How can communal ownership, migratory species, or desires for large, contiguous patches of land or water be addressed? Can norm-based strategies, like social comparisons or conservation education, be used to increase the success of PES? Theory can help refine these questions and raise new ideas for testing, but ultimately the answers must come from carefully controlled field experiments that have the explicit intent of estimating the relative impacts of different contract-design attributes.

There are also two broad issues of relevance for the future design and implementation of PES: Spatial spillovers and the interaction between PES and parallel regulatory systems such as antideforestation laws or protected areas. Little is known of on-site (Arriagada et al. 2012) and off-site spillovers (Alix-Garcia et al. 2010). For example, PES provides cash flow for investments. Thus, when farmers' or fishers' activities are constrained by limited access to credit, PES could lead to greater ecosystem damage in uncontracted areas. In contrast, in PES programs that have more participants interested in participating than can be paid, anthropogenic pressures on uncontracted areas may decline because the PES program creates an option value (i.e., suppliers do not want to lose the option of receiving a payment in future by pursuing damaging productive uses of the uncontracted area). Better theory must guide empirical exercises designed to detect and quantify spillovers in PES programs.

With regard to the interaction between PES and regulatory systems, the debate around PES often seems to imply PES is a substitute for regulatory systems, when in practice it is a supplement. Whether these two systems complement each other, or reduce each other's effectiveness, is unknown. Private payments may erode intrinsic social motivations to conserve, but they may also decrease opposition to regulations. The way forward in understanding these interactions is perhaps the least well understood area for future research. The best way to test competing theories may be to seek opportunities for natural experiments and, when natural experiments are not feasible, use behavioral laboratory experiments with human subjects.

Role of Ecosystem Valuation

Over the last 15 years, conservation scientists have increasingly become interested in placing monetary values on ecosystems and their services. Given PES is often characterized as a market transaction, the question arises whether environmental services need to be valued prior to PES program design and implementation. In practice, valuation is not a precondition for PES implementation because decision makers need to only determine whether the payment price is worth paying, which can be determined the way most consumers determine value when they walk into a store: They observe the product and determine if it is worth the price. They do not try to estimate their maximum willingness to pay.

In PES financed by governments and nongovernmental organizations (NGOs), payments are typically set according to implicit or explicit estimates of suppliers' opportunity costs, rather than according to estimated service values. On the basis of contract theory from the economics literature, this emphasis on opportunity costs is appropriate (Ferraro 2008). In user-financed PES, buyers and sellers typically negotiate a price on the basis of each side's perceptions of the benefits and costs; thus, externally funded valuation studies are often irrelevant.

Another justification for valuation studies arises from an important source of confusion about PES: Whether PES is a mechanism for conservation investment or a mechanism for conservation finance. The former refers to spending conservation funds and the latter to raising conservation funds. Payment for ecosystem services is always a conservation investment tool. In some cases, such as when beneficiaries volunteer or are coerced into paying directly for services, PES is also a source of new conservation funds. Monetary valuation, by quantifying heretofore unknown values of environmental services, is believed to induce beneficiaries, or governments or NGOs acting on behalf of beneficiaries, to invest in PES. This depiction of the causal pathway may be accurate, but there is little empirical evidence to support it. Future research should explicitly test this hypothesis, which fits into the broader debate about the best way to frame conservation values to induce collection action.

Valuation studies, if done appropriately, can be useful in two ways. First, they serve as an input for cost-benefit analyses (i.e., whether the total benefits of additional environmental service flows from PES outweigh the total costs of the program). Second, they provide information to target PES contracts to areas and services of high value. Cost-benefit analyses, however, are not typically used to motivate or guide government PES programs because

other factors drive program adoption and because estimating the value of all relevant benefit flows is difficult. With regard to targeting, cost-efficiency can be improved when program managers target PES contracts on the basis of costs and benefits. However, as summarized in a review of the conservation planning literature (Naidoo et al. 2006), if there is a large difference in the relative spatial variability of costs and benefits, the dimension (costs or benefits) with greater relative variability will determine the efficient contract-allocation solution. Available methods typically yield environmental service estimates that are much less spatially variable than economic cost estimates (the latter can be revealed in fine detail through institutions such as auctions). Thus, given budget constraints and the problems of adverse self-selection, calculating (or inducing suppliers to reveal) more spatially explicit estimates of opportunity costs may represent a much higher PES research priority than attempting to place monetary values on services.

An even more fertile field for informing PES design and implementation would be to integrate valuation studies into evaluation studies that seek to estimate PES environmental and social effects. Most valuation studies are disconnected from real policy contexts and thus produce values of dubious policy relevance (Ferraro et al. 2012). We do not need to know the benefits of ecosystem services, but rather the benefits of specific ecosystem-service policies and programs. There is a big difference between the statement *poor people depend on ecosystem services* and the statement *poor people would be better off with a specific conservation program*. The latter is much more policy relevant and should be the focus of our valuation efforts.

Final Thoughts

Protected areas and other regulatory approaches are the cornerstone of ecosystem conservation policy. In high-income nations, land acquisition and easements also play important roles, and in low- and middle-income nations, indirect alternative-livelihoods approaches persist in the project portfolios of nongovernmental, bilateral, and multilateral donors. Nevertheless, in the last 10 years, performance payments for protecting ecosystems and their services have increasingly been marketed as substitutes or complements to conventional conservation tools. The popularity of the direct-performance-payment approach resulted from frustration and ethical issues associated with regulatory approaches and from dissatisfaction and criticism of indirect approaches. Concerns over inadequate conservation budgets have also pushed supporters to tout PES as a mechanism to raise funds for conservation. In the absence of regulations that force beneficiaries to pay into PES systems, I believe the potential of PES to raise substantial funds for conservation is more hype than hope.

As a tool for investing conservation funds, however, PES programs in the 21st century promise to be strong complements to regulatory and norm-based approaches and substitutes to indirect alternative-livelihoods approaches. Nevertheless, their promise is far from being realized. The most critical need is to measure the environmental and social effects of current and planned PES programs and to better quantify the heterogeneity of responses and the mechanisms through which these responses arise. Although it is not unusual for empirical research to lag well behind theory and policy implementation, the current state of the PES evidence base is cause for concern. There is an urgent need for PES programs to be designed at the outset with the intent to evaluate their effectiveness and to explore competing notions of effective contract design.

Note

To calculate instances of *incentive* in *Conservation Biology*, I searched for the term *incentive* within the journal *Conservation Biology* on Google Scholar Advanced Search and Wiley Online Library Advanced Search. I then confirmed manually that the word was used to mean incentive to conserve rather than some other meaning. To calculate instances of *performance payment*, I used the same search engines to search for *payment* and then manually checked the way the term was used.

Literature Cited

Alix-Garcia, J. M., E. Shapiro, and K. R. E. Sims. 2010. The environmental effectiveness of payments for environmental services in Mexico: results from a pilot analysis. Working paper. University of Wisconsin, Madison.

Arriagada, R., P. J. Ferraro, S. K. Pattanayak, E. Sills, and S. Cordero. 2012. Do payments for environmental services affect forest cover? A farm-level evaluation from Costa Rica. Land Economics **88:**in press.

Boza, M. 1993. Conservation in action: past, present, and future of the national park system in Costa Rica. Conservation Biology **7:**239–247.

Ferraro, P. J. 2001. Global habitat protection: limitations of development interventions and a role for conservation performance payments. Conservation Biology **15:**990–1000.

Ferraro, P. J. 2008. Asymmetric information and contract design for payments for environmental services. Ecological Economics **65:**811–822.

Ferraro, P. J. 2009. Counterfactual thinking and impact evaluation in environmental policy. New Directions for Evaluation **122:**75–84 (special issue on Environmental program and policy evaluation).

Ferraro, P. J., and R. D. Simpson. 2002. The cost-effectiveness of conservation payments. Land Economics **78:**339–353.

Ferraro, P. J., K. Lawlor, K. L. Mullan, and S. K. Pattanayak. 2012. Forest figures: a review of ecosystem services valuation and policy evaluation in developing countries. Review of Environmental Economics and Policy **6:**in press.

Hartshorn, G., P. J. Ferraro, and B. Spergel. 2005. Evaluation of the World Bank—GEF Ecomarkets Project in Costa Rica. World Bank, Washington, D.C.

Mech, L. D. 1995. The challenge and opportunity of recovering wolf populations. Conservation Biology **9:**270–278.

Meine, C., M. Soulé, and R. F. Noss. 2006. 'A mission-driven discipline': the growth of conservation biology. Conservation Biology **20:**631–651

Naidoo, R., A. Balmford, P. J. Ferraro, S. Polasky, T. H. Ricketts, and M. Rouget. 2006. Integrating economic costs into conservation planning. Trends in Ecology & Evolution **21:**681–687.

Pattanayak, S. K., S. Wunder, and P. J. Ferraro. 2010. Show me the money: Do payments supply ecosystem services in developing countries? Review of Environmental Economics and Policy **4:**254–274.

Rawlings, L. B., and G. M. Rubio. 2005. Evaluating the impact of conditional cash transfer programs. World Bank Research Observer **20:**29–55.

Simpson, R. D., and R. A. Sedjo. 1996. Paying for the conservation of endangered ecosystems: a comparison of direct and indirect approaches. Environment and Development Economics **1:**241–257.