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The Effectiveness of Payments for Environmental Services

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Summary. — We adopt a theory-based approach to synthesize research on the effectiveness of payments for environmental services in achieving environmental objectives and socio-economic co-benefits in varying contexts. Our theory of change builds on established conceptual models of impact pathways and highlights the role of (1) contextual dimensions (e.g., political, institutional, and socio-economic conditions, spatial heterogeneity in environmental service values and provision costs, and interactions with pre-existing policies), and (2) scheme design (e.g., payment type and level, contract length, targeting, and differentiation of payments) in determining environmental and socio-economic outcomes. To shed light on the overall effectiveness of payment schemes, and its determinants, we review counterfactual-based empirical evaluations, comparative analyses of case-studies, and meta-analyses. Our review suggests that program effectiveness often lags behind the expectations of early theorists. However, we also find that theory has advanced sufficiently to identify common reasons for why payment schemes fail or succeed. Moreover, payment schemes are often rolled out along with other policy instruments in so-called policy mixes. Advances in theory and evaluation research are needed to improve our understanding of how such policy mixes interact with the targeted social-ecological systems.

Key words — payments for ecosystem services, environmental effectiveness, trade-offs, policy design, impact evaluation

1. INTRODUCTION

Over the past two decades, a rich academic debate has emerged around the effectiveness of payments for environmental—or ecosystem—services (PES) (Muradian *et al.*, 2013; Pattanayak, Wunder, & Ferraro, 2010). Dozens of PES initiatives have been implemented in communities, regions, or countries around the world (Ezzine-de-Blas, Wunder, Ruiz-Pérez, & del Pilar Moreno-Sanchez, 2016). These programs provide land users with an incentive to protect or enhance the provision of ecological or environmental services (Daily, 1997). Well-studied examples of PES programs include the Costa Rican and Mexican national programs for forest protection (Alix-Garcia, Shapiro, & Sims, 2012; Pagiola, 2008), agri-environmental policies in the USA and the EU (Baylis, Peplow, Rausser, & Simon, 2008), and the Chinese Sloping Land Conversion Program (Bennett, 2008).

The literature on PES has grown rapidly. According to Google Scholar, [1] an average of 1715 articles per year was published on the topic during 2010–15. The early literature tentatively defined the concept of PES and documented the first field experiences with this type of program (Ferraro & Kiss, 2002; Landell Mills & Porras, 2002; Muradian, Corbera, Pascual, Kosoy, & May, 2010; Wunder, 2005). Summarizing the debate on the definition of PES, Wunder (2015) concluded that "…PES can be defined as voluntary transactions between services users and service providers that are conditional on agreed rules of natural resource management for generating offsite services" (Wunder, 2015: p. 241).

The literature on PES features descriptive case studies, theoretical work on incentive design and behavioral responses, systematic reviews, and a small but increasing amount of counterfactual-based impact evaluations. In the early years of PES evaluation studies (2003–11), PES programs were still being piloted, designed and tested (Asquith, Vargas, & Wunder, 2008; Engel, Pagiola, & Wunder, 2008; Kosoy, Martinez-Tuna, Muradian, & Martinez-Alier, 2007; Wunder, 2005). The PES concept was pioneered in Costa Rica, where a national payment scheme was set up in 1997 to maintain and enhance environmental service provision in the forestry sector (Pagiola, 2008). In industrialized countries, large-scale incentive-based programs had also previously been designed to protect agricultural soils and retire environmentally sensitive lands. One of the earliest agricultural payment schemes, the Conservation Reserve Program in the United States (initiated in 1985), was found to have reduced soil erosion on participating farms (Goodwin & Smith, 2003). After the EU agricultural reforms in 2001, multiple programs under the Common Agricultural Policy paid farmers to undertake conservation measures on farms, such as reducing input use inten-

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sity and preserving habitat (Baylis *et al.*, 2008). China was also an early adopter of PES, introducing the sloping-land conversion program in 2002, which paid participants to restore large tracts of marginal agricultural land with trees or grasslands (Xu, Bennett, Tao, & Xu, 2004). Much research during this early period focused mostly on developing monitoring indicators and collecting data on outcomes to inform program design (Honey-Rosés, López-García, Rendón-Salinas, Peralta-Higuera, & Galindo-Leal, 2009).

As PES gained popularity among researchers and practitioners alike, an increasing number of conceptual and empirical studies identified potential drawbacks. Payment schemes were alleged to potentially reinforce tradeoffs between environmental and social outcomes or to induce adverse behavioral effects (Corbera, Kosoy, & Martinez Tuna, 2007; Muradian *et al.*, 2013; Pascual, Muradian, Rodríguez, & Duraiappah, 2010). Some case studies also highlighted that PES are frequently part of a policy mix, where policy instruments interact, deliberately or not, in producing both desired and undesired outcomes (Howlett, 2004, 2009; Barton, Blumentrath, & Rusch, 2013). Clearly, when payment schemes are embedded in complex social-ecological systems, outcomes can be the result of multiple interacting factors. Such complexity makes it difficult to attribute impact from simple before-after and/or with-without comparisons. To understand the true effect of PES programs, scholars are pushing the PES literature to adopt counterfactual-based evaluation approaches and construct a systematic evidence base, such as in medical or development research (Baylis *et al.*, 2016; Ferraro, 2011; Pattanayak *et al.*, 2010).

Given the sustained interest in PES, much has been written about the potential benefits and pitfalls of payment-based approaches in environmental governance (Muradian *et al.*, 2013; Wunder, 2013). Yet, it has not always been clear whether arguments rest on theoretical considerations, case-study-based anecdotal evidence, comparative analysis, or counterfactual impact evaluations (Corbera, 2015). Here we aim to shed light on these issues by summarizing what we know so far about the conditions under which payments can achieve environmental objectives and socio-economic co-benefits.

Section 2 begins with a fresh look at how PES is thought to induce positive environmental and socio-economic outcomes (i.e., a theory of change), highlighting which PES design features and implementation contexts are key to such outcomes (White, 2009). While it is too early to draw externally valid conclusions from the still small number of counterfactual-based PES evaluation studies, Section 3 synthesizes currently available findings. A systematic global PES review is beyond our scope, but we seek to extract the major lessons from previous reviews. Section 4 thus reviews previous PES assessments, both comparative case studies and meta-analyses, covering various sector and country contexts. Section 5 summarizes, discusses key insights, and identifies future research needs.

2. A THEORY OF CHANGE FOR EFFECTIVE PES OUTCOMES

By directly compensating environmental service providers for the opportunity costs of conservation, PES was originally conceived as a theoretically cost-effective[2] instrument for maximizing the impact of scarce conservation funds (Ferraro & Kiss, 2002; Ferraro & Simpson, 2002). Still, PES programs—especially in low-income countries—often have the dual objectives of conservation and improved economic and social welfare.[3] Here we review the theoretical predictions of the extent to which a given PES program will deliver upon multiple promises. We assess factors determining the environmental effectiveness and welfare implications of PES programs.

Environmental effectiveness is defined as the change in provision of services induced by the program, compared to a counterfactual without PES. Effectiveness will be determined by four main factors. First, program costs—i.e., transaction and implementation costs net of PES transfers—which determine the number of contracts that can be offered for a given program budget and payment level. Second, the direct changes in land/resource-use among participants induced by the program, compared to a baseline of "no PES" (i.e., *additionality*). Third, the indirect effects (positive or negative) of the program on land/resource use and environmental service (ES) provision outside of contracted land (*spillovers*). Fourth, the effects these changes in land/resource-use among participants and non-participants have on the actual provision of environmental services (e.g., the biophysical link between induced behavioral changes in practices and the targeted ES). Each of these factors is, in turn, shaped by the interplay of features related to the context, design, and implementation of PES (Engel *et al.*, 2008; Persson & Alpizar, 2013) that are discussed below. See Figure 1 for an overview.

Just as with environmental effectiveness, the impact of PES on welfare will be determined by a range of socio-economic and environmental factors (see Figure 1). The most important of these factors are highlighted below, ending with a discussion on the potential trade-offs and synergies between environmental and welfare-related outcomes in PES.

(a) *PES program costs*

Any cost of PES implementation above the minimum payment necessary to induce landowner participation in the PES program will indirectly reduce the environmental effectiveness of the program through a reduction in the number of PES contracts that can be secured for a given budget (Ferraro, 2008). This effect will not be captured by impact evaluations of PES, as these usually only measure the effect of the contracts actually made.

Information rents[4] captured by ES providers can potentially reduce program cost-effectiveness significantly. Just like adverse participant selection, information rents result from a basic information asymmetry: ES buyers do not have (perfect) information on the opportunity and transaction costs associated with PES enrollment, and hence payments will tend to overcompensate ES providers. Under uniform payments, there will be efficiency losses due to information rents even under perfect information about participants' opportunity costs (unless they are perfectly homogenous). Reducing information rents therefore requires differentiating payments to better match ES providers' opportunity costs (Engel, 2016). This can be achieved, for example, based on proxies for opportunity costs (e.g., biophysical land characteristics), screening contracts, or procurement auctions (Ferraro, 2008). The effectiveness gains from payment differentiation will be higher, the larger the heterogeneity in opportunity costs among potential PES participants (Engel, 2016; Wünscher, Engel, & Wunder, 2008). Still, the potential gains have to be weighed against the potential effectiveness losses from increased transaction costs associated with differentiating payments, as well as associated welfare implications.

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