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Payments for ecosystem services: A review and comparison of developing and industrialized countries



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ARTICLE INFO

Article history:

Received 15 May 2012

Received in revised form

7 January 2013

Accepted 9 January 2013

Available online 14 February 2013

Keywords:

PES

Payments for environmental services

Agri-environmental programs

Environmental incentives

Economic instruments

Conservation measures

ABSTRACT

Payments for ecosystem services (PES) received a lot of academic attention in the past years. However, the concept remains loose and many different conservation approaches are published under the 'PES label'. We reviewed 457 articles obtained in a structured literature search in order to present an overview of the PES literature. This paper (1) illustrates the different analytical perspectives on PES concepts and types, (2) shows the geographic focus of PES research and (3) identifies the major foci of the overall PES research. The paper finally (4) identifies differences and similarities in conservation programs and main research topics between developing and industrialized countries to (5) disclose potentials for research synergies, should research experiences in the two types of countries be exchanged more deliberately. We demonstrate that only few publications describe Coasean PES approaches. The majority of research refers to national governmental payment programs. The overall design of national PES programs in Latin America resembles the design of those in the US and EU considerably. Programs in the US and EU have been in place longer than most of the frequently published Latin American schemes. However the former are hardly considered in the international PES literature as research is usually published under different terminologies.

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1. Introduction

In the Millennium Ecosystem Assessment (MEA) ecosystem services (ES) are broadly defined as “the benefits people obtain from ecosystems” (Millennium Ecosystem Assessment, 2005: V). Changes to ecosystems and degradation of ecosystem services are increasing at an alarming rate (Millennium Ecosystem Assessment, 2005). From an economic perspective, degradation occurs as many ES exhibit the characteristics of public goods, resulting in externalities. “As public goods, ecosystem services have been traditionally underprovided due to their lack of value in the marketplace” (Jenkins et al., 2010: 1060). Thus, society fails to establish institutions that internalize the value of services provided by intact ecosystems (Pattanayak et al., 2010). Payments for Ecosystem Services (PES) are discussed as a novel conservation approach and “probably the most promising innovation in conservation since Rio 1992” (Wunder and Wertz-Kanounnikoff, 2009: 576) as it attempts to overcome the problem of externalities (Engel et al., 2008). Van Hecken and Bastiaensen (2010a: 785) pointed out that the conceptual basis for PES can be found within neoclassical environmental economics, “where

environmental degradation is ascribed to the chronic failure of markets to internalize environmental externalities and to free-riding induced by the public-good nature of ecosystem services. Hence, the PES philosophy argues for the internalization of environmental externalities through the creation of markets and quasi-markets”. Private actors are assumed to “put in practice the Coase theorem” (Engel et al., 2008: 665), meaning that the problem of externalities can best be overcome through private negotiations between affected parties. I.e., beneficiaries of sound environmental practices providing and/or sustaining valuable ES pay land stewards for adopting land use practices that are assumed to provide the demanded and contracted ES. The payment is the carrot motivating land users to comply with environmentally sound land use practices.

In the last decade, both, the concept of ES and PES received more and more attention among scientists. The historical development of the ES concept and its incorporation into markets and payment schemes was depicted by Gomez-Baggethun et al. (2010). Jack et al. (2008) summarize literature on how the environmental socio-economic and political context influences the outcomes of PES schemes.

However, PES remains a multi-faceted term with many diverse definitions coexisting. A seminal definition is given by Wunder (2005: 3) focusing on market transactions and construing PES as “(1.) a voluntary transaction where (2.) a well-defined ES (or a land-use likely to secure that service) (3.) is being ‘bought’

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by a (minimum one) ES buyer (4.) from a (minimum one) ES provider (5.) if and only if the ES provider secures ES provision (conditionality)". This definition has been criticized for being too narrow and thus excluding many payment schemes that do not comply with these criteria. In particular the voluntary aspect of the transaction has been questioned—at least from the buyer's side. Many PES cases rather involve governmental intervention and public payment schemes (Vatn, 2010). Wunder's definition, relying on the Coasean conceptualization of markets, led to the subdivision of 'genuine PES' and 'PES-like' approaches (Muradian et al., 2010; Vatn, 2010). Consequently, Muradian et al. (2010) elaborated a definition, focusing rather on the public good character of most ES and the resulting externalities that shall be internalized within PES. "PES ought to be the creation of incentives for the provision of such goods, thereby changing individual or collective behavior that otherwise would lead to excessive deterioration of ecosystems and natural resources. Therefore, it may be convenient to define PES as a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources" (Muradian et al., 2010: 1205). This definition does not exclude governmental payment schemes, which are frequently referred to as the Pigouvian conceptualization of PES (Vatn, 2010). Also Vatn has a wider understanding of PES as opposed to Wunder's definition where payments are linked to markets. Vatn clearly differentiates PES from the ecosystem/environmental services markets concept: "... markets demand payments. However, also hierarchies and communities may use payments—e.g. in the form of state taxes and subsidies or community compensations. Hence, I find it productive to make a distinction between the wider concept of payments for environmental services (PES) and the narrower concept of markets for environmental services (MES)" (Vatn, 2010: 1247).

Many different PES cases have been published and discussed in the past decade.

The objective of this paper is to answer the following questions:

- (1) What kinds of conservation approaches are found under the "PES label" and what is their economic conceptualization?
- (2) Which are the major research priorities in the PES literature?
- (3) Is there a difference between PES labeled incentive programs in developing countries and industrialized countries in terms of types and challenges?
- (4) Is there potential for research synergies, if PES research in developing and industrialized countries is exchanged more deliberately?

This paper is organized as follows. Section 2 explains how the literature for the review was selected and sorted followed by a brief overview of how the PES concept has accumulated over time and where PES field research has been conducted geographically. Section 3 summarizes the various PES case studies described in literature, sorted (i) according to their underlying economic conceptualization and (ii) regarding their geographic origin. It also gives a first comparison of PES in developing and industrialized countries. Section 4 highlights the diverse research priorities found within PES literature and compares findings in developing and industrialized countries. The discussion (Section 5) focuses on potential research synergies between developing and industrialized countries. We will highlight in particular potential synergies if the long standing research on agri-environmental incentive programs in industrialized countries (frequently not labeled as PES) is considered. Section 6 finally concludes our results.

2. Method and material

2.1. Collecting and sorting literature

The reference material used covers 457 articles and was obtained through a structured literature survey of the "ISI Web of Knowledge"¹ database (all years). Literature survey was executed in May 2011. All possible combinations of the terms "payment(s)", "ecosystem service(s)", "environmental service(s)", "ecological service(s)" and "PES" were entered in the literature search. No other search terms were considered. Terms such as agri-environmental schemes, agri-environmental measures or agri-environmental programs etc. were not included in the literature search as the aim is to clearly identify conservation approaches and research priorities attended under the PES terminology. The references were exported to our database; double entries and material not related to PES were excluded. Any statistical findings and our result section are based on this dataset. However, for the discussion we included some more recent papers and papers currently not considered in the PES discourse but which are likely to enhance this discussion.

Papers were sorted according to continents and countries where the PES research was focused on. Thereafter, papers were successively classified into one of three categories, depending on their respective content: (1) papers briefly describing a PES case study (2) papers discussing overall PES concept from a theoretical/conceptual perspective² and (3) basic research (helpful for PES implementation).³

Papers of the third category were not further considered in this review as these did not actively add to the international PES discourse. Papers of the first and second category were analyzed for their major research priorities (to be discussed in Section 4).

Additionally papers of the first category were further sorted and categorized according to their underlying economic conceptualization: (a) PES case studies reflecting the Coasean conceptualization, (b) PES case studies reflecting the Pigouvian conceptualization and (c) PES case studies reflecting a mixture of these two ideal types (see for instance Vatn, 2010).

Sorting of case studies according to their underlying economic concept was done by us. However, differentiating PES cases accordingly has been proposed frequently in the literature (Vatn, 2010; Engel et al., 2008).

2.2. Temporal and spatial dissemination of the PES concept

Fig. 1 depicts the accumulation of PES publications over time. All articles were published between 1974 and 2011. However, until 2004 a total of only 41 papers were found. The bulk of papers were published from 2004 onwards; the increase in publications from 2004 onwards exhibits an almost exponential growth rate.⁴

The geographic distribution of PES research, i.e. the continents and countries where PES case studies and basic research

¹ Next to the Web of Science, the following databases were included in the WoK search: Biological Abstracts CABI, and Food Science and Technology Abstracts.

² This category comprises e.g. papers discussing PES from a theoretical institutional economic perspective and/or papers elaborating on the potential of PES to be used as a poverty alleviation lever.

³ This category comprises e.g. papers assessing biomass production and carbon sequestration potential of certain plants and trees or land use practices; papers assessing the relationship between forestation and habitat fragmentation and impact on sediment production; forest and watershed interactions; leaf area index measurements; etc.

⁴ Note that publications in 2011 decreased because only articles published until May 2011 are included!

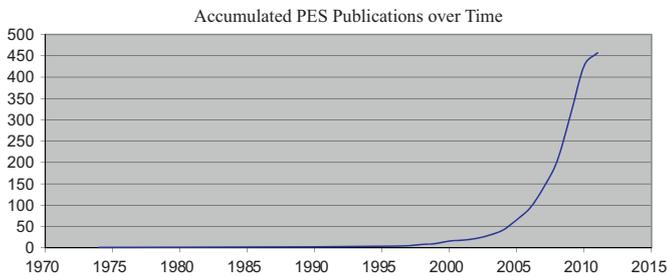


Fig. 1. Accumulated PES publication over time in the ISI web of knowledge (n=457).
Source: own illustration.

Geographical distribution of overall PES publications

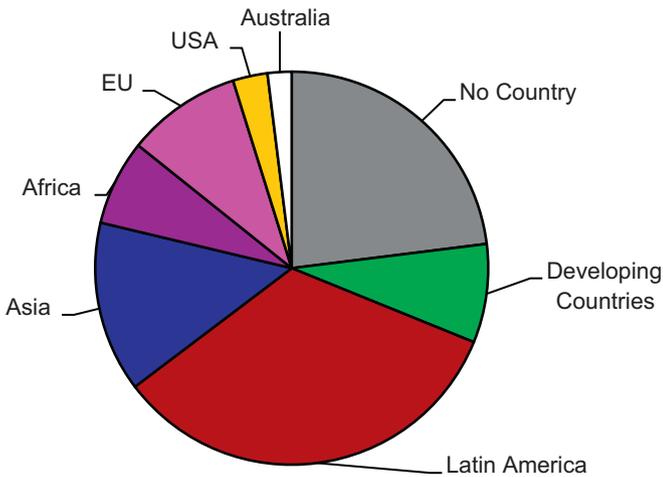


Fig. 2. Geographic distribution of overall PES publications (n=457).
Source: own illustration.

supporting PES are located, emphasizes the importance of developing countries in general and Latin America in particular (see Fig. 2). We did not look at the geographic distribution of authors and research institutions.

Approximately one fifth of all publications do not refer to any country; most of these are conceptual papers about ES, ES valuation and various conceptual and institutional economic discussions about PES. The majority of publications refer either to developing countries⁵ generally or to Asia, Latin America or Africa particularly. Remarkably, one third of all publications focus on Latin America (where studies about governmental PES schemes in Costa Rica and Mexico and the Regional Integrated Silvopastoral Ecosystem Management Project (RISEMP) scheme in Costa Rica, Nicaragua and Colombia together account for two thirds of all Latin American articles).

Approximately 15% of all published articles within the PES literature refer explicitly to the EU, US or Australia; most of these papers report on agri-environmental programs (AEP).

When looking at publications that describe a PES case study in detail, it becomes obvious that the Pigouvian conceptualization is by far the most dominant approach (Fig. 3). In particular the Costa

⁵ We sorted papers to this category if authors either explicitly referred to developing countries in general or described briefly research in more than one developing country.

Economic conceptualization of case studies

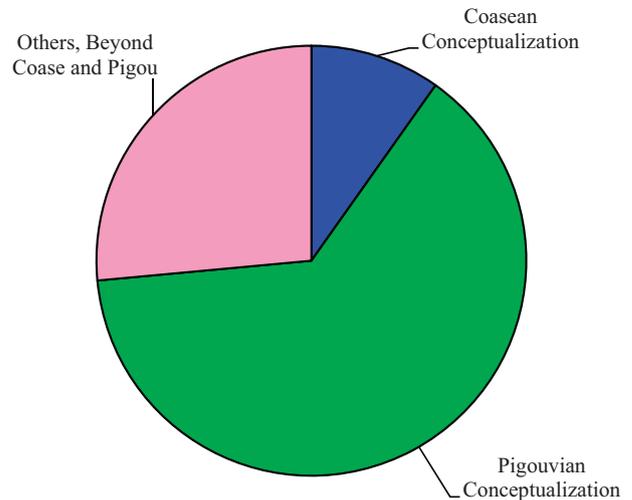


Fig. 3. Economic conceptualization of PES case studies (n=102).
Source: own illustration.

Major PES Case Studies Described in Literature

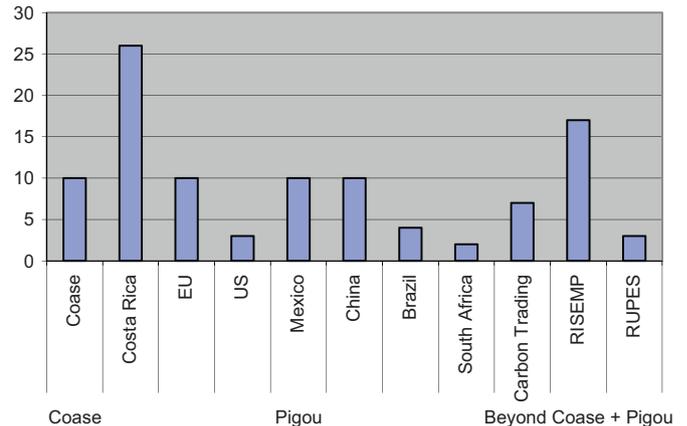


Fig. 4. Major PES case studies described in literature (n=102).
Source: own illustration.

Rican program is analyzed and described in detail, as can be seen in Fig. 4.

3. Economic conceptualizations of PES

3.1. Coasean conceptualization

A common conceptual approach underlying PES is based on Coasean ‘market’ economics. The Coase Theorem argues that – given low to no transaction costs and clearly defined and enforceable property rights – no governmental authority is needed to overcome the problem of internalizing external effects. Rather private ‘market negotiations’ among social actors will lead to an optimal allocation of resources regardless of initial allocations, as the beneficiary will compensate the provider for the externality. According to Coase (1960) there is no reason to assume that governmental intervention will perform better or produce more efficient outcomes than leaving the distribution of resources to the market. He restricts the task of government to the initial

allocation of property rights and to warranting a legal environment where property rights are enforceable.

Engel et al. (2008) point that proponents of this approach emphasize positive effects on economic efficiency and environmental effectiveness as compared to Pigouvian ‘governmental’ approaches. Coasean PES approaches are “likely to be efficient, as the actors with the most information about the value of the service are directly involved, have a clear incentive to ensure that the mechanism is functioning well, can observe directly whether the service is being delivered, and have the ability to re-negotiate (or terminate) the agreement if needed” (Engel et al., 2008: 666).

Pure Coasean PES examples are hardly described in literature. Coasean PES examples generally refer to cases where benefits from ES management are provided at local scales. In the French Vosges Mountains the water bottler Vittel has been running a PES scheme with 27 dairy farmers since 1993. Farmers are paid for reconvertng to extensive farming practices to maintain high water qualities. Wunder et al. (2008) argue that the program is complex and goes far beyond simple market transactions.

Benefits from upstream–downstream watershed management activities also accrue at local scales. Downstream water users commonly pay upstream land stewards for land use changes that are assumed to increase both, water quality and quantity. Watershed PES schemes are found in the literature, however not all of them comply with the Coasean perspective, as municipalities are often involved to varying degrees in setting up and running the scheme. The Paso de Caballos River Basin in Nicaragua fits the Coasean conceptualization. Upstream landowners are paid by private downstream households for reforestation and conservation efforts. Private households created a Water Committee and negotiated individual contracts with upstream land users (Corbera et al., 2007). The *Escobas River Basin* example also fits the Coasean PES conceptualization. The major downstream beneficiary of upstream forest conservation efforts is a local hydroelectricity and water company that benefits from continuous water flows and reduced sediment loads. Payments are made by the company, which increased the water tariff to water users (Corbera et al., 2007). A comparable approach is seen with the Cidanau River, where a state-owned water company signed contracts for watershed conservation with upstream farmers. International agencies such as the World Agroforestry Centre and the International Institute for Environment and Development were also involved in supporting the scheme (Leimona et al., 2010).

The Pimampiro PES scheme in Ecuador relies on the local municipality, charging an obligatory water fee to downstream water-using households. The fee is paid via a water fund to upstream landowners, who are contractually committed to halting deforestation and allowing some degraded lands to naturally regenerate and thus reverse agricultural expansion (Quintero et al., 2009; Wunder and Alban, 2008). Since the water fee is obligatory, the voluntary aspect as emphasized in the Wunder definition is lacking. It conflicts with the Coase Theorem, as the municipality collects and distributes payments on behalf of the main beneficiaries; contracts are not negotiated privately among relevant stakeholders.

In Bolivia a PES scheme for watershed management and migratory bird conservation in the cloud forest of Los Negros Valley was initiated in 2003. Watershed management targets on curbing upland deforestation to overcome the growing problem of water scarcity. However, upstream landowners are not paid directly by local downstream irrigators, but rather by the municipality of Pampagrande. The international conservation donor, US Fish and Wildlife Fund, paid the PES start-up costs and payments for biodiversity conservation, particularly bird protection. What is remarkable is the in-kind payment mode of this part of the PES

scheme, which transfers beehives and apicultural training to program participants (Asquith et al., 2008).

PES schemes borrowing from the Coasean conceptualization are also found in the context of wildlife conservation. A community-based ecotourism program in Cambodia targets highly threatened bird species. The scheme links generated revenues from bird-watching tourism to long-term species conservation. Villagers are paid for ceasing to hunt birds (Clements et al., 2010). PES schemes to promote wildlife conservation are also described in the literature for savannah ecosystems in Africa. Tourism operators contract areas mostly from Maasai pastoralists via conservation concessions or land lease contracts. Annual payments are made to residents of the areas. Formal agreements exclude agricultural cultivation, permanent settlements, charcoal burning and unlicensed hunting within the areas. Aim of payments is to halt and reverse the great increase in land accession for agriculture and cattle farming. Wildlife habitat loss and illegal hunting is assumed to have caused a substantial decrease in resident wildlife and migratory wildebeest populations (Nelson et al., 2010).

Interestingly, other publications found describe studies assessing the possibility of implementing a Coasean based PES scheme in the future (Fisher et al., 2010; Baltodano and Alpizar, 2006; Calles and Piedra, 2005). This could imply that the Coasean PES concept is likely to gain in importance in the future.

3.2. Pigouvian conceptualization

Governmental payment programs are commonly referred to as the Pigouvian concept of PES (Vatn, 2010; Pattanayak et al., 2010; Van Hecken and Bastiaensen, 2010a, 2010b). We will therefore use this as one category of PES. However, to be accurate in definitions, we would like to point out that governmental payment approaches rather follow the environmental pricing and standards procedure (Baumol and Oates, 1971). The Pigouvian conceptualization is based on the “Pigouvian philosophy of taxing negative or subsidizing positive externalities within existing product markets” (Van Hecken and Bastiaensen, 2010b: 422). The Pigouvian technique requires that the payment equals the marginal net benefit that it is supposed to generate. The environmental pricing and standards procedure, in contrast, “begins with a predetermined set of standards for environmental quality and then imposes unit taxes (or subsidies) sufficient to achieve these standards” (Baumol and Oates, 1971: 51). Consequently, a uniform set of payments reflects the price for the provision of public goods. The pricing and standards procedure provides ES at lower costs than the Pigouvian approach, however it will not lead to a Pareto-optimal allocation of resources (Baumol and Oates, 1971).

Also van Hecken and Bastiaensen emphasize that governmental PES schemes diverge from classical Pigouvian subsidies, as payments are not necessarily linked to a commodity which is assumed to provide the beneficial externality. Rather, the ES itself is converted into a tradable commodity (Van Hecken and Bastiaensen, 2010a; Kosoy and Corbera, 2010). Within governmental PES schemes the state is considered as a “third party acting on behalf of service buyers” (Engel et al., 2008: 666). The main difference between Coasean and Pigouvian PES schemes is thus the directness of transfer: in the former the direct beneficiary pays the service provider, buyers in the latter case are not the direct users. Consequently Vatn (2010) emphasizes that the delineation between these two types of PES schemes is often characterized by different exclusion cost structures: Coasean PES schemes frequently pay land stewards for the provision of ES that are characterized as club goods. Beneficiaries of such ES exist only at local scales and can therefore be directly identified. Pigouvian

PES schemes rather focus on the provision of public goods. Beneficiaries cannot be excluded at all or at reasonable costs.

Governmental financial incentive programs are discussed under the PES label for Costa Rica, Mexico, the EU member states, the US and China. Even though Australia has comparable national programs to those in the US or European Union (EU), hardly any information was found in the literature under the PES label. Australian programs are therefore not further considered, with its potential to enrich the international PES noted only briefly discourse in the discussion section.

Even though China's governmental conservation instruments are published under the 'PES label', key governance characteristics are distinct from other national PES programs. Brazil does not currently have a national PES program. However a proposal for such a program is being developed to be submitted to Brazil's Ministry of the Environment. South Africa has a governmental program that is mentioned within the PES discourse: the Working for Water program (WfW) focuses primarily on relieving people of poverty and unemployment. Conservation of hydrological functions and biodiversity within mountain catchments is only secondary. PES programs and schemes are described in more detail below.

3.2.1. Costa Rica

Costa Rica's national PES program – called 'Pagos por Servicios Ambientales (PSA)' – was established in 1996 and implemented in 1997 (Sanchez-Azofeifa et al., 2007; Rodriguez, 2002). The program was based on existing political support and a system of payments for reforestation and forest management developed in the 1970s (Araya, 1998; Pagiola, 2008). The PSA program targets four ES: (1) greenhouse gas mitigation; (2) hydrological services; (3) scenic beauty and (4) biodiversity (Sanchez-Azofeifa et al., 2007: 1166). Private forest landowners are paid either for forest conservation or reforestation “with the aim of integrating environmental considerations in landscapes outside protected areas” (Pagiola, 2008: 716). Initially landowners were also paid for sustainable land management but this measure was removed from the PSA program in 2000.

Payments are the same across the country, varying only between conservation and reforestation contracts (Pagiola, 2008). Approximately 95% of enrolled areas are contracted under forest conservation agreements; by the end of 2005 about 10% of all forested land in Costa Rica was enrolled in the PSA program. The program is criticized for a lack of targeting, for distributing undifferentiated payments that do not consider opportunity costs and for a lack of additionality, i.e. paying for services that would have been provided anyway (Sanchez-Azofeifa et al., 2007; Daniels et al., 2010). This is reflected in the fact that at the national level almost all forests would have been preserved without payments (Pfaff et al., 2008; Robalino et al., 2008; Daniels et al., 2010). Additionality is neither part of the PSA program nor explicitly mentioned in the Forest Law 7575, under which the PSA program was enacted (Daniels et al., 2010). Pagiola argues that “in a sense, the PSA program was a quid pro quo for legal restrictions on clearing” (Pagiola, 2008: 718), as an official ban on forest clearing coincided with the enactment of the PSA program. Without payments, landowners' opposition against legal restrictions could have been higher. This implies that a regulatory mechanism has become effective and that land users could voluntarily file for monetary compensation for compulsory land use changes. Thus this program conflicts heavily with the voluntary criteria of Wunder's PES definition (Wunder, 2005) and also with the 'creation of incentives' under the PES definition by Muradian et al. (2010).

The bulk of program financing comes from a mandatory tax on fossil fuels, raising approximately US\$ 10 million/year (Sanchez-Azofeifa et al., 2007; Pagiola, 2008). Also bi- and multilateral donors such as the Global Environment Facility (GEF), the World Bank, Conservation International or the German aid agency KfW support the program and pay for the preservation of biodiversity and global benefits such as carbon sequestration (Blackman and Woodward, 2009; Pagiola, 2008). Domestic water users pay for water services obtained. In 2005 a mandatory water tariff with a special conservation fee was introduced, representing “a shift from voluntary agreements to compulsory ones” (Pagiola, 2008: 715). Norway purchased carbon offsets worth US\$ 2 million in 2001, which under Kyoto's Clean Development Mechanism (CDM) were only eligible for re- and afforestation activities (Subak, 2000; Corbera et al., 2009).

Even though Costa Rica appears to have the most prevalently analyzed PES scheme, it deviates from the Coasean market conception. It fails Wunder's PES definition as commitment does not appear to be voluntary on the buyer's nor on the provider's side (due to the ban on forest clearing) and does not comply with the criteria of conditionality.

3.2.2. Mexico

Mexico's national PES program – initially called 'Pagos por Servicios Ambientales Hidrológicos' (PSA-H) – was launched in 2003 (Southgate and Wunder, 2009). The program was implemented at the national scale to halt the overexploitation of aquifers. Payments were linked to the conservation of existing forests and distributed according to a uniform payment scheme, differentiating only between cloud forests and other forests (Munoz-Pina et al., 2008). The Mexican PES program distributes payments to private land owners and *ejidos*⁶ (Alix-Garcia et al., 2009).

An obligatory water fee secures the monetary funding for the program, creating a slight link between water beneficiaries and providers. The public good character of water prompted the Mexican government to “opt for a system in which it would act as an intermediary between service providers and users, instead of creating a framework for private transactions between them” (Munoz-Pina et al., 2008: 734).

The program lacks targeting; neither overexploited aquifers nor marginalized communities are targeted explicitly, even though both were planned for initially (Alix-Garcia et al., 2009; Corbera, 2010). As a result, enrolled watersheds were not or only moderately overexploited.

Consequently the cost-effectiveness of the program has been criticized frequently. “It is clear that the payment level was high enough to attract a substantial number of participants, but it would seem that often those who chose to participate had no intention of cutting down the forest in the first place” (Alix-Garcia et al., 2009: 187). I.e. payments could probably have been lower with the same result.

After successful lobbying by peasants and forest-based organizations, the PSA-H program was enlarged to PSA-CABSA in 2004 (Corbera, 2010). PSA-CABSA is a national policy program paying for “(i) carbon fixation by forests to halt climate change; (ii) for rural communities who support biodiversity conservation; and (iii) for the development of agroforestry systems, specifically for shade grown coffee plantations” (Government of Mexico 2003, translated by Kosoy et al., 2008: 2077). Finally, all national forestry programs were merged into one common PES policy

⁶ Ejido is a local land management process, which considers land and forests as common property. Ejidos play a dominant role with 47% of all signed contracts and 93% of enrolled land (Alix-Garcia et al., 2009).

framework, known as *Pro-Árbol* in 2006 (Kosoy et al., 2008; Corbera, 2010).

3.2.3. European Union

Within the EU, the discussion on PES as a mechanism to internalize externalities dates back to the 1970s and thus long before PES implementation in Latin America. The earliest article found within this research was published in 1974, investigating “deficiency payments as compensation for the ecological services of agriculture” in Austria (Kaiser, 1974: 36). In 1988 Giessubel-Kreusch (1988) discussed the “stimulation of environmental protection through payments for positive environmental effects emanating from agriculture”. Pevetz (1992: 886) discussed in 1992 the necessity of considering agricultural policy payments “not merely as a social aid but rather as a payment for genuine ecological services”.

In the 1980s, national PES programs were implemented and coordinated at the individual member state level (Baylis et al., 2006). In 1992 the MacSharry reforms resulted in a coordinated policy at the supra-national level of the EU (Baylis et al., 2008). The regulation EC 2078/92 introduced agri-environmental programs (AEPs) as a supplement to the Common Agricultural Policy (CAP) instruments across the EU member states (Baylis et al., 2008; Baylis et al., 2006). AEPs provide payments to farmers choosing to implement conservation efforts that improve the environment and/or maintain the countryside on a voluntary basis.

Hampicke emphasizes that “in granting payments for ecological services according to new CAP regulations the trend towards rewarding positive environmental externalities has begun” (Hampicke, 1997: 253). However, the introduction of AEPs also induced a controversial discussion on whether AEPs are disguised production subsidies providing a more acceptable way of income transfer to farmers or rather an instrument “to encourage the optimal production of positive and negative externalities” (Baylis et al., 2006: 1).

Farmers within the EU wanting to receive single farm payments from the first pillar need to comply with a certain minimum of Good Farming Practice (GFP).⁷ Beyond the GFP baseline additional payments in form of PES payments can be obtained on a voluntary basis (Baylis et al., 2008). AEPs consist of a variety of different agri-environmental schemes and measures. Depending on the agri-environmental scheme, both, the reduction of negative externalities (e.g. reduction of nitrate and pesticide pollution, conversion of intensive to extensive arable farming land etc.) and the provision of positive externalities are remunerated (Baylis et al., 2008). In the EU, approximately 20% of all farmland “is under some form of agri-environment program to reduce the negative impacts of modern agriculture on the environment, at a cost of about \$1.5 billion” (Scherr et al., 2007: 381). Scherr et al. (2007: 381) emphasize that the “largest public biodiversity PES programs are the agri-environment payment programs in the United States and Europe, which compensate farmers for providing a variety of conservation-friendly land-use and management practices”.

AEPs often lack targeting on important areas. Consequently, unsatisfactory and inefficient results are obtained often (Uthes et al., 2010; Haaren and Bathke, 2008; Bertke et al., 2005; Groth, 2005).

⁷ The actual level of GFP needed to receive cross-compliance payments is set individually by member states. Complying with GFP is voluntary. However, Baylis et al. (2008: 755) note that “it is in reality compulsory because few farmers would be able to continue in business without Pillar 1 payments” (Baylis et al., 2008: 755).

3.2.4. USA

The history of governmental incentives to promote conservation efforts in the US had been in existence longer than in the EU. In the 1930s, the fore-runner of the modern Conservation Reserve Program (CRP) protected soils and attempted to reduce certain crop production to prevent a surplus (Baylis et al., 2008). The 1985 Farm Bill broadened the US agricultural policy to integrate environmental and farm income concerns. Swampbuster and Sodbuster were integrated in the Farm Bill to halt conversion of wetland and highly erodible land to cropland (Baylis et al., 2008). Highly erodible land was taken out of production with the creation of the Conservation Reserve Program (CRP) (Dobbs, 2006).

In 1996, the Environmental Quality Incentives Program (EQIP) was introduced in the Farm Bill and continuously modified in the 2002 Farm Bill with expanded financing and creation of the Conservation Security Program (CSP). EQIP and CSP are AEPs for working lands and are essentially “programs for the Federal government to purchase environmental services from agriculture” (Dobbs, 2006: 16). CSP is the closest program to what ‘multifunctionality’ is in Europe (Dobbs, 2006).

3.2.5. China

In China PES schemes are most commonly described under the term eco-compensation. No clear definition for eco-compensation exists currently. It can be understood as an economic instrument aimed at the provision of public goods. According to Xiong and Wang (2010), it is a public regulation that uses fiscal transfer mechanisms to internalize externalities and to thus correct the distortion between private and social interest. They define eco-compensation as a “fiscal transfer compensation mechanism [...] that increases the cost (or income) of damaging (or protecting) environmental actions through charge (or compensation), and encourage operators to decrease (or increase) due to the external non-economy (or external economy) brought from the damage (or protection) actions so as to achieve the objective of protecting resources” (2010: 390). This complies with the PES definition of Muradian et al. (2010). Either a fee is levied to reduce negative externalities or compensations in different forms are distributed for the provision of positive externalities (Xiong and Wang, 2010; Qiu et al., 2008). The latter complies with the Pigouvian PES conceptualization. However, eco-compensation actually contradicts PES because the payment is in fact a compensation for legal land-use restrictions and thus not an economic incentive to foster land use changes (Mullan et al., 2011). Hence it is rather a program to compensate for regulatory interventions. Zhen and Zhang (2011)⁸ provide a detailed overview of payment programs in China.

The most important eco-compensation regulation is the forest ecological benefit compensation mechanism (Xiong and Wang, 2010). The two major components of China’s six key forest conservation programs, the Natural Forest Conservation Program (NFCP⁹) and the Sloping Land Conversion Program (SLCP¹⁰), are briefly described in the literature (Liu et al., 2008).

3.2.5.1. NFCP. The NFCP was initiated as a pilot program in 1998 covering 12 provinces and autonomous regions. By 2000 it was expanded to 18 provinces and regions and thus became one of the largest forest conservation policies in the world (Mullan et al., 2011).

⁸ The literature review of Zhen and Zhang had been published two month after the cut off date for our literature search. It is not considered in the statistical documentation.

⁹ Synonymously referred to as the Natural Forest Protection Program (NFPP).

¹⁰ Synonymously referred to as the Grain to Green Program (GTGP) and the Farm to Forest Program.

Natural forests were to be restored and protected through bans on logging to preserve ecosystem services such as soil erosion, water retention and flood control (Liu et al., 2008). Payments compensate for economic losses due to the legal restriction on logging and remunerate for reforestation and sustainable forest management activities (Mullan et al., 2011). Funding for the program is provided by the central government (81.5%) and local governments (18.5%) (Liu et al., 2008).

3.2.5.2. SLCP. To convert sloped cropland to grasslands or forests, the central government complemented the NFCP with the Sloping Land Conversion Program (SLCP) in 1999 (Gauvin et al., 2010, Weyerhaeuser et al., 2005).¹¹ The overall goal is to further reduce soil and water erosions (desertification) (Bennett, 2008) as well as to alleviate rural poverty in China's most vulnerable regions (Gauvin et al., 2010). In comparison to the NFCP, the SLCP is much broader in its geographic and social scope (Liu et al., 2008). Enrolled participants are compensated according to a two-tiered payment scheme with an in-kind and a cash component. Payments are differentiated between the upper Yangtze River Basin and the upper and middle reaches of the Yellow River Basin. However, Gauvin et al. (2010) demonstrate that cost-effectiveness of the program could be improved by targeting parcels with low opportunity costs and high environmental benefits.

Another example of eco-compensation found within the PES literature is the 'returning farmland to lake' program in Hunan Province, with the objective of expanding 779 km² coverage of wetland for biodiversity protection, climate regulation, recreation and culture and to increase water volume for flood control and drought resistance. The inhabitant resettling plan resettled more than 815,000 people to mostly newly established towns. They were compensated mainly with housing subsidies, tax exemptions and land utilization (Xiong and Wang, 2010).

The Chinese conceptualization of PES thus rather reflects a compensation mechanism for legal restrictions.

3.2.6. South Africa

The South African Working for Water Program (WfW) was established as a governmental program in 1995 and is run as a public poverty relief work program. It is included in the PES discourse because hydrological functions and biodiversity of mountain catchments are targeted and restored. The WfW program does not pay land stewards for land use changes that are assumed to provide or conserve certain ES. Instead unemployed individuals are contracted to clear invasive plant species and to restore natural fire regimes in private, communal or public mountain catchments and riparian zones. Funding for the WfW program comes mostly from public poverty programs and water tariffs (Swallow et al., 2010; Turpie et al., 2008).

In reference to the emphasized PES definitions, the WfW program is not an economic mechanism to internalize externalities by assigning economic values to ES. It is rather a public employment program. Still, it represents a fiscal transfer, which remunerates activities that preserve ES.

3.2.7. Brazil

Brazil currently has neither a national PES program, nor does it recognize the legal concept of ES and their respective economic values (Costenbader, 2009). However, both, a national policy for the conceptualization of ES and a national PES Program are currently under discussion (Farley and Costanza, 2010).

If approved, the Brazilian PES concept will rely on the definition of ES from the Proambiente program (Costenbader, 2009).

Proambiente is based on a "Programme of Socio-Environmental Services" supported by a 'Social-Environmental Fund' to provide payments to small producers for environmental services rendered" (Hall, 2008b). It was developed by civil society organizations (rural unions, community groups and environmental NGOs) in the Amazon region in 2000 and had been transferred from these civil society organizations to the Ministry of the Environment in 2004 (Hall, 2008a). Under the Proambiente program smallholder payment schemes were developed to remunerate farmers for the provision of ecosystem services, such as the "(i) reduction or avoidance of deforestation; (ii) carbon sequestration; (iii) recuperation of ecosystem hydrological functions; (iv) soil conservation; (v) preservation of biodiversity; and (vi) reduction of forest fires" (Hall, 2008a: 1928) and to reduce the loss of ES induced by agriculture (Boerner et al., 2007). The to-be-developed national PES program in Brazil will also include Reduced Emissions from Deforestation and Degradation (REDD) as well as carbon sequestration (Costenbader, 2009).

3.3. Financial Incentives beyond Coase and Pigou

Within the literature other conservation approaches are described that neither fit the Coasean 'market' conceptualization where private negotiations between concerned stakeholders lead to an optimal allocation of resources, nor the Pigouvian conceptualization where governments distribute economic incentives to align individual land use decisions with the social interest.

These are briefly described below.

3.3.1. RISEMP

The Regional Integrated Silvopastoral Ecosystem Management Project¹² (RISEMP) was set up as an action research project in three selected areas in Latin American countries, namely Costa Rica (Esparza), Nicaragua (Matiguás-Río Blanco) and Colombia (Quindío) (Calle et al., 2009; Rios and Pagiola, 2010). The project was funded by the GEF and implemented and researched by the World Bank. RISEMP investigated how PES can be used as a lever to foster sustainable silvopastoral land use practices. Silvopastoral practices frequently require a substantial start-up investment, with a considerable time-lag until return on start-up investment becomes profitable. This hinders the adoption of sustainable silvopastoral practices even though private on-site benefits and profitability increase over the long run (Pagiola et al., 2005a). RISEMP is based on "the hypothesis that a relatively small payment provided early on could 'tip the balance' between current and silvopastoral practices" (Pagiola et al., 2005a: 208). PES provides this payment to finance start-up investment. The aim was to test "(1) the effects of the introduction of PES on farmers' adoption of integrated silvopastoral farming systems in degraded pasture lands; and (2) the resulting improvements in ecosystems functioning, global environmental benefits, and local socio-economic gains resulting from the provision of said services" (Van Hecken and Bastiaensen, 2010b: 426). Since the GEF was the only ES buyer with funds from international institutions, only ES providing global benefits were targeted within the project, namely biodiversity conservation and carbon sequestration (Pagiola et al., 2007). The research methodology to check PES impact "was based on a randomized experimental design with various participant groups receiving different incentives (payment and/or TA) or no intervention (control group)" (Van Hecken and Bastiaensen, 2010b: 426). ES providers were paid for the

¹¹ The SLCP targets all sloped cropland with a slope greater than 15° in western China and with a slope greater than 25° elsewhere in the country (Liu et al., 2008; Weyerhaeuser et al., 2005).

¹² It is also referred to as GEF-CATIE Project.

adoption of certain land use practices that were expected to provide targeted ES. An 'environmental service index' (ESI) was elaborated based on indices for biodiversity conservation and carbon sequestration under certain land use practices (Pagiola et al., 2007). Participants signed PES contracts for four years and were paid according to their increase in ESI points relative to their own base line measured prior to project implementation. In contrast to national PES programs in Costa Rica and Mexico, where participants are paid solely for adopting the contracted land use change, RISEMP participants are remunerated according to gained ESI points and thus according to the level of additional ES provided (Pagiola et al., 2007).

If the Worldbank and GEF are considered as institutions that bundle the demand for global ES beneficiaries, RISEMP represents a PES scheme that follows the Wunder definition and resembles the Coasean conceptualization. However, the importance of the institutional set-up and non-economic factors (such as e.g. technical assistance) were included and examined during the project. A major result from RISEMP highlights that both economic and non-economic factors motivated farmers to adopt sustainable land use practices. Consequently, van Hecken and Bastiaensen (2010b: 421) argue "that the actual role of PES is mistakenly understood as a simple matter of financial incentives. [...] PES approaches should be understood as part of a broader process of local institutional transformation rather than as a market-based alternative for allegedly ineffective government and/or community governance". This again deviates from the 'market based' conceptualization defined by Wunder and Coase.

3.3.2. RUPES

The Rewarding Upland Poor for Environmental Services (RUPES) program was established in 2002 and implemented as a joint PES experimental scheme by the International Fund for Agricultural Development (IFAD), the World Agroforestry Centre (ICRAF) and other local, national and international partners (Pascual and Perrings, 2007). It covers six action research sites in Indonesia, the Philippines and Nepal (Van Noordwijk and Leimona, 2010). RUPES aims to conserve local and global ES while simultaneously enhancing the livelihoods of the upland poor (Pascual and Perrings, 2007). Targeted ES include improved watershed management to enhance water qualities and quantities, biodiversity protection and carbon sequestration for voluntary markets (Pascual and Perrings, 2007; Van Noordwijk and Leimona, 2010). Remuneration for ES provision is distributed as rewards (impacting in any currency on the ES supplier's natural, financial, human, social or physical capital) and direct monetary payments (Van Noordwijk and Leimona, 2010). Rewards include scholarships for local students, provision of technical assistance to local farmers and investment in infrastructure such as roads, electricity or a water pipe system. The range of ES buyers is substantial and includes conservation funds from local governments, private buyers such as the private automotive wheel industry demanding sustainable 'jungle rubber' for 'green vehicles' and hydroelectric power companies (Van Noordwijk and Leimona, 2010). This part of the RUPES program resembles the Coasean 'market' conceptualization as the direct beneficiary of sustainable 'jungle rubber' pays the provider. However, it deviates again from the PES conceptualization in that it pays for the provision of an environmental commodity rather than an ES that cannot be transferred spatially.

3.3.3. International carbon trading

Within the literature, international carbon payments are referred to as International Payments for Ecosystem Services (IPES). Farley et al. (2010) argue that IPES are probably the only

mechanism likely to be effective in ensuring the provision of global ES (GES) (Farley et al., 2010). The Clean Development Mechanism (CDM) and Reduced Emissions from Deforestation and Degradation (REDD) are discussed in this context. The CDM, as defined in Article 12 of the Kyoto Protocol, enables industrialized countries to offset their excess greenhouse gas production (GHG) by purchasing carbon credits. Some payments under the CDM are used for restoration of degraded lands and reforestation projects. Maintenance of standing forests ('avoided deforestation') is however not part of the CDM (Hall, 2008a). Such a mechanism will likely be included in a post-2012 Kyoto regime under the REDD label, as deforestation and forest degradation are one of the primary causes of carbon emissions on a global scale (Pereira, 2010).

The two major global initiatives promoting the REDD action plans are the United Nations Framework Convention on Climate Change (UNFCCC) and the Forest Carbon Partnership of the World Bank (Chhatre and Agrawal, 2009). As currently discussed under the UNFCCC, REDD "will take the form of national programs in which a country may sell carbon credits either as offsets or to a globally managed forest carbon fund, based on overall reductions in emissions across the country compared to an agreed reference emission level at the end of a given accounting period" (Skutsch et al., 2011: 143). Thus, REDD schemes would likely involve a national level implementation (Wertz-Kanounnikoff et al., 2008).

At present, the REDD mechanism is not yet developed. However, since 2007 more than 100 REDD demonstration activities testing implementation possibilities, scheme design and so on have emerged around the world with more than half located in Indonesia (Madeira, 2009). Furthermore, REDD activities and comparable carbon projects are under way in Latin America and Africa (Costenbader, 2009; Pereira, 2010; Peskett et al., 2011; Wertz-Kanounnikoff et al., 2008). In Brazil such policy initiatives are relevant, especially since deforestation is responsible for three quarters of Brazil's GHG emissions (Hall, 2008a). The Bolsa Florestal Forest Conservation Grant Program, established under the Amazonas State Law for Climate Change in 2007, remunerates traditional communities and families in 'sustainable development' protected areas for signing a Zero Deforestation Agreement, thus halting conversion to crop and pasture areas (Costenbader, 2009; Hall, 2008a, 2008b). The 'Juma Sustainable Development Reserve Project' was established under this program. It is referred to as Brazil's first REDD project because it sells reduced deforestation carbon credits that comply with the Climate, Community & Biodiversity Alliance Standard to the international voluntary carbon market (Costenbader, 2009).

Currently all REDD cases are just demonstration activities, testing scheme design and implementation possibilities. Other carbon projects for the voluntary carbon market were briefly described for Mexico and Belize by Corbera et al. (2007). There is no clear consensus within the literature as to whether REDD will serve as a PES case or not. According to Madeira (2009) REDD can best be described as a mechanism using financial incentives to reduce GHG. However, payments for carbon sequestration are generally linked to carbon emissions emitted elsewhere. Therefore it remains questionable whether this mechanism resembles a PES program in the sense that economic values are linked to ES in order to internalize externalities and to provide ES that would not have been generated or preserved in the absence of the payment. Critics of carbon payments conceptualize the mechanism rather as a modern traffic in indulgences, enabling the buyer to continue business as usual.

3.4. Comparison developing and industrialized countries

It appears that the international PES discourse refers mostly to conservation efforts in developing countries and specifically to

two governmental programs in Costa Rica and Mexico (see Figs. 2 and 4). In particular Costa Rica is considered the pioneer in the use of PES (Rodríguez, 2002). The first article explicitly referring to payments for environmental services' found within this literature review was published in 1998 by Araya (1998) and focuses on Costa Rica. Pagiola (2008) restricts this pioneering role to developing countries in general. Also Wunder (2005: 3) highlights PES as a novel approach and "the most promising innovation in conservation since Rio 1992". However, based on the finding that most approaches even in developing countries resemble Pigouvian conceptualizations (see Fig. 3), the PES approach is not as new as frequently highlighted. As pointed out in Section 3.2.3, incentive payments to foster environmental protection and to stimulate beneficial ecosystem services have been in place in Europe since the 1980s, culminating with the introduction of AEPs in 1992 within the CAP. The history of comparable governmental intervention in the US dates back to even earlier times. The underlying economic concept of AEPs in the US and EU is similar to PES programs in Costa Rica and Mexico and overlaps considerably with many financial incentive approaches around the world. Still, it appears that AEPs in the EU and US are only recently labeled as PES, research results on these programs and schemes are underrepresented in the international PES discourse (see Fig. 4). Only one paper by Wunder et al. (2008) compared selected case studies of governmental AEPs in the US and EU with PES case studies in developing countries. Except for this paper, we hardly found any literature emphasizing the potential to transfer lessons learnt and research results across countries and continents. Hardly any direct links were made between PES research in industrialized and developing countries, and if so only on a very theoretical level (Jack et al., 2008; Sommerville et al., 2009). It appears that there is no direct and continuous exchange of practical PES experience and major lessons learnt, and no mutual learning between industrialized and developing countries.

One major difference between analyzed national PES programs in developing and industrialized countries are the targeted ES. PES programs in developing countries mainly relate to reforestation and sustainable forest management practices to halt deforestation. National PES programs in industrialized countries target mostly ES produced on agricultural plots and working landscapes. However, agroforestry systems and silvopastoral practices receive considerable attention in Latin America. I.e., preservation of ES within agricultural systems are accounted for in Latin America as well.

4. Research priorities

The majority of PES articles appear to discuss the institutional conceptualization and underlying governance structures of PES programs and schemes. Research on how governance structures can be leveraged to boost economic efficiency and environmental effectiveness appears to be of particular importance. In this context many articles emphasize (1) design characteristics of PES contracts (in particular performance payments, auctions, spatial targeting and cost benefit targeting) and (2) factors enhancing PES scheme acceptance. Even though these are related to the overall discourse on institutional concepts and governance structures, we have highlighted the major research findings in a separate sub-chapter for clarity. Finally, many articles discuss equity considerations, however within the PES discourse these are exclusively related to developing countries.

4.1. Institutional conceptualization of PES

According to Vatn (2010: 1245) institutions "can be understood as solutions to collective choice problems", and the respective PES contracts are governance structures shaping those institutions. Corbera et al. (2009) define institutions as "formal and informal rules which regulate what to do and not to do in a given situation" and conceptualize PES as "new institutions designed to enhance or change natural resource managers' behavior in relation to ecosystem management through the provision of economic incentives" (Corbera et al., 2009: 745).

Many articles emphasize (i) the importance of property rights and their distribution and (ii) transactions costs and means to reduce these. Both challenge the feasibility of PES in general and in particular the feasibility of the Coasean approach to PES. However, neither the consequences of property rights distribution nor the determinants and impact of transaction costs were assessed empirically.

Vatn (2010) elaborates on how governance structures relate to (1) the distribution of rights and the rules of coordination and interaction between agents (2) the level of transaction costs and (3) the motivational aspects of PES and their implications (Vatn, 2010). Muradian et al. (2010) explain why and how costly information, uncertain markets, unequal access to resources and the initial allocation of property rights, social embeddedness and perceptions, as well as the role of the intermediary and the institutional environment and cultural setting need to be considered in governance structures. Kemkes et al. (2010) presented a framework to determine how the characteristics of ES – in particular rivalry and excludability – affect the shaping of the respective governance structures and how and where PES can be an effective tool for ES provision. Corbera et al. (2009) present a conceptual approach to assess (1) institutional design, (2) institutional performance (3) institutional interplay as well as (4) capacity and scale of PES. Furthermore they identify factors impacting on the success of natural resources management institutions, such as acceptance of rules by relevant stakeholders or monitoring of compliance.

4.2. Governance structures to lever effectiveness and efficiency

4.2.1. Spatial targeting and cost–benefit targeting

Poor targeting of ES is one of the main reasons for low economic efficiency and environmental effectiveness of PES (Robalino et al., 2008). Spatial targeting improves both, environmental effectiveness and economic efficiency by targeting payments to most vulnerable, degraded or suitable lands. Consequently, ES are either provided at lower costs than elsewhere (Uthes et al., 2010) and/or payments are targeted to parcels with highest degradation risk and thus to areas where they will have the largest impact (Robalino et al., 2008). Targeting payments to areas where they are most needed (Sierra and Russman, 2006) increases environmental effectiveness. Wuenschel et al. (2008) developed a site selection tool for spatial targeting, which takes account of ES provided, degradation risk and participation costs. To empirically test the tool's potential for increasing economic efficiency and environmental effectiveness of PES, data from Costa Rica is used.

Cost–benefit targeting combines spatial targeting either with auctions (as done for instance within the Conservation Reserve Program in the USA) or with performance payments (as done e.g. in Germany: Haaren and Bathke, 2008; Klimek et al., 2008). Cost–benefit targeting is assumed to further improve economic efficiency.

4.2.2. Performance-based payments

Performance-based payments (also ‘payments by results’, ‘result-oriented payments’, ‘outcome-oriented payments’, ‘outcome-based payments’ or ‘success-oriented remuneration’) relate payments to actual ES provision. In contrast to payments prescribing certain actions or inputs, performance payments are likely to improve economic efficiency and environmental effectiveness. Whereas centrally prescribed land use practices are often not tailored and adapted to local needs, performance payments trigger local knowledge and provoke active and innovative land use practices (Groth, 2005). Land stewards will “find the best way of combining inputs in their particular location to meet the overarching goals of generating a desired level of environmental services” (Zabel and Roe, 2009: 126). Service providers commonly know more about needed inputs and land use practices, enabling ES supply at lower costs. Performance payments help to reduce asymmetrically distributed information and improve the cost-effectiveness of ES provision. However, the risk of service provision is transmitted to the service provider, who might consequently charge a risk premium that ultimately increases the payment again (Zilberman et al., 2008).

Performance payments often require only one final inspection visit (Hoft et al., 2010), thus decreasing overall monitoring costs. However, payments must be tied to observable and therefore often distorted indicators (Zabel and Roe, 2009). Consequently, reliable indicators need to be developed; otherwise payments might be distributed despite missing ES provision. Hasund (2011) demonstrates a methodology for indicator development and Hoft et al. (2010) evaluate newly determined vegetation indicators for grazing activities. Zabel and Roe (2009) discuss the economic theory of performance payments and briefly highlight and compare four different payment approaches with various briefly illustrated field examples. Zabel and Roe (2009) disclose that performance based PES schemes do exist around the globe, many of them being however very small. Performance payments appear to be well researched in Germany, where practical experiments for agricultural biodiversity are already in place (Bertke et al., 2003; Hoft et al., 2010). Zabel and Engel (2010) provide a framework to establish a performance based wildlife conservation scheme in India. Their framework is based on “pioneer performance payment scheme for carnivore conservation which is implemented in Sweden” (Zabel and Engel, 2010: 406) and aims at transferring PES experience from an industrialized to a developing country setting. Skutsch et al. (2011) highlight that carbon projects under REDD will be performance based PES schemes.

4.2.3. Auctions

Auctions (also ‘reverse auction’ or ‘procurement auction’) are a contractual design feature that invites potential ES suppliers to submit price offers at which he is willing to sign a PES contract. Bids must be competitive as only reasonable offers might be contracted. Auctions help to reveal private willingness-to-accept (WTA) and private opportunity costs (Ferraro, 2008). It is a mechanism to enhance economic efficiency and environmental effectiveness of PES contracts as informational asymmetries and consequently informational rents are reduced. The cost-revelation mechanism allows for cost savings for the ES buyer as payments are minimized (Pascual and Perrings, 2007; Ferraro, 2008). Given a fixed budget, auctions allow for the maximization of ES conserved. Auctions are used successfully within the Conservation Reserve Program (Baylis et al., 2008) and are currently implemented and tested in field experiments in Germany (Bertke et al., 2008), in Indonesia (Leimona et al., 2009; Jack et al., 2009) and Australia (Rolfe and Windle, 2011). Furthermore auctions are discussed and recommended for carbon payment

schemes in the Amazon (Boerner et al., 2010; Wertz-Kanounnikoff et al., 2008) and to be implemented in Mexico’s national PES program (Alix-Garcia et al., 2009; Munoz-Pina et al., 2008).

A pilot project in Germany currently tests the combination of performance payments with auctions. This is assumed to further enhance economic efficiency (Groth, 2005; Bertke et al., 2008, 2003). However, Schilizzi et al. (2011) show that combining auctions with performance payments can be counterproductive in terms of expected ES output produced, i.e. auctions can reduce environmental effectiveness.

Southgate and Wunder (2009) discuss the use of Vickery auctions to reduce strategic behavior and transaction costs and thus to increase economic efficiency of PES contracts. In a Vickery auction winners do not receive their winning bid, but rather the amount offered by competitors they have underpriced, i.e. winners receive a payment that is slightly above their bid. Vickery auctions are assumed to discourage exaggerated bids, as these only increase payments to competitors.

4.2.4. Enhancing acceptance of PES Instruments

Acceptance of PES by relevant stakeholders is considered important due to the voluntary nature of PES deals—in particular on behalf of ES providers. Acceptance relates mostly to factors influencing scheme uptake, acceptance of and adhering to the rules of the game. Acceptance impacts on economic efficiency and environmental effectiveness. Interestingly, Sommerville et al. (2010) find that the payment is not always the key driver determining acceptance and compliance. Rather, payments increase acceptance of monitoring, which in turn leads to more compliance as the risk of being caught and fined is increased. The perceived fairness and the distribution of benefits and costs also influence acceptance of payments. Chen et al. (2009) observe that next to payment, social norms at the neighborhood level, program duration, household economic and demographic conditions, farm feature and personal characteristics such as age, gender and education also influence PES program re-enrollment in China. Correspondingly, Zbinden and Lee (2005) find that farm features, household economic and demographic conditions significantly influence participation in the Costa Rican program. Gong et al. (2010) analyze the institutional factors beyond the pure financial incentive and find that PES needs to take account of the institutional environment, such as the formal and informal rules that are in place. If the institutional structure fails to guarantee low transaction costs, clearly defined property rights and build strong social capital, participation in the schemes remains low despite available financial surpluses. Also Kosoy et al. (2008) demonstrate (with a particular focus on *ejidos*) that the institutional environment affects participation. Participation is determined, next to financial incentive, by procedural rules, stakeholder interaction and individual characteristics. The ability to account for and exhaust context-related factors and to successfully incorporate these into scheme design influences participation and thus success or failure of PES schemes (Corbera et al., 2007).

4.2.5. Comparison developing and industrialized countries

PES schemes in developing as well as industrialized countries are frequently criticized for the lack of spatial targeting, lack in additionality and lack of distributing discriminative payments tied to opportunity costs. To improve both, environmental effectiveness and economic efficiency of PES, papers elaborating on innovations and technological changes in contract design and factors improving acceptance of PES received considerable attention.

Interestingly and as highlighted above, the US and EU appear to have adopted a pioneering role in practical field experiments

with diverse innovative contractual design features. Auctions are already an inherent part of the CRP in the US and are currently tested in model regions in Germany. Also performance-based payments and performance-based payments combined with auctions are currently being tested in Germany. Spatial targeting and benefit–cost targeting are realized within the CRP in the US and field experiments are being run in Europe. For developing countries, these contract design features are currently discussed only conceptually. Publications on practical implementation experiences for these contract design features in developing countries are still missing and most programs have not incorporated these so far. Countries planning to integrate any of these contract design characteristics in their existing national programs and schemes might benefit substantially from considering experience and major lessons learnt elsewhere.

4.3. Equity

In the context of PES, equity generally consists of three elements, namely (1) equity in access (who participates), (2) equity in decision making (procedural fairness within project framework) and (3) equity in outcome (distribution of project outcomes among stakeholder, in particular economic payments and their perceived fairness). Equity in outcome is determined by equity in access and equity in decision making (Corbera et al., 2007). Pagiola mentions that equity focuses on how the poor in developing countries can be incorporated into PES contracts and comprises factors determining ability, eligibility, willingness to participate and obstacles to participation for poor households (Pagiola et al., 2010, 2008, 2005b).

Within the literature found for this review, the equity discourse focuses exclusively on developing countries and poor land users. Corbera et al. (2007: 368) mention that “equity has been recognized as a key element to be taken into account when designing and implementing [...] PES, specifically if the poor and most disadvantaged are to be involved in these initiatives”.

Many authors highlight the link between poverty, biodiversity hotspots and environmental degradation (Fisher and Christopher, 2007; Sunderlin et al., 2007) and that poor people suffer most from ES loss (Barbier, 2008). Consequently, PES are frequently discussed as a lever for ‘pro-poor’ rural development (Angelsen and Wunder, 2003; He, 2006; Lal, 2009; Pascual et al., 2010; Sand and Scholz, 2009). However, there is a trade-off between equity and environmental effectiveness and economic efficiency of PES, as those individuals supplying ES at lowest costs may not necessarily be poor resource users. Consequently, Farley and Costanza (2010) argue that PES is an economic instrument for aligning marginal costs of conservation closer to marginal benefits and thus a tool for increasing economic efficiency and surpluses. Hence, PES should always prioritize economic efficiency of resource allocation over poverty alleviation. “Using PES schemes to also alleviate poverty might reduce the economic surplus and future scale of PES. The conventional economic wisdom is that greater poverty alleviation could potentially be achieved by redistributing a larger economic surplus” (Farley and Costanza, 2010: 2063). Pascual et al. (2010) oppose this from a conceptual point of view. They argue that the institutional approach determines an optimal equity–efficiency relationship within PES schemes. Rather than focusing exclusively on economic efficiency, it is the equity–efficiency interdependency that “should be considered as a key feature of PES schemes” (Pascual et al., 2010: 7).

Finally van Hecken and Bastiaensen refer to the potential difficulty in Coasean PES approaches where the most direct ES beneficiary are accountable for its provision, rather than the government as an accumulated proxy for all but more remote

beneficiaries. Thus, the costs of funding for ES provision might be burdened disproportionately to poor locals of low income countries. “Expecting poor local people to pay for locally generated ESs makes a dangerously biased and arbitrary abstraction of the ‘joint production and consumption’ nature of different ecosystem benefits” (Van Hecken and Bastiaensen, 2010a: 6).

5. Discussion

5.1. PES examples

This review unfolds what kind of financial incentives are currently labeled as PES by scientists, practitioners and national governments. In this sense it demonstrates the political relevance of the PES concept more than the extent of PES implementation. Most conservation approaches researched and published under the PES ‘label’ do not follow a Coasean conceptualization as emphasized by the PES definition by Wunder (2005). As our review shows, most existing PES cases in developing and industrialized countries rather reflect the Pigouvian solution, i.e. governmental incentive programs. Sommerville et al. (2009: 6) pointed out that “whether or not an incentive scheme acts as PES approach may be contingent on how government portrays the policy”. Our results show clearly that the PES concept has more policy relevance in developing countries, specifically in Latin America, than in industrialized countries even though the latter have a longer tradition of different financial incentive and market based instruments. With the arising discussion on ecosystem services at the end of the 90s, the PES concept seemed an eligible approach and label for implementing new financial environmental incentive schemes in countries without prior history of such interventions, e.g. Costa Rica. The favorable international political reception and the scientific interest in the PES concept could have been a relevant driver for a rapid distribution as it supported the acceptance of such schemes.

A closer look at the practical examples shows many similarities across existing governmental PES labeled programs, e.g. in Mexico, Costa Rica, China, and European and US agri-environmental programs. When considering these big agri-environmental programs in the US (Claasen et al., 2008), Europe (Uthes and Matzdorf, 2013) and also Australia (Hajkowicz, 2009), Pigouvian PES are shown to be widespread around the world. The practical PES examples show that pure Coasean approaches currently do not play a significant role. PES are commonly imbedded in a broad institutional setting with an actor constellation that does not resemble simple market-based buyer and seller relations. Even though a considerable institutional diversity in PES labeled programs and schemes exists, many long standing economic instruments such as habitat mitigation banking in the US or Australia are not considered in this discourse. Agri-environmental programs from industrialized countries are hardly found in the reviewed PES literature.

5.2. Conceptualization of PES

In contrast to the marginal relevance of Coasean PES cases found in practice, the Coasean conceptualization received considerable attention from a theoretic perspective. The literature review shows that the most frequently cited definition by Wunder (2005) was a very helpful driver for fruitful academic discussions, in particular with respect to economic efficiency. Pascual et al. (2010) pointed out that the Coasean conceptualization is commonly regarded as the dominant approach to PES. Not surprisingly, both advocates as well as critics of PES commonly refer to Coasean conceptualization.

In this review we differentiated between the Coasean and Pigouvian conceptualization of PES to characterize existing PES cases. Despite the emphasized insignificance of Coasean PES cases in practice and the fact that Pigouvian cases rather follow the environmental pricing and standard procedure (Baumol and Oates, 1971); differentiation of these two categories does not mirror the broad diversity of existing institutional settings. We agree with Van Hecken and Bastiaensen (2010b: 421) who state that “PES is mistakenly understood as a simple matter of financial incentives” and that “PES approaches should be understood as part of a broader process of local institutional transformation rather than as a market-based alternative for allegedly ineffective government and/or community governance”. Well-designed PES programs and schemes can complement regulatory intervention rules rather than substituting these. Well-designed PES programs and schemes help improve economic efficiency and environmental effectiveness of ES provision. However, what is crucial for the success of PES is the interplay of the whole institutional setting (cf. Corbera et al., 2009; Muradian and Rival 2012).

5.3. Pooling PES research of developing and industrialized countries

When comprising the US and EU’s experience with governmental PES programs, it appears that the PES concept is neither as new and novel as frequently emphasized nor does Costa Rica hold the pioneering role. Similarities between governmental PES programs in developing and industrialized countries are considerable. Analogies between Pigouvian PES approaches in developing and industrialized countries are frequently larger than analogies between Coasean and Pigouvian PES approaches in the same country. Consequently, it might result in research synergies if PES experience and research results from large governmental programs in the EU and US are considered and integrated more deliberately in the international PES discourse. Our review shows that there is a lack of exchange between research experiences and results across continents and countries. Reasons for that can likely be found in the different histories of financial incentive programs and because of the different political, social and cultural contexts across countries. When comparing PES instruments and the various respective experiences and lessons learnt for transferring research findings across countries, it is important to keep in mind that the institutional environment and the institutional setting of PES matter. From an institutional economics perspective, the importance of clearly defined and enforceable property rights and low transaction costs are emphasized. Even though this is emphasized in particular for the Coasean conceptualization, institutions are important for Pigouvian PES programs too. For developing countries the legal and institutional environment is often regarded as rather weak. The legal framework in the US and EU however is considerably strong, property rights are clearly defined, law is enforceable and these countries are highly monetized, i.e. people are used to receiving monetary payments and incentives. Also there are many cultural deviations between countries and particularly between continents. We argue that these differences between countries should be considered carefully. If the underlying economic concept, the institutional environment and set-up in which the PES approach is embedded is not carefully considered, it might lead to misinterpretations and unintended outcomes when findings on strengths, weaknesses, opportunities, pitfalls or any other factor are simply transferred across countries.

To further advance with PES approaches, in particular with respect to issues of defining the commodity (including the use of models), contract design, monitoring and evaluation of PES programs and schemes, it may be helpful if research communities and research results in developing and industrialized countries

will be consolidated. The history of experience and research in governmental PES programs in Australia, the EU and US is much older than elsewhere. Consequently it does not come as a surprise that research appears to be more advanced regarding certain topics in industrialized countries.

Considerable experience and research results exists specifically with regard to innovative contractual design characteristics to enhance economic efficiency and environmental effectiveness, such as performance-based payments (e.g. Matzdorf and Lorenz, 2010; Burton and Schwarz, 2013), auctions (e.g. Latacz-Lohmann and Van der Hamsvoort, 1998, 1997; Claassen et al., 2008; Windle and Rolfe, 2008) and spatial targeting (Uthes et al., 2010, Raymond and Brown, 2011; Schirmer et al., 2012). Also factors impacting on acceptance are well researched in industrialized countries. Attitudinal characteristics of farmers and how these influence scheme uptake are considered by e.g. Falconer (2000). Factors influencing participants’ acceptance of schemes are discussed by e.g. Hanley et al. (1999), Sattler and Nagel (2010), Greiner and Gregg (2011) or Lokocz et al. (2011). Key factors influencing the decision to contract for and comply with voluntary payment schemes in the UK are researched by e.g. Hodge and McNally (1998). Hodge (2000) also discusses the importance of the financial incentive and how it influences acceptance.

As emphasized, many publications debate the consequences of (high) transaction costs. Even though transaction costs for governmental PES programs in the EU have been carefully explored beyond pure conceptual considerations, none of these publications were found in the PES literature search. For instance, transaction costs associated with participation in schemes is researched and measured by Falconer (2000). Falconer and Saunders (2002) calculate and compare transaction costs of individually negotiated and standard management agreements. Mettepenningen et al. (2008) analyze the factors influencing public transaction costs and assess them with different quantitative and qualitative techniques. However, the “number of practically relevant approaches that meet the criteria of having low private and public transaction costs while also not causing excessive deadweight costs appears to be smaller than theoretically expected” (Uthes and Matzdorf, 2013: 262).

Also there are many other conservation instruments in the EU and US that remunerate land stewards for the provision of ES that are not considered in the PES discourse and which publications were not found for this review. For instance, compensation pools under Germany’s Impact Mitigation Regulation (Wende et al., 2005; Macke, 2009). The US also has a long history of wetland (Bayon, 2004) and conservation banking (Carroll et al., 2008). However, no publications on these approaches were found under the PES ‘labeled’ reviewed literature even though these kinds of market-based instruments have the same design challenges as PES (e.g. Hallwood, 2007). An overview on the existing international compensation approaches is given by Madsen et al. (2010).

6. Conclusion

PES is a multifaceted term and many diverse conservation approaches are published under this “label”. This review clearly demonstrates that PES most commonly refers to the large governmental payment schemes existing at national levels in both developing and industrialized countries. Practical experience on Coasean PES approaches remains, at least for now, relatively insignificant.

Even though the majority of published PES papers focus on Latin American PES cases, it appears that PES instruments have been in existence far longer than the Costa Rican governmental programs. Agri-environmental programs in the EU and US are

based on the same economic concept. However, experience with and research results of these national programs are hardly considered within the international PES literature. We reason that this is mainly due to the use of different terminologies for governmental incentive programs across countries and continents. PES research on AEPs in the EU for instance commonly refers to 'non-commodity output', 'multifunctionality of agriculture' and 'agri-environment(al) programmes', 'agri-environment(al) measures' or 'agri-environment(al) schemes'.

Given that the EU and US have a longer tradition of national governmental payment programs than for instance Latin American countries, research on these programs is more advanced regarding many institutional design characteristics. We argue that the international PES discourse and in particular practical PES approaches and cases might benefit considerably if this experience is considered more deliberately. This argument holds true, as many research priorities attended in the PES literature overlap across countries. Consequently, we conclude that pooling PES research from developing and industrialized countries and considering comparable research and experience published under different terminologies might result in research synergies for all.

Acknowledgments

The research presented has been funded by the German Federal Ministry of Education and Research (BMBF) within the Social-ecological Research (SÖF) program, contract no. 01UU0911. The authors are grateful for helpful comments and remarks provided by two anonymous reviewers.

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