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Fairly efficient, efficiently fair: Lessons from designing and testing payment schemes for ecosystem services in Asia

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ABSTRACT

Payment for ecosystem services (PES) is commonly defined as a market-based environmental policy instrument to efficiently achieve ecosystem services provision. However, an increasing body of literature shows that this prescriptive conceptualization of PES cannot be easily generalized and implemented in practice, and that the commodification of ecosystem services (ES) is problematic and may lead to unfair situations for relevant PES actors. This paper synthesizes case studies in Indonesia, the Philippines and Nepal to provide empirical observations on emerging PES mechanisms in Asia. Lessons learned show that fairness and efficiency objectives must be achieved simultaneously in designing and implementing a sustainable PES scheme, especially in developing country contexts. Neither fairness nor efficiency is a primary aim but an intermediate 'fairly efficient and efficiently fair' PES may bridge the gap between PES theory and practice to increase sustainable ES provision and improve livelihoods.

1. Introduction

The real value of ecosystem services (ES) to human well-being is only partially included in market economics (De Groot, 1992; Turner et al., 1994). Currently, conventional markets fail to reflect the full or true value of services (the 'welfare effect') such as pure water (eliminating the need for artificial purification) or natural pollination in enhancing crop yields. Conventional markets also rarely treat or even neglect negative effects of economic activities on ES or in economic term, externalities, most of which are, public goods. As one of several possible policy responses, market-based instruments, such as payments for ecosystem services (PES), have been developed to capture at least some of the financial value of these services through the monetisation and commodification of ES (Gómez-Baggethun et al., 2010).

Initially, the PES concept was strictly defined as a market-based environmental policy instrument to achieve environmental protection in the most efficient way (Engel et al., 2008; Pagiola et al., 2005). Efficiency means producing the greatest social value (determined subjectively by individuals and measured by economists either in markets or by using non-market valuation methods) for the least possible (social) cost. In short, efficiency is achieved when net value is maximised, ideally resulting in positive net benefits. This is based on the principle 'you get what you pay for' for positive effects from the flow of ES (Wunder, 2007). The 'efficiency' line of argumentation on PES among scientists and practitioners is that a PES instrument should not be burdened by additional social equity goals in achieving the environmental quality, natural capital conservation and cost effectiveness goals of sustainable ES provision. The ideal PES schemes based on environmental and cost-efficiency principles should "integrate ecosystem services into markets and should be like any other market transaction" (Farley and Costanza, 2010). This is supported by the assumption articulated by Coase (1960) over 50 years ago that effective legal structures and enforceable policy rights exist to overcome the problems of current market failures. Nevertheless, recent literature shows that the Coasean and pure market approach that dominate the conceptualisation of PES cannot be easily generalised or implemented in practice (Muradian et al., 2013, 2010). The concept also disregards equity issues because the aggregate of gains and losses by different economic agents is counted as more important than how they are distributed in society (Pascual et al., 2010).

Kosoy and Corbera (2010) further argued that the commodification of ES is problematic because it promotes efficiency over fairness. Case studies in Latin America showed that social values beyond financial payments induced participation in PES (Kosoy et al., 2007) and the monetisation of ecosystem services were mostly rejected by the PES recipients (Asquith et al., 2008). However, a potential combination of equity and efficiency may be possible (Pascual et al., 2010). Thus, there is a clear need to adjust Coase's argument and

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incorporate the context and perspective of local stakeholders (Adhikari and Boag, 2013; van Noordwijk et al., 2013), particularly when PES schemes are applied in the context of developing countries with skewed wealth distribution, contested property rights, low law enforcement and weak institutions (Neef and Thomas, 2009). A recent review by Wunder (2013) highlighted the importance of taking the ecological-economics perspective (Costanza et al., 1997, 2004; Farber et al., 2002) in analysing the applicability of PES focusing on "the insistence on the importance of equity and the diversity of institutional contexts". Moreover, in the perspective of developing countries, the inclusion of a poverty-alleviation, rural empowerment and social justice goals might be considered when a PES scheme deals with historical imbalances in the power, right and wealth status between ES suppliers and beneficiaries (Swallow et al., 2009).

It is essential to embrace the perspective of multidimensional poverty in analysing local perspectives on PES outcomes beyond their household income increment (van Noordwijk et al., 2004). In many cases, poverty defined simply as the inadequacy of income is still common in the literature on human deprivation. However, this view lacks the understanding that income influences people's ways of living and also contributes to the impoverishment of life (Sen, 2000). The perspectives on poverty inescapably surpass the notion of welfare utility and encompass a broader range of capabilities (Kahneman et al., 1997; Sen, 1999; Wegner and Pascual, 2011), including the capabilities of pursuing individual happiness (Frey and Stutzer, 2002; Kubiszewski et al., 2013). Therefore, it is important to seek evidence and support the theory of plural dimensions of human well-being when incorporating poverty reduction elements to the PES design and implementation (Wegner and Pascual, 2011).

The broad understanding of PES in Asian countries is, however, still limited, particularly regarding the analysis of how to balance efficiency and fairness involved in changing land use, socio-cultural values and the behaviour of relevant stakeholders. In current discussions, efficiency refers to ES additionally gained by clearly linking land-use practices contracted under a PES scheme and ES provisions and the cost effectiveness of the scheme. Fairness refers to pro-poor aspects of PES, where marginalised actors of the potential scheme, be they men or women, have non-biased (or preferential) opportunities in participating, planning, designing, implementing and monitoring the scheme, and getting benefits from it. Fairness also embeds stakeholder perceptions on what is fair beyond quantifiable equal distribution. Much of the discussion on PES is about the degree to which and the way 'efficiency' and 'fairness' objectives can be reconciled.

While there are multiple and partly contrasted views on the theoretical basis ('theory of change') of how individual and collective human behaviours can be influenced to internalize the environmental externalities, a growing body of empirical evidence of apparently contradicting findings needs to be contextualized to frame 'theories of place' of which approach might work where, and to which degree. Here, we review experience in Asia to contribute to such theories. Our main hypothesis is that practices in developing countries mostly rule out fair PES if the PES definition is strictly applied as a market-based or commodification of ES. The case studies in Indonesia, the Philippines and Nepal presented in this paper aim to contribute to the debate that successful PES implementation needs to simultaneously achieve efficiency and fairness objectives if it is to provide sustainable solutions that achieve both an increase in ES provision and the enhancement of livelihoods (natural, human, physical, social and financial capitals).

1.1. Reward or payment? Environmental or ecosystem services? A contribution to basic definitions

The solution of environmental problems in developing countries (including the overexploitation of natural capital as well as the loss of biodiversity and ecosystem quality as a result of pollution), specifically in Asia, requires the emphasis of the dual goals of poverty alleviation and environmental conservation (Tinbergen, 1976; UN, 1992). PES is seen as an instrument to help achieve these goals (Muradian et al., 2010; Pascual et al., 2010; van Noordwijk and Leimona, 2010). Proponents of fairness dimensions as elements that need to be added to effectiveness and efficiency prefer the use of the broader concept of 'rewards' (RES) rather than 'payments' for environmental services (Gouyon, 2003; Swallow et al., 2009; van Noordwijk et al., 2004). The notion of RES focuses on the "multiple goals of ecological sustainability, just distribution and economic efficiency and favours a variety of payment mechanisms to achieve these goals, both market and non-market" (Farley and Costanza, 2010; Muradian et al., 2010). RES proposes the integration of anti-poverty elements into economic instruments to enhance environmental services with the basic argument that poverty alleviation has to be included in any portfolio to protect the environment, especially in developing countries.

The term 'RES' also offers broader recognition to ES providers, not only focusing on financial transactions between stakeholders but also including in-kind rewards, such as access to land, access to markets, capacity building and the recognition of identity and rights (van Noordwijk et al., 2004). Swallow et al. (2009) introduced the term 'compensation and reward for environmental services' to refer to "a range of mechanisms linking ecosystem stewards and environmental service beneficiaries, including the mechanisms normally included under the term payment for ecosystem service". They noted that the relationships between ecosystem stewards, environmental service beneficiaries and intermediaries may be more complex than a simple transaction, with agreements that are not wholly voluntary, and payments that are not wholly conditional. In general, the paper uses 'payments for ecosystem services' as a more common term and argues that the current trend shows that 'payment for ecosystem services' have been used to explain some cases with pro-poor elements on its design. Therefore, shifts from the original concept of PES have existed and will be strengthened by this paper.

Furthermore, we also acknowledge these arguments using the terms 'payments for environmental services' and 'payments for ecosystem services'. Environmental services and ecosystem services are two important concepts widely used in the academic and empirical literature to discuss environmental policy, sometimes as synonyms, sometimes with different delineations. The concept of 'services' in both terms refers to the flow of benefits obtained by people. Ecosystem services are interpreted as the flow of benefits from natural capital (including all species) to human beings (MA, 2005; Wegner and Pascual, 2011). Ecosystem services include 'provisioning' services for which markets may exist and function well, plus regulating, cultural and supporting services that tend to be 'externalities' of decision making. Some authors use the term 'environmental services' for ecosystem services beyond provisioning (van Noordwijk et al., 2012). Others have defined environmental services as the broader concept of all human benefits derived from natural and/or actively managed landscapes, which involve natural capital as part of their production function, often alongside social and human capital and aspects of built-up infrastructure. In this view, ecosystem services are considered a subcategory of environmental services, provided by 'natural' subsystems (Muradian et al., 2010; Swallow et al., 2009) or even "a systematically different category" (Derissen and Latacz-Lohmann, 2013).

In theory, the notion of environmental services is "input-based and focused on the efforts undertaken by actors to generate environmental improvements and improved natural capital", and the notion of ecosystem services is "outcome-based and focused on the well-being benefits provided to society from natural capital" (Greiner, 2010). As the debate continues, we envisage the model of ecosystem services from the Economics of Ecosystems and Biodiversity (TEEB) diagram as a conceptual improvement of the Millennium Assessment

(MA) diagram (Braat and de Groot, 2012). The authors recognised ecosystem services as "a combination of natural (ecosystem process-based) energies with human energies". Thus, this paper focuses on PES in the case of payments to the provider of ecosystem services produced through the interaction of human intervention and ecosystem processes.

2. Socioeconomic context of the PES schemes in Asia

This paper synthesises the findings from a decade of action and learning in the sites (2002–2012) that are part of the Rewarding Upland Poor for Environmental Services (RUPES) project of the World Agroforestry Centre (ICRAF), Southeast Asia Region (Fig. 1). Nine sites in three countries, i.e. Indonesia (Kapuas Hulu–West Kalimantan, Singkarak–West Sumatra, Bungo–Jambi, Sumberjaya–Lampung), the Philippines (Kalahan–Nueva Vizcayas, Bakun–Benquet, Lantapan–Bukidnon) and Nepal (Kulekhani–Makwanpur) become the focus of this study where the project conducted action research sites (Leimona, 2011).

2.1. The landscape

Following the agro-ecological zones of Hadi and van Noordwijk (2005) and configurations of forest and landscape transitions of van Noordwijk et al. (in press), some combinations of agro-ecological zones (ranging from tree-based landscapes, intensive agriculture and the urban land-use system) were distinguished in these sites to analyse the potential for establishment of payments for ecosystem services (Fig. 2, Table 1 and Annex 1). Kalahan and Kapuas Hulu sites are examples of the Configuration I of the forest and landscape transitions characterized by forest still inseparable part of the local livelihoods. In Kulekhani and Bakun, the segregation of forest and agriculture described for Configuration II is apparent as agriculture prevails due to several reasons, mostly population pressures and high demand of marketable crops, particularly horticulture and vegetables. In Configuration III as found in Sumberjaya, Bungo and Cidanau, agroforests and agroforestry systems have become very important parts of the landscapes and people's livelihood. The systems connect the forest (mostly protected for providing watershed services of the urban beneficiaries) and the intensive but limited crops located mostly in the riparian zones. Agroforests supply most of the ecosystem service provisions. Configuration IV as represented by Lantapan and Singkarak in our data represents the landscape that once has experienced severe degradation and is in a process of recovery. This last configuration is patchier compared to others where natural forests support the agriculture and agroforestry systems for providing the provisioning services of income and food.

2.2. The community

In Asian rural areas, traditional land and resource management systems fail owing to population increase and the diminishing of land leading to overuse. Skewed land distribution often compels the poor to survive by cultivating marginal land, leading to erosion. Without tenure and often with only passing claims on the land they cultivate, the poor are less likely to make investments to protect natural resources (Brandon and Ramankutty, 1993; van Noordwijk et al., 2002). Market imperfection and policy distortion that neglect the social and economic importance of ecosystems are claimed as the root causes of environmental problems in Asia (TEEB, 2010; Tomich et al., 2004).

These socioeconomic conditions were apparent in the nine research sites in three countries (i.e. Indonesia, the Philippines and Nepal) as shown on Table 2. The ES providers in these sites are smallholders with average landholding of 2 ha either indigenous people or long-resided migrants acculturation with local cultures. Insecure access to land tenure is common in all sites. However, some communities have received legal permits to manage their forests, such as in Kalahan and Bakun, and partly in Sumberjaya and Kulekhani. In Kapus Hulu, Singkarak and Bungo, collective ownership of land is still practiced among community members. Private ownership dominates the farmers in Cidanau and Lantapan.

Most of the sites focus on rewards for watershed services under private and public schemes. Two sites (Singkarak, Indonesia; and Kalahan, the Philippines) test the voluntary carbon market and one (Bungo, Indonesia) seeks opportunities for an eco-certification scheme of rubber agroforestry. The stages of implementation are also varied, ranging from initial development of PES where the intermediary partners conduct scoping studies of mature schemes where contractual agreements have been signed, and schemes are ready to be increased in scale. Action research on the sites followed the principles of boundary work and negotiation support

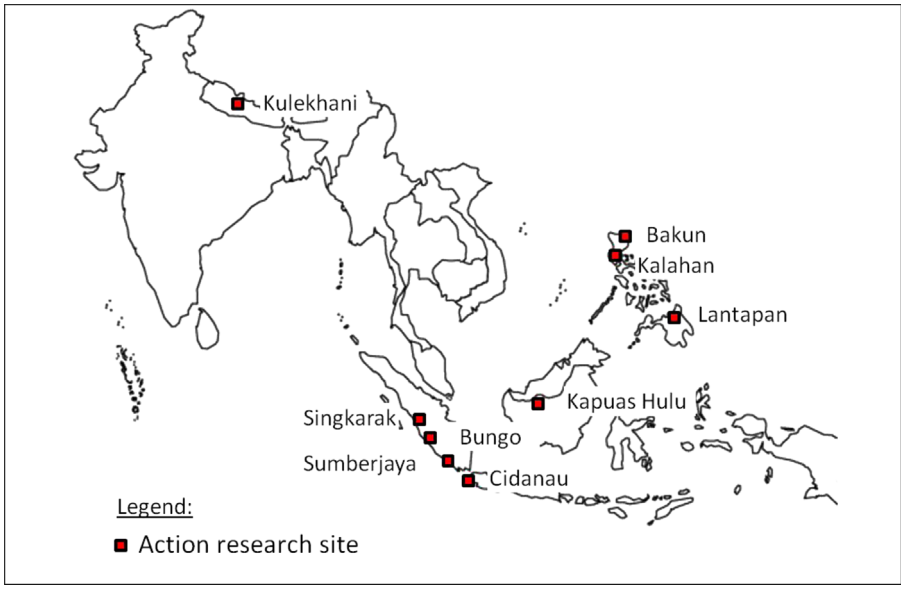

Fig. 1. Action research sites as the focus analysis of the study.

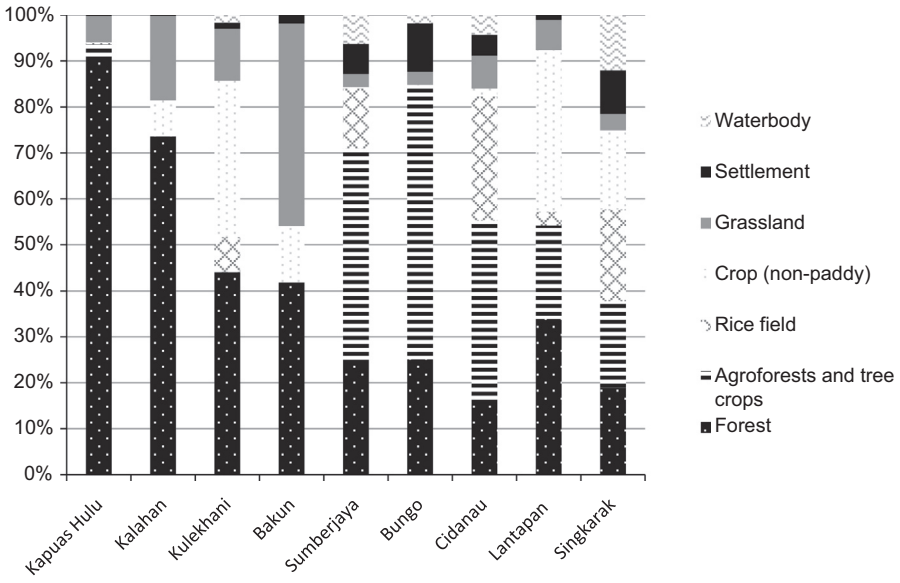

Fig. 2. Land use fractions presenting configuration of forest and landscape transitions.

Table 1
Basic statistics of demography and land use in the nine case study areas around 2010 (HDI Data: 2009–2013).
Source: National Bureau of Statistics and Spatial Analysis Unit of World Agroforestry Centre

	Configuration I		Configuration II		Configuration III			Configuration IV	
	Kalahan	Kapuas Hulu	Kulekhani	Bakun	Sumber-jaya	Bungo	Cidanau	Lantapan	Singkarak
Human population density, km2	36	4	355	69	130	70	613	150	90
HDI	0.72	0.71	0.50	0.74	0.70	0.73	0.69	0.67	0.75
Forest fraction	0.74	0.91	0.44	0.42	0.25	0.25	0.16	0.32	0.17
(ha per capita)	27.00	19.10	0.12	0.60	0.19	0.36	0.03	0.22	0.18
Agroforestry and tree crops	0.00	0.03	0.00	No data	0.46	0.60	0.39	0.19	0.17
(ha per capita)	0.10	0.60	0.00	No data	0.35	0.85	0.07	0.13	0.18
Rice field fraction	No data	0.00	0.08	No data	0.13	No data	0.27	0.03	0.17
(ha per capita)		0.00	0.02		0.10	0.00	0.05	0.02	0.19
Crop (non-paddy) lands	0.08	0.00	0.34	0.12	0.00	0.00	0.02	0.33	0.15
(ha per capita)	2.78	0.04	0.10	0.18	0.00	0.00	0.00	0.22	0.17
Other land	0.18	0.06	0.11	0.44	0.03	0.03	0.07	0.06	0.03
(ha per capita)	6.75	1.20	0.03	0.63	0.02	0.03	0.01	0.04	0.03
Settlement	0.00	0.00	0.01	0.02	0.07	0.11	0.05	0.01	0.08
(ha per capita)	0.07	0.05	0.00	0.03	0.05	1.42	0.01	0.01	0.09
Reservoir/ Water body	No data	No data	0.02	No data	0.06	0.02	0.04	0.00	0.11

with problem-solving efforts to make schemes work in local contexts combined with reflection on the underlying challenges of refining the conceptualisation. Therefore, we focus not only on the established and operational cases but also the ones that have not been successful yet.

3. Main findings

3.1. Co-investment in environmental stewardship as opposed to a strict and prescriptive PES definition

In our case studies, the precondition for the Coasean conceptualisation of PES was hardly met. The reasons for this, among others, were a lack of data and the capability to measure, map, model, value and monitor ES with multiple scales; unclear property rights; a lack of sustainable funding; and close links between poverty and environmental degradation as commonly observed in the case studies. Lack of data and capability were found in most of the cases. The Kalahan Education Foundation is the most advanced site in collecting data of biodiversity and carbon stock. However, it does not guarantee the quality of the data when the ES provider group has to prepare a business case for PES transaction and no transaction has been made until currently. While most of the sites were facilitated by NGOs as intermediaries, more long-term capacity support that is expected from the government as the 'permanent' facilitator is lax. In addition, these Asian cases mostly placed ES providers as a more marginalised community group with low formal education and lack of access to information and justice. As showed in the fraction of non-forest land per capita (Table 1) that the profile of ES providers in Asia contrasts with the ones in Latin America, particularly in Costa Rica where the categorization of smallholders are farmers with less than 30 ha farm lands. In Asia, the majority of smallholders cultivate less than 2 ha of farm lands with uncertain access to land.

Supported by the Heredia Declaration of Payments for Ecosystem Services (Farley and Costanza, 2010), our cases show that PES in the form of ES commodification is not feasible for watershed services in our Asian case studies under this current condition. 'Commodification' implies strict conditionality of PES, where tangible benefits for ES providers are conditional on the actual enhanced delivery of ES. Our River Case in Sumberjaya was specifically designed to test this condition (Pasha et al., 2012). The payment was based on the

Table 2
Research sites and the status of the applied PES scheme.

Site	Started in	Socio-political-economic conditions	Main ES	Scheme	Status
Configuration I					
Kalahan (Villamor and Lasco, 2006)	2002	Indigenous people with strong cohesion recognized by the national law to self-managed their ancestral lands	Carbon sequestration (voluntary)	Financial payment from national companies	Initial negotiation with potential buyers
Kapuas Hulu, West Kalimantan (Lusiana et al., 2008)	2008	Indigenous people as hunter gatherers and local communities as rubber smallholders as parts of communities managing the upper watershed	Watershed services for a district water company	Public conservation fund from the district	Agreed public conservation fund from the district
				Earmark payment from water bill	
Configuration II					
Kulekhani (Joshi, 2011)	2002	Local community provided forest management rights practicing intensive fallow rotations and free-roaming cattle	Watershed services for a private HEP	Distribution of HEP's royalty to the community	Agreed share of royalty
Bakun (Villamor and Lasco, 2009)	2004	Indigenous people investing their lands for high market-value vegetables with remaining forest certified as ancestral domain	Watershed services for private HEPs	Distribution of HEP's royalty to the community	Agreed share of royalty
Configuration III					
Bungo, Jambi (Leimona and Joshi, 2010)	2002	Local community preserving jungle rubber or old agroforestry rubber pressured by oil palm	Agro-biodiversity conservation of jungle rubber	Financial payment from a philanthropic scheme	Ad hoc reward for a micro-hydropower unit
				Eco-certification for jungle rubber	Price transparency from a large-scale tire company for rubber slabs coming from rubber agroforests
Sumberjaya, Lampung (Pasha et al., 2012)	2002	Local community, mostly migrants cultivating coffee agroforestry struggling for formal recognitions of their land use practices in maintaining watershed functions	Watershed services, mainly sedimentation reduction	5 to 25 year certificate of community-based forestry	Agreed 1-year contract extended to other sites
				"Conditional CSR" from a parastatal HEP company	
Cidanau, West Java (Leimona et al., 2010)	2001	Local community in a rural-urban area practicing fruit-based agroforestry and subsistence rainfed rice field	Watershed services for domestic and industrial demands	"Conditional CSR" from a water company	Agreed 5-year contracts in four villages
Configuration IV					
Singkarak, West Sumatra (Leimona et al., 2006)	2002	Local community with strong traditional norms cultivating food crops and rice fields for commercial markets, traditional fishing of high value catches and agroforestry products with remaining watershed protection forest	Watershed services	Distribution of royalties from a state-owned hydroelectric power (HEP) company Financial payment from an international carbon broker	Ad hoc share of royalty
			Carbon sequestration (voluntary)		Agreed 10-year contract over a total 49 ha
Lantapan, Bukidnon (Catacutan et al., 2010; Duque-Piñon et al., 2012)	2006	Local community and commercial large-scale community side by side cultivating intensive banana, pineapple and vegetable farms in the buffer zone of the National Park	Watershed services	Incentive-based policy by the Local Government enacted by the Municipal Ordinance No. 114/2008	Agreed 'family conservation contracts' in Alanib sub-watershed by the NPC
				The National Power Company (NPC) to implement a rewards' mechanism for watershed services	

percentage of sedimentation reduced by the farmers. As biophysical scientists recognize that the supply of ecological goods and services is uncertain because of climate change and other threats, a commodification approach shifts this risk to the farmers. It may be efficient for the beneficiaries since they do not have to pay when the targeted ES is not reached, however, it might not be pro-poor because farmers shoulder the biophysical uncertainties in provisioning ES. In our first pilot in Sumberjaya, after the farmers completed about 80% of constructing a simple technology to reduce sediments, a landslide coming from the state-forest ruined the construction and farmers' performance of the contract. Our second pilot showed that despite the lower level of sedimentation achieved by the farmers, the hydropower company rewarded the full amount of payment to the farmers due to their appreciation for the farmers' hard work.

Alternatively to bring the theory of PES conditionality closer to practice, we observed a stratification of conditionality rather than strictly limit the actual and measurable ES as the outcome of PES. This is also to respond the 'PES-like' term positively reflecting in different PES practices in developing countries. We categorize the PES strata based on their different outcomes as earlier introduced by van Noordwijk and Leimona (2010). Those strata are: level I: when the tangible benefits for the ES providers conditional on the actual measured ES (such as percentage of sediment reduced, percentage water quality improved); level II: when farmers are evaluated based on the performance of agro-ecosystems in a desirable state (such as quantity, quality and composition of trees on their farm lands); level III: when farmers are evaluated by the implementation of agreed actions to enhance ES (such as plant

riparian area to avoid collapsed riverbank, construct terracing); and level IV: when farmers, mostly collectively, are evaluated based on their commitment in implementing management plans to enhance ES with respect for local sovereignty in conserving the environment for both local and external benefits.

Based on these levels of conditionality and the recognition of PES practices in Asia, three distinct perspectives of PES can coexist: (1) the commodification of ES; (2) compensation for opportunities that are skipped/forgone; and (3) co-investment in environmental stewardship (van Noordwijk and Leimona, 2010; van Noordwijk et al., 2012). *Commodification of ES* operates at conditionality level I with no explicit poverty targets with derivation or the definition of standardised units of ES being traded. *Compensation for opportunities skipped/forgone* is the payment to land users for accepting restrictions on their use of land, with conditionality at level II or III. These payments are mostly government-mediated payments to offset the opportunity of more financially beneficial land use. *Co-investment in stewardship* is when enhancing ecosystem services, local and external stakeholders prioritize mutual trust and jointly invest capitals in land-use trajectories. Technically, the PES contracts between ES providers and buyers are flexible with broad sanctions and monitoring requirements.

Our case studies also showed that there are opportunities for phased strategies. Co-investment in ES supported by the human and social capital of the stakeholders is appropriate as a way to further develop PES paradigms and can take in a much broader range of values, including reconciling individual and group altruism (van Noordwijk et al., 2012). After creating, for example, a basis of respect and relationship through the *co-investment* paradigm, there may be more space for the specific development of the *commodification* paradigm for the actual delivery of ES to meet conservation and additional ES objectives (Pasha et al., 2012) (i.e. a PES scheme is additional when the scheme increases ecosystem services compared to baselines without a PES scheme). The Sumberjaya case shows that the relationship between the hydropower company and farmer groups is beyond buyer and seller transaction. The hydropower company recognized that as the beneficiary, they also had responsibility in maintaining the watershed and this has to be done jointly with the communities. As a consequence, they agreed to modify the next step to reflect such collaboration, while building better indicators in measuring ES within the PES contract. This indicates dynamic and flexible process of PES on the field, while theoretically modifying its concept.

When we tested the co-investment concept towards landscapes in four configurations, yet, for all configurations co-investment has emerged as the primary paradigm. As the baseline, different nuances on the relationship between communities' right, ES stewardship and 'payment' exist as land tenureship is contested. The contrast between Configurations II and III, with or without agroforests as primary source of ES in the landscape, has major consequences of who can expect or claim to be providers of ES that deserve to be rewarded. In Configuration II, they can vary from the managers, guardians and stewards of remaining patches of forests, often the state or those who get permits from the state, such as the ancestral domain in Bakun. In Configuration III, ES providers are the ones who manage and own the agroforests, at least in local perspective. In practice, however, the agroforests may have been (erroneously) classified as state forests, and an essentially first co-investment step towards conflict resolution and progress is in the state's recognition of local stewardship as clearly shown in Bungo, Jambi in the form of Village Forest or *Hutan Desa* (Akiefnawati et al., 2010) and in Sumberjaya Lampung as the Community Forest or *Hutan Kemasyarakatan* (Suyanto, 2007). Overcoming deeply engrained negative perspectives by state forest managers on shifting cultivation in Configuration I (van Noordwijk et al., 2008), requires similar steps to achieve the trust levels needed for co-investment. The restoration context of Configuration IV similarly requires that basic issues of land and resource tenure are clarified.

3.2. A shared understanding of multiple types of ecological knowledge in providing and managing ES to increase the efficiency and fairness of PES schemes

One of the main problems of any PES scheme is that there are widely held assumptions between changes in land cover and ES provision. We observed that the proposed solutions for environmental problems, including increases in ES provision, are mostly based on the relative merits of reforestation, which emphasise that ES is provided only by natural forests but not by other land uses. Furthermore, standardised solutions to natural resource management are usually land-rehabilitation projects that are too narrowly defined. For example, planting trees often neglect other landscape management techniques and concerns, such as constructing a simple sedimentation retainer along a riparian zone to maintain the watershed functions.

In natural resource management, different stakeholders may, in fact, have opposite interests in utilising a landscape. From the policy perspective, agroforestry-mosaic landscapes, which are found in many Asian countries, can offer excellent opportunities to combine economic and environmental targets. In these landscapes, farmers combine elements of the natural forests that provide ES with trees for productive purposes and intensive food cropping systems (Jellinek et al., 2013; van Noordwijk et al., 2002). However, potential ES buyers and policy makers in general sometimes fail to recognise these agroforestry systems. For example, agricultural landscapes may not meet the legal definitions of 'forest' or be in conflict with the existing land-use regulation system and policies even though the land practices can provide ES at similar levels as forest ecosystems.

The appreciation of the various quantitative ES indicators probably differs by stakeholder group. To ensure an established PES, it is essential to understand these ES indicators from the multiple ecological perspectives. These perspectives come from both upstream and downstream local communities (i.e. local ecological knowledge), the general public and policy makers (i.e. public ecological knowledge), and ecological modellers or hydrologists (i.e. modeller ecological knowledge) (van Noordwijk et al., 2013). In Singkarak (Farida et al., 2005), for example, the upper stream farmers were blamed for deforestation causing reduced water quantity of the lake as the source for hydropower electricity generator and decreased harvestable local fish due to high siltation. However, the scientific data proved that the water quantity of the lake was more influenced by the amount and frequency of the rainfall, while the reduction of the fish was mostly due to overharvesting by the downstream fishermen.

The multiple ecological knowledge approach combines efficiency and fairness components in its application at the pilot sites. The scientific hydrological assessment as the source of 'modeller ecological knowledge' clarifies the real problems of the watershed, offers appropriate land management and hydrological monitoring procedures and avoids unrealistic targets of the PES schemes. These aspects support in increasing the efficiency of the PES. Complementarily, the understanding of the 'local ecological knowledge' through a series consultation and focus group discussion with the communities enables designing a mechanism that is sensitive to local capacity and their knowledge in managing their landscape. Overall, the approach clarifies the expectations of relevant stakeholders in the watershed: the communities as the ES providers, the public ES beneficiaries and the intermediaries. This contributes to fairness in designing the PES project.

Beyond its potential, however, the issue of strategic use of information (Martín-López et al., 2014), a discrepancy between scale in the provision of ES and its investment and the vested interests of intermediaries and donors hinder the optimal use of

such multiple knowledge analysis in designing and implementing rewards for the schemes for watershed services. The case study in Kapuas Hulu (Lusiana et al., 2008) also shows that the availability of information is only a prerequisite for increasing the quality and sustainability of PES schemes. Interviews with practitioners in this study found that the factors influencing the design and implementation of PES programs are varied and beyond the availability of multi-perception knowledge and scientific data. The hydrological assessment in Kapuas Hulu resulted that the watershed still had good functions in providing its services and the river siltation was caused by boats cutting the edge of the river bank rather than the farming practices of smallholders. The assessment also recommended that another scheme, such as carbon stock protection at the upper watershed, may be a more effective solution. However, since the Kapuas Hulu case was designed as a 'payment for watershed services' project thus the manager could not change the project design easily.

3.3. Anti-poverty PES to adapt to local conditions in designing the types, forms and expected levels of payments

We analysed the contribution of actual cash from beneficiaries to individual ES providers to alleviate poverty and proved that such a design has to attentively consider some key ratios of the relative number of service providers and beneficiaries and their income-per-capita measures (Leimona et al., 2009b). The analysis of income and spatial data of Indonesian agro-ecosystems indicated that a modestly increased target of 5% of the annual disposable income of upstream rural households may be difficult to be achieved given the population and income structure of downstream and upstream areas.

Identifying payments that match with people's needs and expectations, is one particularly important aspect of anti-poverty PES approaches. The findings from focus-group discussions at the different sites (Leimona et al., 2009b) suggest that there is a substantial variation between communities concerning poverty concepts and payment preferences. Hence, anti-poverty PES is heterogeneous and highly context-dependent (Adhikari and Boag, 2013). This provides important insights into the various dimensions that well-targeted reward schemes need to address. Our analysis concluded that payments in the forms of human, social and physical capital – or what are often referred to as non-financial incentives – are very often the most preferred, and most feasible, types of payments: public social investments, such as education and health services (i.e. human capital) as mentioned by almost potential ES participants; good road conditions (i.e. physical capital) as in Cidanau, where farmers are unable to timely market their perishable fruit harvests from their agroforestry gardens due to bad road conditions; the security of land tenure as mentioned by people in Bakun and Sumberjaya, who had experienced severe violence due to insecure land tenure; recognition as an environmental champion as expected by the Kalahan community, who are applying sustainable landscape management for decades but still have difficulties in gaining ES buyers; and the development of trust with the government in maintaining an intact environment (i.e. social capital). In developing countries as described in this study, these public investments are less well delivered compared to the industrialized ones. Therefore, these aspects, combined with high social cohesion that defies the concept of free-riding (i.e. we don't mind our neighbour enjoying our payments from maintaining good ES, and we prefer that everybody is happy, support the preference for non-financial payments).

3.4. A multidimensional approach to poverty and livelihoods to enable a broader analysis of local perspectives on PES

When examining local perspectives on PES outcomes, all case study analyses employed a multidimensional perspective of poverty, drawing to some extent on the Sustainable Livelihood Approach originally developed by Chambers and Conway (1992). This approach is a unified concept of wellbeing that encompasses both economic and non-economic aspects, and it has been used both for project design and the evaluation of impacts (Ashley and Hussein, 2000). Therefore, the livelihood capitals offered by this approach provides multidimensionality on how outcomes of a scheme can be assessed.

The Cidanau case showed that benefits were mostly non-financial, including expanded social networks with external stakeholders, the increased knowledge and capacity of the community and investments in small-scale public infrastructure (Leimona et al., 2010; Pasha et al., 2012). Direct financial benefit was limited. The fraction of PES payment was only about three percent of the total income in Cidanau. We observed, in most cases, that non-financial benefits combined with recognition from governments and external stakeholders were enough incentive to foster farmers' commitment to a scheme. When financial payment was given, adjusting the value of new contracts was important so that farmers could cover their true opportunity cost. However, our finding at the Sumberjaya case revealed that most of the schemes could not cover farmers' true opportunity costs because of the buyers' limited funds (Ajayi et al., 2012; Leimona et al., 2009a). Furthermore, in Kulekhani, Bakun and Singkarak, if the royalty of hydropower company is distributed proportionally to all the upper stream households, each household will receive less than one US$ annually.

Although the PES schemes did not drastically change the livelihoods of participants, particularly their financial capital, links with external stakeholders created opportunities for participants to diversify, or capture greater value from, their income sources. The Cidanau case showed that exposure to these partners also increased the participants' knowledge of conservation, their skills to manage their farmers' organisation, and helped to build networks to improve their businesses and implementation of the PES scheme. It also highlighted the need for awareness of the social dynamics between participants and non-participants to design benefit packages that minimise community conflict. The literature on PES mentions that conditional monetary PES forming an extrinsic motivation might crowd out the intrinsic motivation of people to do something right for society (Farley and Costanza, 2010). Experience from the behavioural economics and psychology fields show that even simple reminders of money made people act in an independent and socially insensitive manner (van Noordwijk et al., 2012). Furthermore, experiments showed that people might commit more effort in exchange for no payment, such as in social markets where reciprocity is expected, rather than when they receive low cash payments, such as in a monetary market (Ariely, 2009; Heyman and Ariely, 2004).

Table 3 provides an overview of the links between theoretical perspectives on PES and their empirical implementation in Asia.

4. Conclusions

The case studies of PES in Asia experienced shifting perspectives, from legitimating cost-efficient and effective natural resource management to concerns about fairness in the design and benefit distribution of the scheme. The monetisation and commodification of ES through PES can create technical problems in simultaneously addressing efficiency and fairness outcomes; it also raises ethical arguments by obscuring cultural, political and social relationships in environmental service generation as also discussed by Kosoy and Corbera (2010).

Five main conclusions are drawn. First, the empirical observation of emerging PES mechanisms in the Asian case studies indicate that the performance of PES to simultaneously achieve efficiency and fairness objectives is strongly influenced by complex behaviour and decision making at the individual level. This behaviour is seen not only in ES

Table 3
Summary of PES theories and findings from Asian cases.

Literature basis *(with the dominant efficiency domain)*	**Assumption**	**Fact** *(with fairness contextually emerging)*	**Hypothesis**	**Findings from the study**
1. Co-investment in environmental stewardship as opposed to a strict and prescriptive PES definition				
The dominant conceptual approach towards PES is derived from Coasean economics, and PES is primarily a way to improve economic efficiency (Muradian et al., 2010)				
Poverty alleviation is a positive "side effect" and should be targeted as long as the inclusion does not imply efficiency losses (Pagiola et al., 2005)	A market-based instrument is efficient in internalizing environmental externalities by 'getting the price right'	A normative vision of efficiency improvement as a guiding principle may create a mismatch between theory and practice (Pascual et al., 2010)	Preconditions for application of the PES concept with strict conditionality are not met in the context of many developing countries, and a wider PES interpretation is needed (van Noordwijk and Leimona, 2010)	In practice, strict conditionality cannot be met among ES providers, intermediaries and beneficiaries involved in PES contracts The analysis of the research sites in Asia suggests that broader perspectives of PES (i.e., commoditized ES, compensation for opportunities forgone and co-investment in environmental stewardship) may well become the foundation to simultaneously achieve the efficiency and fairness objectives of PES schemes
2. A shared understanding of multiple ecological knowledge in providing and managing ES to increase efficiency and fairness of PES schemes				
PES schemes that aim at obtaining efficient outcomes must have well-defined ES	All ES providers participate and voluntarily negotiate with ES buyers with balanced power	PES schemes are likely to change (and sometimes reinforce) existing power structures and inequalities in decision making and access to resources, with significant equity implications (Corbera et al., 2007; Jack et al., 2008; Pascual et al., 2010)	Reducing discrepancies and improving the synergies of ecological knowledge of all actors in PES increases the effectiveness of a PES scheme	Integration of stakeholders' knowledge and perceptions in designing PES can increase efficiency by clarifying expectations from all relevant actors, avoiding unrealistic targets for the quality of watershed services, helping define conditionality of PES and offering appropriate monitoring procedures, and improving PES fairness by reducing conflicts and accepting multiple perspectives Experience with the strategic use of information and vested interests of intermediaries and donors implies that credibility, salience and legitimacy of knowledge for any PES scheme needs to be secured before it can be used in actual negotiations
3. Anti-poverty PES to adapt to local conditions in designing the types, forms and expected levels of payments				
PES schemes are more cost effective than other approaches in the conservation and poverty alleviation nexus, such as integrated conservation and development projects (Ferraro and Simpson, 2002)	PES directly targets land managers who provide ES, and payment (mostly financial) must be sufficient relative to income and at least commensurate with opportunity costs	Relative numbers and wealth of ES providers and beneficiaries are varied, thus the willingness and ability to pay may be lower than willingness to accept of ES providers	Only under specific circumstances will cash incentives from PES contribute substantially to increase disposable income and alleviate poverty for ES providers	Anti-poverty PES can only have a significant effect on rural income if it (1) involves upstream providers who have low population density and/or a small area relative to the beneficiaries; (2) involves downstream beneficiaries who have relatively higher income than the upstream providers; (3) provides highly critical and non-substitutable ES; (4) is efficient and has low opportunity and transaction costs but high willingness and ability to pay of downstream beneficiaries
4. A multidimensional approach to poverty and livelihoods to enable a broader analysis of local perspectives on PES				
Monetization of ES is the basis for enhancing the efficiency of environmental policy and				

Table 3 (*continued*)

Literature basis *(with the dominant efficiency domain)*	**Assumption**	**Fact** *(with fairness contextually emerging)*	**Hypothesis**	**Findings from the study**
correcting the market failure of ES by capturing total economic value of ES (Gómez-Baggethun et al., 2010)				
Commodification of ES transforms natural capital into financial capital	Cash payments are frequently viewed as having the highest degree of flexibility because they can be converted to local goods and services as prioritized by the receivers	Cash payments for participating individuals are mostly much smaller than opportunity costs	Indirect, non-financial benefits at the community level contribute to reducing poverty or a common-goods PES design (Pascual et al., 2010)	Non-financial incentives are very often the most preferred and possible types of payments
			PES schemes open links between communities to various types of capital	PES schemes do not drastically change the livelihoods of participants. Contributions to the improved welfare of participants so far are towards social and human capital with limited effects on financial, natural and physical capital

providers as the main actors in PES but also in beneficiaries, intermediaries and supporters (e.g. governments and international agents). The motivations and perceptions of stakeholders drive relationships, and political interest in PES can further shape the design and implementation of any scheme. A language of 'co-investment in environmental stewardship' may be more conducive to the respect, mutual accountability and commitment to sustainable development. Therefore, we envision PES as a joint and voluntary investment between ES providers and beneficiaries in a binding agreement under different degrees of conditionality for the provision of ES. The paper also highlighted phased strategies in ES provision under a dynamic and flexible contractual agreement. When the social and political preconditions (such as basic respect and relationships among stakeholders) have been met, there likely is greater space for real actions in delivering measurable ES to meet conservation objectives. The tentative classification of the landscapes in four configurations, as an initial theory of place, does help to contextualize the generic theories of change.

Second, in addition to financial payments, non-financial payments probably are an important incentive for ES providers. These payments have weaknesses, such as giving indirect benefits to ES providers and this reduces the effectiveness of the payment and can trigger 'free riders' and patronage effects. Nevertheless, in-kind payments are often the most feasible transfer owing to the often small budget for PES from ES beneficiaries, which is not able to cover the full opportunity costs of the providers. Moreover, in-kind payments avoid neglecting non-participants and align with the social cohesiveness that characterises rural communities in most developing countries.

Third, the application of multiple ecological knowledge types (i.e. local, public and scientific ecological knowledge and the associated ways of learning, rejecting and augmenting what is considered to be knowledge) can support the establishment of efficient and fair PES schemes. Clarifying problems in the provision of ES and recommending solutions at each spatial scale leads to more realistic expectations of all stakeholders in implementing PES schemes. The roles of each actor are then well-recognised and solutions are based on local contexts rather than on standardised ones, leading to mutual responsibility among PES actors.

Fourth, evaluating an established PES scheme using a sustainable livelihoods framework can provide insight into how a PES scheme can make stakeholders better or worse off. It can also fairly evaluate project implementers because a broader view of impacts is captured. Our Indonesian case suggests that the role of the intermediary is very important and possibly dominant in establishing operational PES schemes. An honest and trusted intermediary is thus one of the key factors of a successful PES scheme. It also highlights the need for the awareness of the social dynamics between participants and non-participants and the design of benefit packages to minimise community level conflict.

Finally, the interdependency of fairness and efficiency is the main consideration in designing and implementing a PES scheme in developing countries. Interestingly, the emerging experience in Africa on PES paradigms is well aligned with our findings for Asia (Namirembe et al., 2014). The cases clearly show that PES is an evolutionary process of landscape management involving multi-stakeholders, and not an end result itself. Therefore, an adaptable mechanism that is fairly efficient and efficiently fair is likely to bridge the gap between the academic approaches (or theories) and the practical PES implementations on the ground.

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Annex 1. Site profiles of the study

Kalahan

Context

The Ikalahan people of Santa Fe in the northern Philippines represented by the Kalahan Educational Foundation (KEF) signed a Memorandum of Agreement with the Philippine Government in 1974. The agreement recognized the control of the Ikalahan indigenous people covering about 15,000 ha of their ancestral land in exchange for protecting forest from wildfires and watershed functions for the users downstream.

State of action

Long before the PES concept introduced in this area, the KEF has organized conservation efforts, such as training for your people,

establishing nurseries where seedlings of indigenous species were produced and planting 50 trees per family each planting season (Rice and Stidsen 2009). In 1994 funded by the Biodiversity Conservation Network, the KEF started monitoring the biodiversity and carbon stocks of their different forest types. In 2002, the KEF joined the RUPES programme for developing more formal Project Identification Notes and approaching voluntary carbon buyers.

Kapuas Hulu

Context

Kapuas Hulu located in West Kalimantan is a region where timber extractions, mostly by large-concessions and mining activities both legally and illegally happening. Ninety percent of this watershed still covered by forest, the Dayak and Melayu people live in this region as hunter gatherer community in the upper stream bordering the National Park and smallholders cultivating monoculture and agroforestry rubber gardens in the downstream of the watershed. A local public water service is sourcing the water from this watershed.

State of action

In 2008, the WWF Indonesia initiated a payment for watershed service project. In collaboration with the World Agroforestry Centre, a hydrological assessment was conducted highlighting that the Kapuas Hulu is currently still able to maintain its watershed function, particularly those related to maintaining river flow (Lusiana et al., 2008). However, the deforestation is increasing by approximately 130 km^2 between 2001 and 2004, and there were already signs of smaller catchment-scale degradation. Therefore, the district government allocated approximately USD 20,000 annually for conserving the Mendalam sub-watershed as part of the Kapuas Hulu basin. This fund targets both the individual participants of the PWS programme and villager in general with unclear percentage of allocations.

Kulekhani

Context

Kulekhani located in the north of Kathmandu, Nepal's capital city provides 17% of the country's hydropower. High sedimentation into the reservoir is the major problem, reducing its expected life time by one third. In 1970s, the government handed over the responsibility for forest conservation to local communities giving them management and limited-use rights. As the government deemed Kulekhani lands as 'critical watershed of strategic importance', it coordinated government-led rehabilitation programmes that somehow bypassed the local villagers' perspective on watershed management. The state hydroelectric company by law pays royalties to the central government that then channels some of the royalties to the districts. These payments are seen as a mix of 'compensation', corporate social responsibility and tax.

State of action

In 2002, the RUPES programme facilitated options for mechanisms of reward transfer from the hydropower company to the upland people. In late 2006, the Makwanpur DDC deposited USD 54,800 in a new Environmental Management Special Fund (EMSF) for a year. The EMSF was managed by a newly established group made of representatives from the Kulekhani communities. The EMSF receives 20% of the royalty share of Makwanpur DDC, and supported conservation and development programs proposed by the communities.

Bakun

Context

The Kankana-ey-Bago people of Bakun was the first indigenous group to obtain a Certificate of Ancestral Domain Title (CADT) from the Philippine Government in 2002. The CADT gave the tribe formal title to its traditional lands organized by the Bakun Indigenous Tribes Organization (BITO). The Kankana-ey have demonstrated responsible stewardship of their natural resources through their indigenous farming practices through a permanent farm for agroforestry providing supply of watershed services for the two downstream hydropower companies. Presented with growing demands from urban areas for vegetables and the comparative economic advantage of urban buyers, many farmers shifted their agroforestry plots to plant temperate vegetables.

State of action

The hydropower company and local government agreed in principle to allocate a portion of royalties from hydropower production to the Bakun people for their environmental services. In 2006, an estimated voluntary benefit provided by HEC as of 2006 was USD 165,000.00. These benefits could be perceived as company's gesture of goodwill in response to the urgent needs of the communities. However, both the government officials and BITO are making claims for managing the funds, so actual payments await the resolution of this discussion until currently.

Sumberjaya

Context

The Government's belief that uncontrolled deforestation and conversion to coffee on sloping land in Sumberjaya had led to a serious increase in erosion that threatened the operation of the newly constructed Way Besai hydropower dam and reduced water availability for irrigated paddy rice downstream resulted in the eviction of thousands of farmers from the forests between 1991 and 1996.

State of action

Since 2004, RUPES provided support to local communities to gain access to the Indonesian Government's Community Forestry Program (*Hutan Kemasyarakatan/HKm*). The HKm program covered 70% of Sumberjaya's protection forest, involved nearly 6400 farmers and accounted for 13,000 ha. Farmers' groups obtained 5-year rights in protected forests envisioned towards 25-year rights, with two requirements: to plant trees; and protect the remaining natural forests. Besides, the HKm program, a pilot project with the community in two sub-catchment and PLN-SBDL (the hydropower company) to develop a mechanism of payments for reducing sediment through a River Care program. Farmers constructed check dams, drainage along pathways and terraces. The River Care group were to receive USD 1000 for a reduction of 30% or more, USD 700 for a 20–30% reduction, USD 500 for 10–20% and USD 250 for less than 10%. At the end of the program, the community had executed the contract with an 86% activity success rate. Analysis of sediment concentration showed a 20% decrease by comparison with the initial baseline. The 30% reduction target was not achieved. However, PLN-SBDL very much appreciated the community's efforts in reducing the sediment concentration in the Air Ringkih River and gave a micro-hydropower unit as a reward, regardless of the results. In 2014, the River Care has been in its third phase and progressively scaled up to all Sumatran watershed by the PLN-SBDL.

Bungo

Context

The Bungo old rubber agroforests or 'jungle rubber' are a corridor bridging the national parks surrounding the area and act as an increasingly important reservoir of forest diversity and other environmental services provided by natural forests. In recent years, the enormous increase of oil palm plantations has led to a reduction in the number of jungle rubber areas in Jambi.

State of action

The communities of Letung, Sangi, Mengkuang Besar, Mengkuang Kecil and Lubuk Beringin villages agreed to retain their complex rubber agroforests (total of about 2500 ha) if incentives were provided. The incentives local people requested included support to establish microhydropower plants, setting up rubber nurseries and demonstration plots of improved rubber agroforests, and clonal plants of high-yielding rubber trees for intensively managed rubber gardens.

Conservation agreements were signed by these four villages in 2006. The incentives provided at the time were seen only as interim while a more permanent reward mechanism was being developed. An international tyre company is supporting jungle-rubber farmers to improve the quality of their rubber and buying the rubber slabs at the global market price, which is more transparent compared to selling it to local traders. In 2009, the Minister of Forestry officially awarded the *Hutan Desa* management rights to Lubuk Beringin. The permit of *Hutan Desa* is valid for 35 years and is renewable for another 35 years subject to approval of annual work plans.

Cidanau

Context

Cidanau is an important watershed for the supply of domestic and industrial water as well as protecting biodiversity. For almost the last two decades, as an impact of rapid growth population Cidanau watershed has experienced rapid land-use change from forestland into agriculture with increased number of people living and illegally practising farming in the upstream of the protected area.

State of action

The farming communities in the upstream areas of Cidanau watershed were selected as the service providers. They were chosen based on the critical aspect of their land, including steep slopes prone to erosion. The state-owned water company (PT Krakatau Tirta Industri), providing water to the Cilegon industrial area, Perusahaan Daerah Air Minum (state-owned drinking water company) and PT Perusahaan Listrik Negara (State Power Company, acted as the buyers for the service. Forum Komunikasi DAS Cidanau (Communication Forum of Cidanau Watershed) established in 1998 played the role of the intermediary, not only to assist the farmers but also to be actively involved in administration and to monitor the rehabilitation process. The price was decided through negotiations with the buyer (KTI), the intermediary (FKDC) and the sellers (farmers' groups from four villages). In 2004, KTI signed an agreement with FKDC to provide USD 95,000 in total to pay for the environmental services that the watershed provided for five years. The payment was distributed in instalments: USD 35,000 for phase 1 in 2005–2007 and USD 40,000 for phase 2 in 2007–2009. The third payment in the fifth year was USD 20,000.

Singkarak

Context

The Minangkabau communities in West Sumatra have a unique system of governance called 'nagari' as part of the Indonesia decentralization process. The nagari system recognizes the traditional effectiveness of local communities in managing natural resources. Logging activity in the past created thousands of hectare of bare land, most of which has not recovered. Agricultural activities in the uplands also helped create 'alang–alang' (*Imperata cylindrica*) land in some parts. Government reforestation programs within delineated protection forests had little success.

State of action

Previously, some scientists pointed to erosion around Lake Singkarak as the major problem and grassland reforestation as the main way to enhance environmental services, particularly to increase water supply for the downstream hydropower. However, an ICRAF hydrological assessment revealed that reforestation might not be the only solution and found that the change of inflow to Lake Singkarak was also caused by the rainfall pattern and a hydropower plant. Together with PLTA and local communities, RUPES established a scheme to distribute royalties. This not only benefited the communities through improvement of their economic condition but also had advantages for electricity production. In 2005, Nagari Paninggahan received almost USD 40,000 from the hydropower company, or USD 1 per person per year. Further, a voluntary carbon market project was located on grassed and cleared upland areas in the foothills surrounding Paninggahan, a nagari in Singkarak. A contract was negotiated between the service buyer, which was a company domiciled in the Netherlands (CO_2Operate BV), with the service seller, which was the community of Paninggahan, represented by the 'wali nagari' (village leader).

Lantapan

Context

Lantapan's rich natural resources and favourable climatic conditions attracted migrant farmers and agribusinesses. The shift to commercial agriculture by corporations and large landholders pushed smallholders onto smaller plots in less productive and more environmentally fragile areas. Similarly, the National Power Corporation has over the years, experienced a power generation crisis owing to the poor condition of the Pulangui Reservoir.

State of action

Several incentive policies at the national level existed in Lantapan, such as 'usufructury' rights in the Integrated Social Forestry and the Community-Based Forest Management programs run by the Department of Environment and Natural Resources. The Municipal Government of Lantapan established a policy in 2001 that provided incentives to farmers adopting contour farming. The Government further established Ordinance no. 114 in 2009 (guided by a 5-year Sustainable Farming System Investment Plan), an incentive-based policy under which various forms of support are provided to farmers and farmers' organizations as rewards. The ordinance encourages the adoption of, and investment in, sustainable farming and stabilises the provision of environmental services in the watershed. Using this policy as the framework, the hydropower company is implementing a rewards' mechanism for watershed services.

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