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## Payment for ecosystem services: possible instrument for managing ecosystem services in Nepal

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Payment for ecosystem services (PESs) is part of a new and more direct conservation and management paradigm explicitly recognizing: (1) the need to bridge the interests of communities connected by ecosystems, (2) the costs of securing and maintaining the provision of different ecosystem services and (3) that those who benefit from these services need to pay for these costs. While discussions on the potential of PES are becoming more frequent, Nepal lacks concrete policies and an umbrella legislative framework at the national, sub-national, and institutional levels to operationalize PES. A lack of vertical and horizontal coordination among government departments and agencies often creates problems at the implementation level.

This paper discusses PES as a possible instrument to finance ecosystem management in Nepal, based on lessons learned from various ongoing PES-type schemes. We review a number of such schemes based on the available literature and key informant surveys in selected PES pilot sites. We argue that PES experience in Nepal remains limited and is as yet insufficient as basis for mainstreaming. We recommend that (1) existing schemes need to be monitored to analyze challenges and effectiveness, and (2) such analyses should be carried out simultaneously with informing the national policy dialog to support the debate on implementing PES for sustainable ecosystem management.

**Keywords:** PES; policy framework; local level mechanism; ecosystem services; sustainability

### 1. Introduction

Ecosystems provide numerous goods and services that can maintain sustainable livelihoods. However, global environmental changes coupled with other stressors are affecting the ability of ecosystems to continue providing the same quality and quantity of ecosystem services (ESs). Over the past 60 years, ESs have been degraded considerably at the local and global level (Millennium Ecosystem Assessment 2005), impacting all ecosystems and exacerbating poverty in ES-dependent communities (International Centre for Integrated Mountain Development (ICIMOD) 2010). Land management practices may result in both positive and negative impacts on ES (Baral et al. 2014). For example, if upstream communities clear forests, there may be a considerable increase in soil erosion. This in turn may have many consequences downstream, affecting irrigation infrastructure, flood risk, siltation, river navigability and fish reproduction and productivity. On the other hand, if upstream communities maintain vegetation, they may positively influence downstream water availability during the dry season (Ojha et al. 2009).

Until recently, such ecosystem benefits (e.g. improved water availability due to vegetation management) were regarded as ‘free services’. Land managers and policymakers often ignore these ‘externalities’ and hence fail to achieve anticipated conservation and development results. In recent years, many scholars (Merlo & Briales 2000; Wunder et al.

2005; Cubbage et al. 2007) have described the progress of environmental and forest policies in order to achieve multi-functional objectives of ecosystem management.

Payment for ecosystem services (PESs) is one mechanism which is increasingly used to sustain both the natural environment and local livelihoods (Hubermann 2009). PES is defined as a free-market-based approach designed to conserve the environment, in which the users of ES pay producers (or managers) to adopt (or maintain) environment-friendly regimes to ensure the long-term supply of such services (Wunder 2005). A PES scheme depends upon a number of criteria. It is described by: (1) a voluntary transaction, in which (2) a well-defined land use likely to secure that service is (3) bought by a (minimum of one) ES buyer from (4) a (minimum of one) ES provider if (5) the ES provider secures ES provision (conditionality). These five criteria are the basis for a ‘true’ PES scheme, an innovative instrument through which participants are guaranteed a continuous supply of ESs without compromising social goals (Pagiola et al. 2005; Wunder et al. 2005; Engel & Palmer 2008; Engel et al. 2008; Wunder & Albán 2008). However, alternative ‘PES-type’ schemes also exist. These may aim for the same goals using slightly different approaches and do not necessarily follow a purely market-based mechanism (Wunder et al. 2008). One of the main criticisms of PES focusing purely on market and efficiency is the exclusion of equity in terms

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of benefit sharing for livelihood opportunities. The argument is that ‘commodification of ecosystem or nature’ under neoliberalism does not necessarily benefit the poor segments of population (Corbera et al. 2007; Proctor et al. 2008; McAfee & Shapiro 2010). Especially with ‘efficiency as an overriding goal’, equity may not be explicitly taken care of (Proctor et al. 2008). Many scholars have considered PES as an incentive for local communities to secure their efforts in conserving natural capital through redistribution of livelihood resources and transfer of financial support (Gutman 2007; Kumar & Managi 2009). At the same time, ES inclusion in development planning has emerged as a more holistic approach to achieve adaptation to climate change, to enhance resilience to food scarcity and to reduce poverty (CIFOR 2007). Keeping the equity issue in mind, both PES and PES-type schemes are considered to be possible co-benefit instruments to achieve ecosystem management, climate change adaptation, and development objectives in developed and developing countries alike.

In Nepal and some neighboring countries, there are a number of examples of PES-type schemes which redistribute financial resources to local communities. These not purely market supply and demand-based schemes (Wunder et al. 2005) incentivize local communities to conserve natural capital through established institutional mechanisms and through cash (or another forms of) incentives such as development projects. Examples of these include Markhor (*Capra falconeri*) hunting in Pakistan, the buffer zone management program in Nepal, hydropower revenue in Bhutan, and paying for landscape beauty in Sikkim, India (Landell-Mills 2002).

Nepal has made significant advances in its natural resource conservation and management through various community-based approaches aimed at local development. However, the present community-based approaches do not explicitly consider management of ecosystems and the services that they provide. Although ESs are considered in Nepal’s present development policy, concrete application of this concept has

been lacking. Therefore, PES schemes currently take place without systematic monitoring and analyses of its management and livelihood consequences. Independent projects are managed on a case-by-case basis under the different ministries without synchronization between these ministries. We argue that there is a need for a systematic analysis of present PES practices to inform a wider policy debate in Nepal.

The main aim of this paper is therefore to explore whether any of the existing PES mechanisms can be adopted as part of a long-term and sustainable strategy that will minimize impacts on ecosystems. Two secondary aims are to (1) examine whether (any of these) current PES projects can provide the basis for a more coherent and systematic approach, linking ecosystem management and development objectives across ministries, and (2) inform policy on how these mechanisms in Nepal can be adopted under one umbrella and consequently result in more effective management of ecosystems and goods and services supporting local livelihoods.

## 2. Methodology

This work is primarily based on qualitative research using a case study approach. Both primary and secondary data from 10 different PES-type cases in Nepal were reviewed (Table 1, Figure 1). These 10 cases represent different PES-type models, ranging from government and legislation-initiated schemes to locally initiated schemes supported by various development organizations. Among these, five PES-type cases (indicated with \* in the table), representative of the different institutional frameworks these cases exemplify, were singled out based on the information available for these cases. These selected case studies were then further analyzed, using qualitative methods, with regard to their coverage of five main points proposed to form the basis of an umbrella framework for all PES-type mechanisms in Nepal: (1) standardization of legislation and institutional instruments, (2) a standard methodology and protocol when setting up a PES scheme, (3) a protocol and standardization

Table 1. List of key PES-type mechanisms reviewed in this study. The cases denoted by \* on the table are discussed in detail.

Case No	PES-type schemes and location	Ecosystem services
1*	Kulekhani hydropower, Makwanpur District	Water for hydropower
2*	Dhulikhel water supply scheme, Dhulikhel municipality	Drinking water
3*	Buffer zone management surrounding protected area, National	Biodiversity
4*	Haldekhal irrigation scheme, Kanchanpur District	Irrigation water
5	Mohana Kailali forest corridor conservation, Kailali District	Biodiversity and forest corridor
6*	REDD pilots in three selected watershed in Gorkha, Chitwan and Dolakha Districts	Carbon sequestration and carbon pool
7	Conserving Rupa Lake for water as ecosystem services, Kaski District	Water
8	Nagarjun-Shivapuri National Park, Kathmandu District	Water to Kathmandu city and other associated services
9	Central Terai PES case (Simara underground water, Bara District and Pithuwa Jutpani water supply, Chitwan District)	Water for industrial use and drinking water
10	Shardu Khola watershed management, Dharan municipality, Sunsari District	Drinking water



Figure 1. Map of Nepal locating the case studies of PES. Numbers indicate specific case study (see Table 1).

for agreement on the payment and benefit sharing mechanism, (4) inclusion of conditionality in current and future schemes, and (5) inclusion of a clear assessment of land tenure and property rights.

Facilitated consultations with local community members were carried out in November 2012–March 2013 in selected PES sites in Dhulikhel, Kanchanpur, and Dolakha to create a deeper understanding of existing payment mechanisms. One LLC (local-level consultation) comprising 10–12 local key informants from forest user groups or water/irrigation committees was carried out in each of these selected PES sites. One-to-one interviews or key informant surveys (KIS) with representatives in key positions such as Nepalese policymakers, executive members of water, irrigation, forest management committees, and officials from various institutions supporting PES mechanism in Nepal were also carried out in February to August 2013. In total, 50 participants from diverse backgrounds, gender and ethnicity participated in these KIS (see table S1). Both LLC and KIS comprised open-ended interviews with room for informants to explain context and other relevant related issues, and included questions relating to the history, current status, payment methods and success as measured by both the providing and receiving parties in the PES-type schemes (see appendix I in Supplemental data).

### 3. Policies and legislative framework on payment for ecosystem services in Nepal

Nepal lacks a concrete legislative framework on PES such as used in some other countries such as Vietnam and Costa Rica (Porras et al. 2013). However, there are some policy and legislative frameworks containing provisions for incentives for providing ES (Table 2). The latest three-year national development perspective plan (2011–2014) recognizes the economic value of ESs, thus supporting the potential of PES mechanisms (GoN/NPC 2011). The Local Self Governance Act (LSGA) from 1999 is the key decentralized legislative act that empowers local governments to manage local natural resources. It also states that the central government allocates 12% of the total revenues generated by hydropower (Case 1: Kulekhani hydropower) to the concerned district government (i.e. District Development Committee – DDC). Despite this provision, district governments are independently investing these revenues in any part of the district they see fit and thus do not necessarily invest in areas which contribute to sustainable water production (Adhikaree 2010). This does not mean that none of the revenues are invested in ecosystem management. The example of Kulekhani in Makwanpur District is used to support watershed conservation, management and development activities in upstream area (Khatri 2009).



Table 2. Major policies and legislative frameworks provisioning for PES in Nepal.

Year	Policy/Strategy	Related provisions	PES case (Table 1)
1973	National Parks and Wildlife Conservation Act, 2029	It provides power to declare buffer zones (BZ) around the national parks and wildlife reserves. The Act allows funneling back 30–50% of park and reserve revenue for the community development activities in the BZ.	Case # 3: Incentivizing BZ communities (government – communities PES-type mechanism)
1996	Buffer Zone Management Regulation, 2052	It facilitates public participation in the conservation, design and management of buffer zones and provides guidelines to manage 30–50% of park generated revenue with the communities in the buffer zone	Case # 8: Shivapuri-Nagarjun National Park, Kathmandu District
1993	Electricity Act 2049	It has stated that during the construction and operation of hydropower station, environment and watershed areas should be protected. This Act provisions that 10% of the total revenue generated by hydropower needs to be ploughed back to the concerned district developments.	Case # 1: Kulekhani hydropower, Makwanpur District
1993	Forest Act, 2049	The Forest Act, 1993, accounts for all forest values, including environmental services and biodiversity, as well as production of timber and other products. The Act empowers local people for their participation in decision-making and sharing of benefits in terms of forest resources.	Case # 4: Haldekhal irrigation, Kanchanpur District
1999	Local Self Governance Act, 2055	It provides immense autonomy to the District Development Committees (DDCs), municipalities and Village Development Committees (VDCs). Section 55 empowers VDC to levy taxes on utilization of natural resources. Similarly, Section 189 sanctions the DDC for formulation of and implementation of plans for conservation and utilization of forest, vegetation, biological diversity and soil.	Case # 1: Kulekhani hydropower, Makwanpur District. Case # 10: Shardu Khola watershed management. Case # 7: Conserving Rupa Lake, Kaski District
2000	Revised Forestry Sector Policy	It introduced a new concept in managing the forests of the <i>Terai</i> , <i>Churia</i> and inner <i>Terai</i> named collaborative forest management (CFM). Fifty percent of the income from CFM will be provided to local communities and local governments.	Case # 5: Mohana Kailali corridor
2007	National Water Plan (2007–2027)	This support <i>Churia</i> conservation program for ecological services down to <i>Terai</i> irrigation.	Case # 9: Central Terai PES
2009	Tourism Policy	It states that certain proportion of income from village tourism will be utilized in tourism infrastructure development and environmental conservation.	Case # 3: Incentivizing buffer zone communities, National Case # 8: Shivapuri-Nagarjun National Park, Kathmandu District
2009	Working Policy on Construction and Operation of Development Projects in Protected Areas	It highlights that 10% of the government royalty earned from electricity generated thereof shall be deposited by the hydropower owner to the concerned protected area for environmental conservation and community development.	Case # 3: Incentivizing buffer zone communities. Case # 8: Shivapuri-Nagarjun National Park, Kathmandu District
2010	Three Years Interim Plan's Approach Paper (2010–2012)	It provisions that 35% of the income of community-based resource management models will be returned back to local communities for their livelihood. It states that a trust fund will be created from private contribution to be used for the development of forest-based enterprises.	Overall development policy

Note: Nepal follows the Bikram Sambat (BS) era as its official calendar, which is 57 years ahead of the Common Era (AD).

The National Park and Wildlife Conservation Act (1973) is the key legislative framework for managing protected areas and their buffer zones in Nepal. Subsequent amendments of the act including buffer zone management regulations (1996) ensured adoption of a revenue sharing provision to encourage conservation and

development activities in the buffer zone area. With this provision, 30–50% of the total revenue generated by protected areas is allocated for buffer zone development (Case 3: buffer zone development). However, there is still debate as to whether these resources are invested for conservation activities (Bhatta et al. 2010).

Finally, the Forest Act 1993 provides legislative support to manage forests in Nepal. Under this Act, a district forest officer (DFO) is authorized to hand over part of the national forests to local communities based on an operational plan. Once handed over, these forests are managed under a community forestry framework where communities are liable to manage their resources, including ES, within the framework of an approved plan (Case 4: Kanchanpur irrigation). Community forestry has been successful in sustaining various ESs. However, ES and benefits are not adequately emphasized in policy and community forestry legislative framework (Acharya et al. 2010).

Nepal is presently developing its national strategy on reducing emission from deforestation and degradation of forests (REDD<sup>+</sup>). This strategy aims to reduce greenhouse gas emissions resulting from deforestation and degradation of forests while incentivizing local communities to adopt or maintain forest conservation efforts (GoN/MFSC 2010). The national REDD<sup>+</sup> strategy also includes a REDD benefit sharing mechanism (Case 5: incentivizing local communities through REDD).

These examples (see also Table 2) highlight existing legislation in Nepal which support and integrate PES and PES-type mechanisms. They also illustrate different combinations of: (1) private or self-organized payment agreements, (2) PES trading schemes and (3) public (government-driven) PES. Each combination requires in one way or another some form of legal support and regulations if they are to be developed. In Nepal, public PES schemes, which are most likely to support development of reliable ecosystem markets in the future, require a comprehensive legislative basis. In addition, if the market for ES does not yet exist, PES-related legislation could stimulate such a market. In-depth analyses are needed to map the PES potential for various ESs in Nepal.

#### 4. PES-type practices and schemes in Nepal

##### 4.1. Kulekhani hydropower (government-community PES-type mechanism)

Kulekhani hydropower is a government-initiated pioneer PES-type initiative in Nepal (Khatri 2009). Within the framework of the LSGA from 1999, the Makwanpur DDC receives 12% of the revenue generated from the Kulekhani hydropower facility. Makwanpur DDC endorsed a guideline on benefit sharing of the royalties, investing part of the revenues in upstream watershed conservation as payment for community efforts in conservation (Ojha et al. 2010). As a rule of thumb, communities upstream of Kulekhani watershed receive 50% of the revenues received under this scheme, while the remaining 50% is distributed to downstream and other communities.

There are ongoing debates and disputes regarding the share of these hydropower revenues among Kulekhani upstream and downstream communities. Based on the reasoning that they are the real providers or sustainers of

ES conserving the Kulekhani watershed, upstream communities argue that they should receive the full amount of the revenues. The downstream communities on the other hand argue that benefits should continue to be distributed as is currently the practice. In spite of the ongoing debates, the Kulekhani PES-type scheme is considered to be a good initiative at least to maintain water flow to the reservoir.

However, the unresolved issues on the benefit sharing mechanism and the lack of a concrete institutional framework or provision within the local government covering this indicate that a proper negotiation in advance of such a scheme is essential, with transparency in benefit sharing and a clear institutional role of the subsidiary organizations before such PES schemes are implemented. Adhikaree (2010) also highlights that as part of the basic concept of PES schemes, discontent on benefit sharing among upstream and downstream communities should be addressed and agreement should be reached by all partners before any PES scheme is implemented. While the existing LSGA and Electricity Act include provisions for revenue sharing to local government and are conducive to PES-type arrangement, there is clear need for more explicit policy provisions on benefit sharing and conditionality.

##### 4.2. Dhulikhel drinking water supply (community – local government/municipality PES-type mechanism)

Dhulikhel municipality has many inhabitants and a clear demand for drinking water. The Dhulikhel drinking water supply scheme is the only urban water supply system managed by users and is considered to be a model project (Mahato 2010). The project consists in part of a pipeline to provide safe drinking water to residents of Dhulikhel city. This 14-km long pipeline was completed in 1992 and supplies water from the upstream water source of Kharkhola in the Bhumidhara village development committee (VDC) in Lalitpur District. A second part of the project is a payment scheme in connection with this water extraction/supply, which formalizes the linkage between the key facilitating institutions Dhulikhel municipality and Bhumidhara VDC. In this scheme, established in 2010, the two parties agree on payments both in cash and as in-kind compensations to reward upstream communities for their contribution to conservation of the water source (Bhatta & Kotru 2012). Specifically, the drinking water management committee agrees to pay NRS 1 million (approx. 10,000 USD) per year to upstream communities. Every 5 years, this amount will be increased by NRS 100,000 (approx. 1000 USD). In-kind compensations consist of support of one student from the upstream community with a scholarship for Kathmandu University, support of health services in the local hospital, and payment of the salary of a forest watchman.

The high water demand increases willingness to pay upstream service providers in order to ensure a sustainable supply of such services, and this case reflects that a PES (-type) scheme may function well if and when there is a

clear demand for an ES. However, proper mediation and mutual trust and benefit sharing mechanisms are important to consider when developing PES (-type) schemes.

The Forest Act of 1993 and related regulations empower community forestry user groups (CFUGs) to manage their forest resources and consider CFUGs as an independent entity. In this case, CFUGs manage to sell their ES, water, to downstream communities under the existing forest laws and regulations. These laws and regulations clearly define the institutional framework which is conducive to the operationalization of PES. Downstream water user committees, the consumers establish their institution under the Organization Act of Nepal. The role of local government, the Dhulikhel municipality, as mediator or subsidiary organization is crucial for proper agreement on ES.

#### 4.3. Incentivizing buffer zone communities (government – communities PES-type mechanism)

Nepal's National Parks and Wildlife Conservation Act (1973) has a provision for buffer zones surrounding protected areas (PAs) to encourage local participation in biodiversity conservation. The Buffer Zone Management Regulation (1996) under this Act stipulates that the government will provide 30–50% of the total revenue generated by a PA to the buffer zone communities. This provision, though not directly adopting the concept of PES, agrees to incentivize buffer zone communities for their role in conserving biodiversity and landscape integrity in and surrounding PAs (Paudel et al. 2007).

In 2012 (Nepali FY, 2069/70), protected areas in Nepal generated a revenue of about NRs 402 million (~USD 4.2 million). This is a substantial increase in comparison with earlier years. In the 6 years covering 2005 to 2010, buffer zone communities received about 38 million NRS under this reward system (see Figure 2).

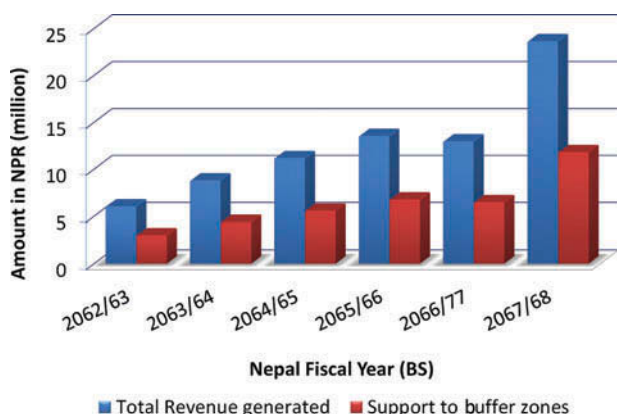


Figure 2. Total revenue vs. support to Buffer zone communities<sup>1</sup>. Source: DNPWC 2011.

<sup>1</sup>Nepal follows the Bikram Sambat (BS) era as its official calendar, which is 57 years ahead of the Common Era (AD). The Nepali official fiscal year starts from Shrawan 1 (16 July) to the end of Ashad (15 July).

Revenues are made out to buffer zone management committees (BZMC), institutions supported by existing laws and regulations where representatives from communities and Park authorities work together for sustainable development and biodiversity conservation. The 30–50% cash incentive provisioned in the BZ management regulation is embedded within BZ development plans. Although the policy provision demands a mandatory 30% of the total grants received to be invested in concrete PA management such as conservation of biodiversity and landscape integrity, the majority of this contribution is invested in local capacity development and in income-generating activities (and not in BZ management itself). This difference in investment and the conditionality in PES schemes to invest in actual biodiversity conservation is one of the distinguishing features qualifying this scheme as a PES-type scheme, not an actual PES scheme. For this case to be used as a good example for PES, the investments and BZMC plans and programs may need further discussion and analysis whether biodiversity conservation investments need to be further prioritized.

Some researchers (e.g. Bhatta & Kotru 2012) argue that this is merely a development effort, rather than a PES mechanism, where controlled PA management is shifted toward a more participatory approach. Despite this argument, the reward mechanism in PA management can be well embedded in government-initiated PES schemes to ensure long-term management of biodiversity resources in and around protected areas of Nepal.

#### 4.4. Paying community forest user groups for irrigation water, Haldekhali irrigation scheme, Kanchanpur District (community-community PES-type mechanism)

Community-based PES mechanisms are often based on effective institutional structures and a capacity for proper negotiation. This situation is more relevant where communities have diverse power relations and values (Lauber et al. 2008). However, there is evidence of growing awareness and capacity at the community level for wider collaboration to ensure community benefits (Ghazoul et al. 2009). In Kanchanpur District in the far western part of Nepal, CFUGs of upstream Siddhanath community forest (CF) initiated a PES scheme involving the provision of irrigation water through a formal contract with downstream users. In established PES schemes, water for irrigation is a well-defined ES, where upstream communities are obliged to sustain a service (here: forest management to sustain provision of water) and downstream communities in need of water for agriculture support this upstream management. Under the current agreement, downstream users pay NRS 30 (USD 0.30) per hour for water use to the upstream CFUG which invests this money in sustainable management and conservation of the water source and surrounding forests.

Nepal's Forestry Regulation (1995) under the Forest Act (1993) gives legislative power to CFUGs, describing

these as an independent entity, thus providing a legislative basis for CF-related PES schemes. The DFO has the responsibility to monitor the status of the ecosystem and water flow to ensure that these PES schemes are functioning well and in accord with the agreement and forestry regulations and directives. However, the institutional arrangement for compliance and monitoring is essential for long-term supply of ES to downstream communities. The present monitoring mechanism needs to be institutionalized within the District Forest Office to ensure compliance from both buyers and sellers.

#### 4.5. Incentivizing local communities through REDD+ piloting in selected micro-watersheds in Dolakha, Chitwan, and Gorkha Districts (government – forest user committee PES)

Policies for REDD+ are often portrayed as win–win solutions for forest-based climate change mitigation and provision of multiple ecosystem goods and services (Phelps et al. 2012). Nepal pilots an initiative on REDD+ in an area which includes three selected micro-watersheds and covers 112 CF user groups with more than 10,000 hectares of forest (Table 1: Case # 6). This pilot initiative was carried out with the support from the ICIMOD in close collaboration with local community groups to develop a REDD+ benefit-sharing mechanism. The initiative showed positive results in terms of conserving forests and incentivizing local communities. A Forest Carbon Trust Fund (FCTF) was established with clear guidelines on benefits sharing from carbon sequestration. The mechanism uses multiple criteria to determine how the benefits would be shared among the participating forest user groups. Carbon sequestration weighs 40% in the equation while the remaining 60% is applied to social aspects, including ethnic diversity, female population, and poverty index (Rana et al. 2012). Table 3 provides details on total payments made from the project supported carbon trust fund from 2011 to 2013. While REDD+ initiatives have been instrumental in improving forest governance, they have also provided opportunities for local-level income generation through REDD+ funds (see Maraseni et al. 2014; Poudel et al. 2014).

#### 5. Challenges and future perspective of PES in Nepal

There are a number of PES-type cases presently operational in Nepal, which provides an opportunity to evaluate and consider the potential of these for collective policy support. A study on the potential for a PES scheme in Shivapuri-Nagarjun (Table 1: Case # 8) National Park reveals that such a scheme would provide economic incentives to local communities to support conservation efforts and reduce park-people conflicts (ICIMOD 2011). The policy provision to provide 30 to 50% of the park revenue to buffer zones is considered useful to mitigate human-wildlife conflict and conserve biodiversity. An increase in the rhinoceros population in Chitwan buffer zone and a reduction of wildlife poaching are some examples linked with community participation and government incentive provisions. A study in the Shardu Khola watershed (Table 1: Case # 10), which is the main source of water supply in Dharan municipality in eastern Nepal, revealed that 42% of the people living in downstream communities are willing to pay (more than 1 million NRS) for sustainable management of the upstream watershed (International Union for the Conservation of Nature (IUCN) 2004). Several conditions for PES are met, and the demand for drinking water is increasing and the willingness to pay for conserving upstream water source is increasing. Another study in the central Terai districts revealed PES (Table 1: Case # 9) to be a potential solution to the current degradation of watershed and livelihoods (MFSC, SNV, and Forest Action 2010). PES piloting in the biodiversity-rich western Terai shows promising results for the restoration of degraded landscapes. In particular, performance-based payment schemes in selected CFs of the Mohana Kailali forest corridor (Table 1: Case # 5) served as pilot sites where CFUGs received rewards based on results after assessment of preselected performance indicators (WTLCP 2012). These examples are indicative for the increasing market of ES, especially water. In the above-described PES cases, there are no provisions or discussions on conditionality of payments or incentives even if the supply of ES does not meet the level indicated in the agreement. For example, the Dhulikhel water supply agreement does not make provisions for payments in the scenario where water availability is reduced to

Table 3. Total payment from project supported Forest Carbon Trust Fund using different criteria from 2011 to 2013.

Watershed (district)	No. CF	Total (USD)	Payment according to different criteria (USD)						
			Carbon stock (ton)	Carbon increment	IP HHs	Dalit HHs	Women	Poor	Basic
Kayarkhola (Chitwan)	16	72,255	16,573	11,049	6905	10,359	10,359	13,811	3200
Charnawati (Dolakha)	58/65 <sup>a</sup>	132,879	28,939	19,293	12,058	18,086	18,086	24,116	12,300
Ludikhola (Gorkha)	31	79,866	17,679	11,787	7366	11,050	11,050	14,733	6200
Total	105/112 <sup>a</sup>	285,000	63,192	42,128	26,330	39,495	39,495	52,660	21,700

Note: <sup>a</sup>In Charnawati, 58 CFs in 2011/12 and 65 in 2013.

Source: REDD pilot project database 2010–2013, International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal.



downstream communities. Similarly, the payment mechanism in the Kanchanpur case does not state what happens with payments if irrigation water availability is reduced or not available. The majority of PES cases we analyzed lack and need an institutional mechanism to operationalize PES within existing policy provisions, and need provisions in case of changes in the quantity or quality of the service.

In spite of its political instability, Nepal has made significant progress in participatory management of several ecosystems and landscapes. A number of community-based management approaches have been institutionalized to support ecosystem management. As a result, natural resource governance has been significantly improved, providing increased access to resources, and transparency in local fund management and the decision-making processes (Pokharel & Tiwari 2013). However, for a large part of the country, management of ecosystems and landscapes, ES and externalities are yet to be addressed. For example, management of water resources and water and forest relations has not been streamlined within a broader management, as presented in some of the cases above.

The increasing number of studies and pilot projects on PES indicates a demand and potential for PES schemes and the need to systematically address the value of ES. For example, in many of the presented cases, the payment is not based on actual valuation of ES but rather on an understanding between users and buyers. Such a potential valuation of ES may help to incentivize communities to sustainably manage and conserve these ES and ensure long-term supply. Besides valuation, there are a number of issues that need to be addressed and made coherent before PES can successfully and systematically be implemented in Nepal. These issues fall into five major categories described below.

### **5.1. Legislative and institutional instruments**

Nepal's sectorial policy and legislation regulates some facets of ES and suggests PES as a potential mechanism for sustainable management of natural resources providing opportunities for livelihoods diversification (see Table 1). However, a national legislative and institutional umbrella supporting PES is lacking (IUCN 2004; Karn 2008; Khatri 2009; Ojha et al. 2010). The five cases discussed in this paper demonstrate a need for more precise legislative instruments or improved alignment with (and of) existing policies.

The concept of PES in a watershed is not compatible with Nepal's existing political boundaries and jurisdictions. In the Lothar Khola watershed for example, upstream land-use change resulted in high siltation downstream. As a result, infrastructure (i.e. a bridge along the east–west highway) is at high risk of collapsing. The existing legislation on road management does not allow the Department of Roads to invest their resources in addressing the causal factors of siltation upstream, nor to address the increased accumulation of sediment itself (Ojha et al. 2010). The REDD incentive to local communities for their contribution to carbon sequestration is presently piloted under the Forest Act and related regulations.

In CFs piloting REDD payment, CFUGs are mandated to manage their forests resources. The issue of carbon management however is not described in existing forestry laws and regulations, and therefore, the issue of entitlement to such carbon storage revenues is still under debate (see also section 5.5 on land tenure and property rights).

The current scattered policies and legislation disperse PES interventions across sectors and within their respective area of jurisdiction. However, PES is a multi-sectorial and multi-dimensional, and a unified approach with coordination across sectorial ministries and departments is fundamental. The need to both institutionalize and embed PES in policies is highlighted in the case of the Dharan water supply (Table 1: Case # 10): while there is a willingness to pay for ecosystem management securing water provision, ongoing disagreements, lack of a unified representation of upstream communities and an unwillingness to talk have led to an already many years ongoing conflict between the municipality, the Nepal Drinking Water Corporation and the citizens of Dharan. This underlines the importance of (1) embedding PES in policies, (2) written agreements and (3) securing involvement of all parties that are affected or contribute to a PES scheme.

### **5.2. Methodologies and standard protocols**

Valuation of ES, particularly in non-monetary values as many communities and households may not have the financial means, is important to determine what consumers are willing to pay for any particular ES. It is also important to analyze how farmers evaluate the relative benefits of conservation (Garbacha et al. 2012). These analyses not only provide a policy perspective to adopt PES mechanisms, but also help to set up sustainable and successful PES processes.

The majority of PES-type cases in Nepal focus on water ES. The value of biodiversity is mostly addressed within the government initiated buffer zone development program under Nepal's National Park Act. There is a clear gap in a standardized scientific methodology to assess the value of ES and hence determining payments has been ad hoc. Determination of payment in most of the analyzed PES cases is typically based on mutual understanding and agreement between the parties involved, without following any proper scientific analysis. For example, upstream producers and downstream users of irrigation water in a PES scheme in west Nepal agreed on payment of NRs 30 per hour for the use of water for irrigation (WTLCP 2012). Communities in Dhulikhel water supply are paying 1 million NRs per year to upstream communities. In both of these cases, payment is mostly based on mutual negotiation, irrespective of any proper scientific analysis or valuation. Similarly, a government-initiated buffer-zone reward program makes provision for 30–50% of the total revenue generated by the protected area, whereas the local government in Makwanpur District received 12% of the total revenue from Kulekhani hydropower. Both the Kulekhani and the buffer zone cases are described in

provisions in respective regulations. However, the scientific basis for these provisions in both of the cases is lacking. Despite the fact that PES-type schemes based on mutual trust and understanding may function well, the payment is determined on an ad hoc basis and is not based on scientific analysis, valuation or standardization. Neither do any of the present PES-type agreements include scenarios for future changes in climate and hydrology, which are important to estimate the (even near-) future sustainability of the service and its impacts on the PES scheme, its mechanism and price agreement.

In several of aforementioned PES-type schemes, upstream communities may become dissatisfied over time with the size of the payments and demand more. This may lead to conflict and issues with the delivery of services. Therefore, a standardized method to determine the flow of services and the realistic price for the use of services (to be invested in sustainable management) needs to be well supported and tested before being adopted on a broader scale in PES schemes in Nepal. That will not only minimize the potential for disagreement and conflict, but will also give a scientific and standardized basis for negotiations.

### 5.3. Payment and benefit sharing mechanism

When determining the size of PES payments, there is always a risk that they may not correctly reflect the full spectrum of services provided by the ecosystem and the intervening management of the local community. Again, valuation following scientific methods is therefore important. At the same time, there may be high transaction costs involved in establishing even a small-scale PES scheme. These costs are additional to the ES value and will increase the seller's price while giving less benefit to producers (Cranford & Mourato 2011).

Once a payment mechanism and value has been agreed upon (see for this also section 5.2), sharing of benefits among communities may be a real challenge. A great number of cases have provided evidence that benefit sharing is one of the main causes of conflict over the use of ES. The distribution of profits made by the hydropower in Makwanpur district is one among several examples of such conflicts. This PES scheme has given rise to an ongoing debate and conflict about whether the profit made by the local government should be distributed in its totality to upstream communities. The conflict has yet to be resolved despite recent local government propositions for an increased benefit sharing mechanism (Khatri 2009). This is an important issue that needs to be addressed from the start in any PES scheme design.

### 5.4. Conditionality

Conditionality is considered to be one of the five main principles of PES. It is essential in any PES scheme that the ES provider should secure its delivery of the ES (Wunder 2005; Tacconi 2012). Until now, conditionality

has not been observed in PES-type cases in Nepal, which may explain some ongoing conflicts. Thus, embedding conditionality in legislation is essential to avoid any such future conflicts. For example, in the Kulekhani hydro-power PES, two major legislative instruments support the PES implementation: the LSGA and the Electricity Act. Neither of these two acts discusses conditionality and compliance issues for PES schemes. If siltation persists and upstream conservation in the Kulekhani hydro-dam is not maintained, what would be the scenario for payment? Similarly, the Dhulikhel drinking water case is enacted under the Forest Act. This act does not give any details on managing and trading ES, nor what happens in terms of payment if the quantity of water is reduced. The same holds true for the Kanchanpur irrigation case; despite the provision in the buffer zone management regulation to invest at least 30% of the total funds received in conservation, the regulation does not include provisions on what happens to the payment if communities do not meet the required conservation needs of biological resources. Embedding conditionality of payments in legislation, in agreements and in a scientific approach, is an important measure to avoid conflicts in PES schemes.

### 5.5. Land tenure and property rights

The success of any type of PES scheme depends on a clear assessment of land tenure and property rights to determine 'whom to pay to' for ES. Well-defined property rights and secured tenure are a prerequisite for performance-based PES mechanisms and flow of ES. The success of PES initiatives also depends on a country's ability to enforce legislation to protect these rights (Bruce et al. 2010).

The majority of the PES schemes in Nepal are designed and implemented at the community level. CFs and buffer zones around protected areas are the major ecosystem and land-use types where PES schemes are initiated. CFs are well defined within Nepal's Forestry legislation. However, this legislation contradicts the LSGA when it comes to use rights. As a result, it is still debated whether carbon storage revenue rights fall to local communities or to the state.

## 6. Conclusion

Nepal has significantly improved its ecosystem and landscape conservation through a number of community-based management approaches. However, there is limited focus on ES value in these management approaches, in particular to the non-use value of ES, and the national accounting system is merely based on the contribution of provisioning services from ecosystems. In recent years, awareness and discussion of sustainable management of ecosystems and their services have increased both at the national political and at the community level. To improve sustainability of both ES and livelihoods, a number of PES schemes have been initiated to reward local communities for their management efforts.

This study has evaluated the successes and challenges in these PES initiatives and finds that these schemes show a promising potential to establish and implement PES for various ES at a larger scale. However, our analysis also indicates that a concrete legislative and institutional mechanism is a basic necessity for making PES successful in Nepal. Conditionality in payments regarding the sustained delivery of the service and rights and entitlement issues must be embedded in legislation as well as in the agreements themselves to avoid conflicts related to such. Given that Nepal still largely lacks concrete PES experiences, a multi-stakeholders' process is needed to help identify key stakeholders, their respective roles and their responsibilities. Standardized methodology and tools to assess the non-monetary values of ES are needed to solidify the local context for a payment mechanism and to bring producers and consumers together in a reliable PES agreement and schemes.

Since PES schemes are very location specific, the results may prevent wider generalization. However, the analysis does provide sufficient understanding to serve as input to the wider policy dialog and discussion on the potential of PES mechanisms in Nepal at a time of climate change. With different local context, diverse ecosystems and ES, it would be practical to develop or/and amendment existing policies and legislative framework making them PES-friendly to meet socioeconomic and environmental goals. Furthermore, this paper provides an entry point to research on the links between PES and ecosystem-based adaptation.

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### Supplemental data

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