



Research article

Payment for ecosystem services: could it be sustainable financing mechanism for watershed services in Nepal?

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Abstract: As a stewardship for watershed services, an incentivizing mechanism of payment for ecosystem services (PES) has been increasingly discussed in global policy arena. In this context, various models of incentivizing mechanisms have been implemented as a pilot program. This study assesses the existing financing mechanisms for watershed services at the national level and examines the pilot PES programs that have been implemented in four different sites of Nepal. Using various participatory and qualitative research methods; this study analyses institutional arrangement, operational procedures and implementation practices from the study sites. Our findings reveal that the pilot PES programs have shown fairly satisfactory outcomes in watershed management. Based on our findings, we argue that the PES mechanism can be a promising approach in financing sustainable watershed management in Nepal. Nevertheless, PES mechanism should be flexible and contextual in terms of institutional arrangement and needs to be strengthened with a strong linkage between service providers and service users, through a regulatory mechanism. An intermediary role of the local government is found to be utmost important to institutionalize the PES mechanism as a sustainable financing mechanism for ensuring watershed services in Nepal.

Keywords: payment for ecosystem services; watershed management; sustainable financing; ecosystem services; institution; intermediaries

JEL Codes: Q24, Q25, Q26, Q57, Q58

1. Introduction

Watershed management has been widely accepted as an integrated approach to natural resource management and sustainable development. The level of significance and priorities for watershed management varies according to the geomorphological and socioeconomic setting of the nations (Shen et al., 2015). However, significant focus on planned watershed management was given after the hydropower dam and large-scale irrigation projects in Asia (Reddy et al., 2017). Usually, these programs on watershed conservation and management are designed and funded by the governmental organizations (Echavarria, 2002).

Nepal, a mountainous country, has several challenges in managing its watersheds. Soil erosion, ranging from 260 to 4,706 tonnes/sq.km/year (West et al., 2015) due to unplanned road construction, increased human settlements, agricultural practices and forest cover loss is affecting water quality (Gurung and Sherpa, 2014; Achet and Fleming, 2006). Changing monsoon pattern and increase in temperature in Himalayan region (Gurung and Sherpa, 2014) accelerates such challenges in managing water and watershed services.

Aside from physical and hydrological characteristics of watershed, it is also social and environmental goods. Being a common pool resource and in the absence of property rights, it is very difficult to establish market for the distribution of cost involved for the management of watershed and benefit generated from it. The distribution of rights to individuals is itself a complicated matter which needs external power for successful water and land reforms (Ostrom and Gardner, 1993). Therefore, the distribution of property rights is more costly and less practical for policy related to the natural resource management (Neupane, 2011; Nuppenau, 2000). On the other hand, there are number of non-monetary value of watershed which cannot be captured by the market. Therefore, the relationship between service providers and service users in a geographical area like watershed need to be institutionalized (Coontz, 1991). This also should aim for contractual arrangement based on an appropriate incentive scheme (Randhir and Lee, 1996). Willingness to pay (WTP) scheme is one of the appropriate options that can be operationalized and institutionalized at watershed level (Bhatta et al., 2014). Bhatta et al. (2019) have showcased such model as an example of two-ways adaptations and sustainable approach to adapt the changes in society, nature and agriculture in mountainous countries like Nepal.

The non-monetary benefits generated by watershed management are not directly accounted in national economy (Bhatta et al., 2014). Watershed management programs have many positive environmental externalities, which might be greater than the direct financial return. But, there is lack of standardized procedure to account direct and indirect benefit of such ecosystem services. In the absence of it, gaining support from policy makers for sustainable watershed management might be challenging (de Groot et al., 2010), who prefer the return on investment in a direct and accountable measure. As a reason, problem of allocating inadequate budget for watershed management is common in developing countries, including Nepal (Kurkalova, 2015). Additionally, problem of watershed degradation and geomorphological remoteness is much beyond the capacity of government budget alone. Therefore,

sustainable financing mechanisms for watershed management is being discussed in recent days (de Groot et al., 2010; Rai et al., 2018).

Different forms of positive environmental incentives are discussed and debated in generating and sustaining various environmental services (Wunder, 2015), which varies from voluntary agreement to market-based contract (Kosoy et al., 2007). Such as, integrated conservation and development projects (Simpson and Sedjo, 1996); compensation and reward mechanisms for environmental services (van Noordwijk et al., 2007); payment for ecosystem services (Wunder, 2005); payment for ecosystem service-like programs (Porrás et al., 2008); and incentives for ecosystem services (Patterson et al., 2017). Those concepts are not all alike but have some common attributes to promote and sustain positive environmental externalities and internalize the negative externalities in common pool resources like watersheds.

Based on theoretical concept as described by Coase and Epstein (1960), payment for ecosystem services (PES) is a dominating concept in the last couple of decades (Hausknost et al., 2017; Muradian et al., 2013). Earlier, PES was defined as a formal set of regulating ecosystem services. However, taking conditionality as a major defining feature, PES is redefined as “voluntary transactions between service users and service providers that are conditional on agreed rules of natural resource management for generating offsite services” (Wunder, 2015). This definition realizes the stewardship of natural processes in the ecosystem, hence consider the land use or resource use proxies as conditional features.

Considering watershed as a functional management unit for defining ecosystem services, some scholars use payment for watershed services, as a subset of PES (Dillaha et al., 2008). Although, many watershed services are considered from hydrological perspective, various resource use including land and vegetation and other socioeconomic services are also accountable with watershed services (Bremer et al., 2018). These watershed services play important role for rural communities to maintain their agriculture and forest based livelihoods (Bhandari and Grant, 2007; Merz et al., 2003). In practice, it is difficult for pricing each service provided by the ecosystem as there are number of non-monetary benefits. In this case, considering shadow price is only the option. If the sets of all ecosystem services multiplied by its corresponding value, it gives the shadow price of ecosystem services (Howarth and Farber, 2002), which might ensure sustainability of the financing in PES mechanism. In the forefront of cascading PES discourse, this paper aims to analyse whether PES can be a sustainable financing mechanism for watershed management for generating and sustaining watershed services in Nepal. Our analysis is also aimed to outline potential payment mechanisms, modes of payment, and institutional arrangements while taking PES as financing mechanisms for watershed services.

Following this introduction, Section two is about the methodology of the research. Results of the study, including review of the watershed financing and finding from the case studies about the key attributes of PES is presented in Section three. Based on the results, analysis of the prospects of institutional arrangement of PES, its resource management and socio-economic development potentials are discussed in Section four. Section five concludes the paper.

2. Materials, methods and study area

This study is primarily based on participatory and qualitative research, using case study approach. Primary data and information were collected using focus group discussions, interview with key

stakeholders, and direct field observation in selected four pilot sites. Secondary information were obtained from review of published and unpublished literature, policy and program documents. Policy and literature review was carried out to outline the past and present practices of watershed management financing in Nepal. Data regarding the institutional arrangement and functioning of PES mechanisms in the study sites were collected through field observation and social survey techniques. Semi-structured questionnaire was developed and administered to service providers in the upstream and users in the downstream. The semi-structured questionnaire was aimed to assess the institutional deliberation and effectiveness of existing PES pilot programs. Responses related to potentials and challenges of the PES mechanisms as well as willingness of upstream and downstream communities to sustain the PES mechanism was also collected through the questionnaire. In-depth interviews were conducted with the key informants, government actors and representatives from the intermediary organizations. The interviews were objectively focused on assessing the implication of PES mechanism for resource management and socio-economic development of watershed dwellers in the study areas.

The field work was carried out in April and May 2018. Field-led work was carried out in Phewa watershed (Kaski District), Mid-Marshyangdi watershed (Lamjung District), Nibuwakhola watershed (Dhankuta District) and Adherikhola watershed (Sindhuli Distirct) (Figure 1).

Phewa watershed is situated in the west of Pokhara City, covering an area of about 122.17 sq. km, is the main source of municipal water and is one of the popular tourist hotspots in Nepal (WWF Nepal, 2014). Mid-Marshyangdi watershed, extending over Lamjung and Manang district, is the source of river which contributes flow for significant hydropower production in Nepal. Nibuwakhola watershed, lying in the North East of Dhankuta town, is the main source of drinking water for Dhankuta municipality (Mishra et al., 2017). Adherikhola watershed of Sindhuli lies 134 km east of Kathmandu which covers three rural municipalities; namely, Jalkanya, Ratanchura and Bhimeshwor. Of these three municipalities, former two falls in upstream and latter one falls in the downstream. Downstream community solely depends on upstream water sources for domestic and agriculture uses. These case studies were observed and compared in terms of PES components and institutional context to discuss the potentials of PES for watershed management financing.

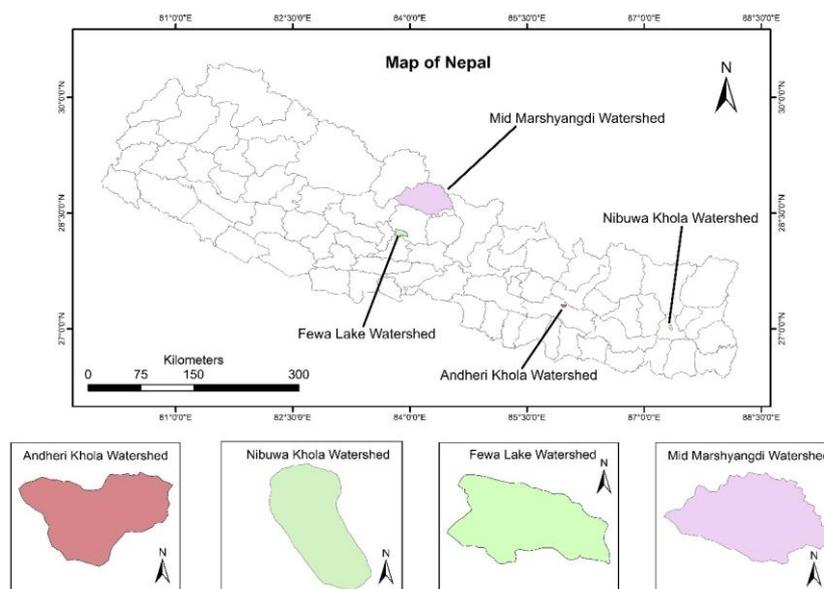


Figure 1. Study areas.

3. Results

3.1. Review of watershed management financing and initiation of PES mechanism

Watershed resources are the foundation of ecosystem integrity and socio-economic wellbeing of the upstream dwellers, who have the rights over resources (Kosoy et al., 2007). Traditionally, farmers were engaged in various soil and water conservation activities in watersheds at an individual basis. Watershed management activities were limited to terrace improvement, conservation pond construction, contour bunding, and fodder tree planting which were carried out at farm level. However, the traditional practices were satisfactory to control erosion at the farmers' level. The condition of watershed is characterized by the overall programs and activities at watershed level, which are costly at the individual level but beneficial through the collective actions (Wunder, 2015). In addition, upstream dwellers are often counted as economically vulnerable communities (Kosoy et al., 2007), with lack of resources for proper land management techniques. Hence, the traditional practices of individual farmers were not self-sustaining for watershed management.

After the mid of 20th Century, project-based watershed management planning and program were started in Nepal with support from various non-governmental organizations and development partners. Following the global discourse of sustainable development, Nepal has also mainstreamed watershed management as a priority program from national level policy and planning (NPC, 2017).

Yet, financing of watershed management initiatives was taken from government and donor agencies (Echavarria, 2002). However, community participation has also been taken as a major approach while implementing the watershed management activities (Khanna et al., 2016). Sustainable financing for generating indirect environmental benefits at the cost of development projects is always challenging in developing countries, including Nepal. Moreover, harsh geo-morphological condition throughout the country and extreme climate events further exacerbates the financial burden to the nation to address the widespread problem of watershed deterioration. In that context, a self-sustained financial mechanism at the watershed level is the absolute need of today's community.

Realizing the need for sustainable financing for watershed management, PES have been initiated through pilot studies at various sites of the country. Based on our study on the four pilot sites, we found that the PES can be prominent mechanisms for financing watershed services, given that the institutional arrangement is strengthened by including local government authority. Our finding further illustrates three major modes of payment mechanisms attributing seven PES characteristics in selected four sub watershed areas of Nepal. Payment mechanism includes, (a) users' direct payment to consumers (b) payment through revolving grant supported by external agencies, also acting as subsidiary organizations, and (c) payment included in water tariff managed through water management committee. Three different mode of payment prevailing in pilot sites were; (1) kind (2) cash and (3) kind and cash. These mode and mechanism are primarily based on institutional capacity and arrangement and level of ecosystem service competitiveness. For example, In Nibuwakhola watershed, an institutional mechanism is well established through local municipal government, and payments are done based on volumetric water use. Whereas, in Adherikhola watershed, consumers of ecosystem services (downstream communities) offer kind contribution to upstream communities (producers) in restoration of upstream ecosystems, for example, plantation, construction of water recharge ponds. However, conditionality attribute has not been well perceived

in all selected four watersheds. Absence of the conditionality attribute indicates that PES mechanism in all selected watersheds is not matured yet.

3.2. Key PES attributes of the study sites

There are number of PES-like schemes operational in Nepal, ranging from legislative provisions to community led initiations supported by different development organization (Bhatta et al., 2014). Most of them are still under the piloting phase or not fully matured schemes. The ecosystem services identified for these schemes are also varied from drinking water to irrigation, and biodiversity conservation to sedimentation control. There is still debate going on whether Nepal should opt for a free-market based PES mechanism or “PES-like” mechanisms. Our study argue that market based PES schemes may not be feasible or contextual to Nepal, as also argued by many other scholars (Nepal et al., 2018; Rai et al., 2017; Wunder, 2015; Bhatta et al., 2014). We selected four PES like mechanism from different part of Nepal with specific to different ecosystem services.

Ecosystem service providers and Users: In all selected four cases, providers and users of particular ecosystem services are well defined. However, in some cases, some households are within both categories, which is possibly because of the internal migration and settlement culture. For example, people living in upstream area of Phewa and Nibuwakhola watershed also have their houses in the downstream side. Similarly, in Andherikhola watershed, seasonal migration within upstream and downstream is observed. Smallholders of this watershed have *bari* (unirrigated) land in upstream and *khet* (irrigated) land in downstream area. However, the amount agreed for the water use is determined by local community groups, and they involved in watershed conservation and restoration activities in upstream area. Indirect beneficiaries of the PES scheme are also observed. For example, purity and sanitation of Phewa Lake, not only provides direct services to hoteliers and businesspersons but also provide aesthetic, recreational services which increase land value to nearby settlements. In such cases, categorization of direct and indirect users is an alternative to avoid free riders of the ecosystem services.

Offsite services of the PES mechanism: Offsite services are clear in all the cases. As Wunder (2015) revealed that the ecosystem services cannot always be well defined, generation of offsite services are well assured on a priority basis. Tourism as an offsite service in Phewa Lake is the good example where environment friendly development and pollution control are offset services with the initiated PES mechanism. Similarly, sedimentation control in Mid- Marshyangdi has subsidiary effect in water quality and river flow control.

Table 1. Key PES attributes of selected study pilot sites.

<i>Components of PES</i>	<i>Phewa</i>	<i>Mid-Marshyangdi</i>	<i>Nibuwakhola</i>	<i>Andherikhola</i>
Voluntary transaction	Basket fund regulated by agreement between parties	PES fund and mobilization guideline through agreement	Conservation contribution embedded in water bill through prior agreement	Downstream communities do have willingness to contribute labors and resources. In the absence of institutional mechanism, it is not in practice yet.
Service users	Hotel owners, boatmen, fishermen	Marshyangdi hydropower promotion network	Water user committee, people of Dhankuta town	Irrigation committees, Agriculture cooperatives, hotel owners
Service providers	Communities in upstream	Marshyangdi Ecosystem service management network	Watershed community, Nibuwakhola sub-committee	Upstream communities of Adherikhola watershed.
Agreed rules of natural resource management	Sediment retention through landslide stabilization, multi-cropping, controlled grazing, rural green roads, terrace farming, gully control, siltation dam, bio-engineering programs, capacity building	Sediment retention, proper implementation of environment management plan of the hydropower, green belt along the road, application of sloping agricultural land technology, improved livestock farming, agro-based tourism, plantation in barren land	Watershed restoration through conservation plantation, conservation pond construction, green rural roads, road canal construction, slope stabilization, organic farming, landslide and erosion control, waste management, change in species composition that uptake less water, agroforestry promotion	Sustainable watershed management through upstream restoration, springshed protection. Reduced use of chemical fertilizer and pesticides in agriculture farms

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<i>Components of PES</i>	<i>Phewa</i>	<i>Mid-Marshyangdi</i>	<i>Nibuwakhola</i>	<i>Andherikhola</i>
Offsite services	Tourism (clean water in Phewa lake)	Hydropower production efficiency	Clean and abundant drinking water	Clean and reliable water supply for domestic and productive uses.
Intermediary (Supporting) organizations	Municipality, hotel associations, travel and tour operators, community groups, (I)NGOs,	District Coordination Committee, local NGOs, community groups,	District Coordination Committee Dhankuta Municipality, local NGOs	Mechanism as not been established yet. Potential organizations are District Coordination Committee, municipal government, (I)NGOs

Conditionality: Conditionality on the resource use plan and land use practices should be well mentioned in the Memorandum of Understanding (MoU) and agreements. Ecosystem services are not always determined by the human interventions but far more greatly by the natural phenomena (Shelley, 2011). Nepal, as a mountainous country, geo-morphological and hydrological characteristics of the region mostly determine rainfall intensity, soil erosion and mass wasting, which is beyond the control of upstream land owners (the producers of ecosystem services). The conditionality, is therefore, important in PES schemes which can be well reflected in MoU or any form of contextual agreement. In all of the case studies, such conditionality is mentioned in their contractual agreement, except in Adherikhola. However, a strong monitoring and compliance mechanism is poor, which sometimes create conflict between the parties.

Payment and transaction scheme: All cases do not follow the competitive market-based payment, as a reason, mostly regulated through subsidiary organizations and are not voluntary payment unlike Wunder (2005) described. Different payment schemes are adopted in all cases. For example, Phewa Lake scheme is regulated through a contribution from hoteliers and business houses around the Lake, with initial grant support from externally funded project. In Mid-Marshyangdi, payment mechanism is still not fully functional, and initial payment is done through externally funded project. In Nibuwakhola, payment from the service users is in the form of water bill. A certain percentage of water tariff is collected and contributed to upstream producers. The agreement is based on the committee of the representatives of both service users and service providers with the intermediation of governmental and non-governmental organizations. However, strong basis for such payment is discussed among stakeholders for sustainability of PES scheme (Bhatta et al., 2014).

Ecosystem services: At least one identified ecosystem service is fundamental for the sustainability of PES mechanism, where users are willing to pay for that particular service (Porras, 2008; Wunder. 2005). In all cases, ecosystem service is well identified. In Nibuwakhola and Adherikhola, drinking water, both quality and quantity, is identified as ecosystem services, whereas sedimentation control for hydropower plant is identified in Mid-Marshyangdi. In Phewa Lake, multiple services are discussed, including sediment control in the Lake.

Existing institutional arrangement: Nepal lacks concrete policy and legislative instrument on PES, however, is mentioned in number of public policies, including forest policy. Majority of the PES-like schemes are managed under locally created institutions, taking all stakeholders on board. For example, local municipal authority formed a 21 member committee to oversee and manage Nibuwakhola watershed, where PES is part of the watershed management. In Phewa Lake, a multistakeholders' committee is formed under the chair of municipal government, representing all stakeholders on board. In Mid-Marshyangdi, the committee formed at local level to oversee PES mechanism, but is not effectively functional.

Subsidiaries and external support: Local municipal governments are acting as subsidiary organizations in all cases, whereas number of external agencies and projects are supporting these PES-like schemes. The initial grant support from WWF Nepal/Hariyo ban programme in Phewa Lake, and Mid-Marshyangdi helped to accelerate these innovations. Similarly, International Centre for Integrated Mountain Development (ICIMOD) supported other two cases, in close collaboration with local government. Our study suggests that local government, if acts as a subsidiary to the PES or PES-like mechanism, these schemes are effectively managed.

4. Discussion

4.1. Theoretical framework for institutional arrangement

There are two popular approaches of conceptualizing the institutions related to common pool resources like watershed, namely: new institutional economics (NIE) and common pool resource (CPR) (Basnet, 2007). The NIE group views institutions as rules and regulations imposing constraints on human behavior to facilitate collective action by minimizing transaction costs and uncertainty (North, 1994). The second approach, CPR, has recognized the role and importance of local institutions in determining human behavior (Poudel, 2008 cited in Neupane, 2011). Local norms influence managing and controlling common resources because these local norms facilitate and constrain the action of humans and their property rights (Agrawal, 2003). Once people realize their dependence on the CPR, they create their own institutional arrangements that help them to allocate and distribute the resources and benefits equitably (Poudel, 2008 cited in Neupane, 2011). They also manage it in a sustainable way for long time period with only a limited loss in efficiency (Agrawal, 2001). Ostrom et al. (1994) and Ostrom (1990) have argued that by devising their own rules-in-use, those who are depending on CPR overcome the tragedy of the commons. However, Saleth and Dinar (2005) have given a more comprehensive definition of water institutions that combines both CPR and NIE thoughts. They defined institution as rules that together describe action situations, delineate action sets, provide incentives and determine outcomes both in individual and collective decisions related to water resource development, allocation, use and management. According to them, institution like watershed managing institutions are also subjective, path dependent, hierarchical and nested both structurally and spatially as well as embedded within the cultural, social, economic and political context like other institutions.

To function an institution, it requires huge transaction costs in terms of monetary and non-monetary transactions. If allocation and use of resources with a delineation of a given institution can generate sufficient transaction costs, then institution tend to transform into formal from informal mode (Neupane, 2011), which is prominent in most of the organization related to Community

Forestry, Farmers Managed Irrigation System and Water Users Committee in Nepal. If the allocation and use of resource cannot generate sufficient fund, in such situation institution tend to remain in informal mode minimizing the transaction cost for operationalizing institution like the case of Upstream-Downstream Committee of Andherikhola sub watershed of Sindhuli (Nepal et al., 2017).

Various formal and informal institutional set up, legal and procedural agreement and arrangement is crucial in establishing and functioning PES mechanisms (Paudyal et al., 2018), as PES mechanism cannot work in a vacuum (Fauzi and Anna, 2013). Government of Nepal legalized four typologies of environmental services through second amendment to the Forest Act 1993, namely: services that are derived from carbon sequestration, biodiversity conservation, hydrological cycle, and ecotourism. Other various environment related legislations are indirectly supporting incentives for generating ecosystem services. However, no specific policy and guideline have been prepared for institutionalization of PES mechanism at the national level (Bhatta et al., 2018).

A common institutional framework of the PES schemes is conceptualized in all four watersheds (Figure 2). However, the monitoring and compliance mechanisms differ and locally contextualized. Since the initiations of these PES pilot sites, a substantial changes and modifications are observed, both in terms of payment and compliance mechanism.

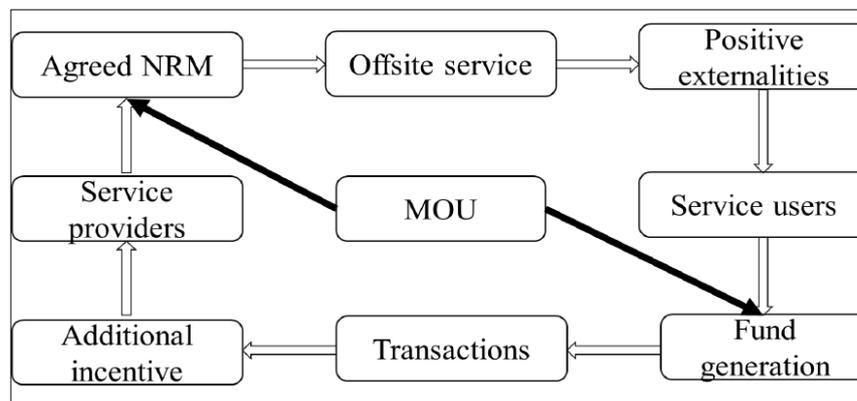


Figure 2. Common framework for PES institutional arrangement (Adapted from Bhatta et al., 2018).

MoU and/or agreement is the formal guiding document for PES implementation. Various stakeholders are involved in finalizing the agreement and its monitoring. In case of Phewa watershed, Phewa Watershed Ecosystem Management Board, under the chairmanship of Mayor of Pokhara metropolitan city, is the supreme organization to regulate the PES pilot programs. Under the board, management committee, implementation committee, monitoring and evaluation committee, and user committee have been formed for planning, managing and monitoring of the PES program and activities. Likewise, District Technical Management Committee, under the chairmanship of District Coordination Committee, is acting as a mediator for regulating the MoU between service users and service providers in Mid-Marshyangdi watershed. Moreover, in Mid-Marsyangdi watershed, District Technical Management Committee is playing the mediators' role between Marshyangdi Hydropower Promoter's Network and local communities. In the case of Nibuwakhola watershed, a tripartite agreement was made among Dhankuta Municipality, Dhankuta Drinking Water Management Committee and Joint committee formed of people from two upstream watershed area. Dhankuta municipality is taking the front responsibility to regulate and sustain the PES mechanism and the municipal council has already approved the PES

program in their regular program planning. Likewise, in the case of Andherikhola, watershed community group is the main institution for PES implementation.

In all the four sites, government agencies (such as forest office, soil and watershed management office, and agricultural development offices) are acting as subsidiary organization for facilitation and technical support. This study suggests that leadership from local government is crucial for sustaining PES mechanism. Nevertheless, participation, mutual understanding, and negotiation between service providers and service users is the fundamental in PES success.

4.2. Implications for common property resource management

Integrated management of land, water and vegetation for watershed restoration as well as to fulfill resource demand of watershed dwellers are the major resource management objectives (Bremer et al., 2018). In doing so, watershed management objective of soil conservation, such as in-situ moisture conservation and water harvesting can be well achieved (Reddy et al., 2017), together with clean and controlled water flow (Khanna et al., 2016). In Phewa Lake, upstream agriculture practices are major source of sedimentation in the Lake, as a reason, changing upstream agriculture practices can control sedimentation, which helps in water quality improvement. Due to this reason, upstream communities need to be incentivized through PES mechanism, for the sustainable supply of water and its quality. Similarly, sedimentation control in Mid-Marshyangdi positively impact on hydropower, and reduce the costs of operation. Haphazard road construction in upstream of Nibuwakhola watershed is considered as major source of sediment load in downstream water reservoir, whereas, use of pesticides and chemical fertilizer causing water quality poor. If upstream communities are well incentivized through PES schemes, upstream landuse management activities can be modified which not only reduce sedimentation, but also supply good quality water. This study suggests that multiple benefits can be achieved, both at upstream and downstream, if proper land use management activities are applied, and rural roads are constructed with minimum damage.

PES at watershed level often correlates with the demand of clean and abundant water, soil conservation and sedimentation retention. Whether the offsite service of the PES is sediment retention, tourism promotion, hydropower production or abundant clean water availability, all the positive externalities are achievable with the resource management objectives of watershed. Voluntary transaction which is conditional upon the agreed norms of resource management would influence the landowners to act accordingly to gain performance-based incentives through PES (Dillaha et al., 2008). The issue of performance based incentives, however, is still not well discussed in all cases because of the lack of strong monitoring and compliance mechanism. A strong monitoring and compliance, is therefore needed for the sustainability of PES schemes in Nepal.

4.3. Potential of decentralized socio-economic development

Watershed management programs fulfil the socio-economic objectives of not only the downstream people but also the upstream landowners. The problem is for both, sedimentation and water pollution to the downstream and loss of top soil and decrease of land fertility in the upstream side. Hence, well established PES is a win-win situation catering ecological, social and economic benefits to service users and providers (Nepal et al., 2017; de Groot et al., 2010). For example, replacement of seasonal cropping in the upstream of Phewa watershed by multiyear vegetative

practices has helped in reducing the rate of sedimentation to the downstream, while this is evidence that controlled top soil loss in upstream increases production. In most of the developing countries, PES mechanisms are, to some extent, aligned with the compensation and rewards for the upstream dwellers for proper land use practices (Rai et al., 2018; Van Noordwijk et al., 2007). Evidences from our case studies also suggest that upstream communities in Nibuwakhola and Phewa Lake are already changing their traditional agriculture practices, and reducing use of chemical fertilizer and pesticides since the PES schemes were initiated.

Proper watershed management reduces the vulnerability of upstream people by diversifying livelihood options in the upstream (Engel et al., 2008) and reduced incidence of water and climate induced disasters in the foothills of watershed (Nepal et al., 2017). This study also revealed diversifying livelihood options which are well aligned with socio-economic objectives of watershed management (Bhatta et al., 2018).

4.4. Possible institutional and monitoring mechanism

Functional participation of both service providers and service users as well as intermediaries is crucial in institutionalizing PES. Due to the lack of confidence and maturity of the PES mechanism, both service providers and service users tend to believe in the mediation of local authority. Involvement of local government in all the four cases is found positive in the implementation of PES programs. Initiation of the local governments is considered as a milestone for sustainability of the PES mechanism (Bhatta et al., 2018; Rai et al., 2018), which is well aligned with the constitutional provision of Nepal.

The level of participation of the upstream people in the PES mechanism is found positive in all cases, however, there is still a tendency of free ride downstream, as Mishra et al. (2017) also highlighted on voluntary transaction as major challenge. The challenge of voluntary transaction is well noticed in and around Phewa Lake, where communication and networking among the hotel owners is found difficult to establish. This is also because of the nature of people who enjoy the offsite services at free of cost, and they need to be convinced for providing additional incentives to the upstream dwellers.

Effective monitoring of the impact of watershed conservation and management interventions at upstream level on watershed services helps to motivate in financing PES directly (Namirembe and Bernard, 2018). Developing simple and low cost technologies for monitoring (van Noordwijk M et al., 2013), and involving local communities both from upstream and downstream is found effective for long term sustainability of watershed services and its financing. A monitoring committee composed of representative of service provider, service users and other stakeholders in the Dhankuta municipality to facilitate and support fund disbursement and monitoring activities can be good initiation for effective monitoring and compliance (Bhatta et al., 2018). However, major challenges such as transaction cost and monitoring cost (Fauzi and Anna, 2013), time lags (Lusiana et al., 2008) and scale of interventions (Leimona et al., 2015) could question long term sustainability of PES mechanisms. Figure 3 is proposed institutional and monitoring mechanism for PES in watershed area, which nonetheless, need to be contextualized and should be taken as guiding arrangement.

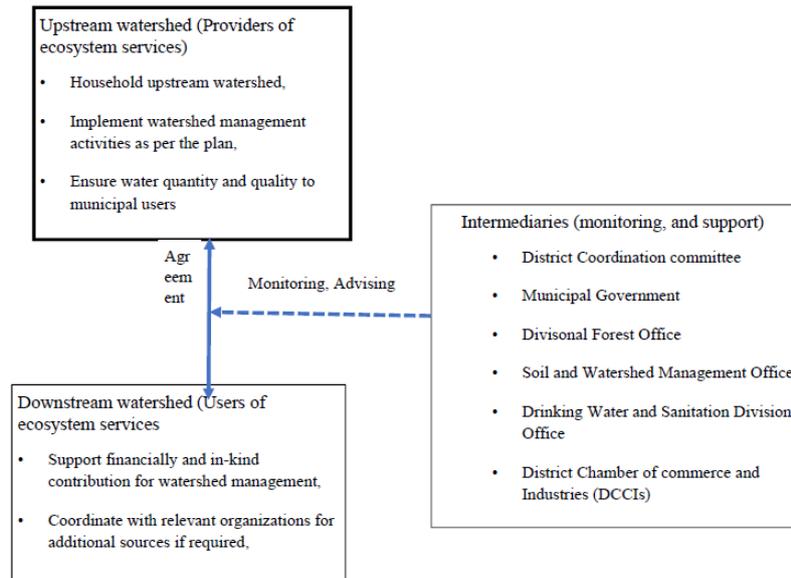


Figure 3. Possible institutional set up for PES mechanism.

5. Conclusion

Declining water source and its availability in Nepal has become serious issue in recent years. As a reason, management of watershed is critical to ensure sustainable source of water availability contributing to community livelihood and ecosystem health. The dependency primarily on public funds to manage watersheds appeals discussion for various self-sustaining institutional and financing mechanism. Payment for ecosystem services is becoming a dominant discourse in financing watershed management in recent years. This study found that PES is a promising approach for financing watershed management, if implemented in close collaboration with local government in Nepal. This study also found that institutional arrangement for PES has already initiated in Phewa, Mid-Marshyangdi and Nibuwakhola watersheds whereas Andherikhola watershed is still to go such arrangement. In order to sustain watershed services, linking upstream to downstream communities is crucial. The willingness to pay in all four cases for upstream management is a positive sign and indication for successful PES mechanism in a long run. However, there is a need of concrete policy and legal instrument to streamline PES mechanism in development plans and programmes, as all these four schemes are operational with some innovative funds supported externally. There is a need of systematic analysis of services generated monetary value derived from watershed services, which help to convince local government and policy makers, to streamline this approach in their local plans and programmes.

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Conflict of interests

The Authors declare no conflict of interest.

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