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Case Report

Payment for Ecosystem Services in Nepal: A Literature Review on Overview and Recommendations for Further Research

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Abstract

The term "Ecosystem Services" was coined to indicate "all the multiple benefits humans obtain from 'natural capital' (i.e. the world's stock of natural assets-geology, soil, air, water-including living things and beings)" that make human life possible, such as natural water purification, flood control by wetlands, and others. When applying the context of PES programs, many adjustments need to be considered to make it more fruitful and effective. For the proper management of the watershed and its alarming cause of deterioration, understanding upstream and downstream linkages or process is must. Deforestation leads to climate change (temperature and precipitation) and watershed deterioration, which has become the aggravating factor for landslide and soil erosion in upstream and flood in the downstream. It was found that the most promising opportunities are likely to be those PES schemes that generate multiple benefits, including climate change adaptation mechanism especially in the developing countries. Thus, finally it proves that PES are market-based mechanisms that are designed to provide incentives to the owners of natural resources to increase the provision of ecosystem services upon which our society depends. Lastly, the policy makers, researchers as well as the practitioners should be well aware about the PES and its using mechanism.

Keywords: Upstream; Downstream; Deforestation; Climate Change; Practitioners

Introduction

Human well-being is linked with the ecosystem (i.e. cropland ecosystem) [1,2]. Payment for environmental/ecosystem services, or PES, programs exist in many countries around the world. Land management practices may result in both positive and negative impacts on environmental services (ES) [3,4]. For example, if upstream communities clear the forests, there may be a considerable increase in the soil erosion. This in turn may have many consequences downstream, affecting irrigation infrastructures, flood risk, siltation, river navigability and fish reproduction and productivity [4].

PES is a voluntary transaction where a well-defined ecosystem service is bought from the ecosystem services provider by a buyer and assures service provision for those who are willing to pay for the service [5]. These days, several developing countries have launched the programs of payments for environmental services which have emerged as major components of sustainable development policies in these countries. However, the implications of PES programs for the rural poor, the optimal design of programs to contribute to economic development, and how these initiatives integrate into international treaties to address global warming and biodiversity loss, are still not clear [6].

Hundreds of PES schemes have been and are being implemented around the world, covering a variety of ecosystem services. Many governments have implemented the programs of PES. For example- the Chinese government has implemented a number of land-use conversion programs that provide environmental services to relevant stakeholders. Eco-compensation or payments for ecosystem services have been seen exponential growth in academic articles.

The ecosystem degradation is causing decline in ecosystem condition and widespread biodiversity loss, leading to reduced provision of ecosystem services [7-9], and may cause the irrevocable loss of ecosystem functions such as soil and soil moisture retention, regulation of water flows, and regulation of carbon and nitrogen cycles [10,11].

According to Huang., *et al*. [12], the global environmental change, including climate change, spread of invasive species, and increased pollution, could strongly affect the ability to restore this ecosystem. The ecosystem services approach clearly has great potential. Indeed, it is a natural extension of the market-based carbon tax or cap-and-trade approaches now being implemented to curb carbon emissions, in that it tackles environmental externalities historically ignored by the global economy.

The social system in the context of PES is characterized through the interaction between Ecosystem Service (ES) buyers, ES providers, intermediaries, and non-participants of the scheme and the institutional arrangements in which they take place [13]. This PES concept has received to provide incentives for local actors for sustained supply of ecosystem services and adoption of sustainable management practices. Growing scarcity of ecosystem services and less interest in conservation led to a flurry of conservation innovations over the past decade in the form of payment schemes [5]. Ecosystems provide numerous goods and services that can maintain sustainable livelihoods [4].

PES scheme includes five basic components: well-defined environmental services, at least one buyer, at least one environmental service in the transaction, at least one service provider, and conditionality [5]. Ecosystem services consist of flows of materials, energy, and information from natural capital stocks which combine with manufactured and human capital services to produce human welfare [14].

PES is fairly a new concept for us, so developing countries like Nepal encounter several implementation barriers and challenges. Ecosystem services are the benefits nature provides that contribute to human wellbeing [14]. Developing countries are potentially important suppliers of global ES, as they may be low-cost producers of the service or a unique source of the services which are location specific. The development of payment schemes for the provision of local-level ES could also be an important contributor to economic development. The impacts of the payments on employment and incomes are likely to be important here too, but in addition there could be significant economic development benefits associated with the ES itself [15].

In the arid and semiarid area, evaluation of ecosystem service change caused by ecological protected projects implementation needs to take into account complex surface change. The reason is that maybe more net radiation is absorbed by the restoration vegetation [16]. Furthermore, PES should also be aimed at reducing poverty; how that could be implemented has been the subject of heated discussion [17,18]. This paper, thus, attempts to review the contribution of ecosystem services to climate change mitigation and adaptation as well as the watershed management in Nepal. This paper also tries to attract the interest of policy makers, researchers and other practitioners who can develop effective mechanisms to incorporate ecosystem services issues into the natural resource management, especially focusing in the developing countries like Nepal.

PES and Water/watershed

There are several reasons for focusing on Payment for Water Services (PWS) in particular. First, water services are involved in the large majority of current PES schemes. Second, the water cycle provides a good fit to what can be called an ecosystem services approach as emerged from the Millennium Ecosystem Assessment (MA) [19], it forms a good context for expressing the effects. Water conservation service, as one of the most important terrestrial ecosystem services, is a comprehensive feature of ecological function by water, soil, and vegetation interactions [20].

Linkages between forests and water is evident within the watershed context [21]. Forests play an important role in the hydrological cycle, contribute in reduction of disaster risks and provide an array of ecosystem services including provision of fuelwood, timber etc., regulation of water quality and flow, carbon sequestration, reducing erosion and supporting a wide array of flora and fauna [22,23]. Development organizations are increasingly using such schemes as a tool to promote the twin goals of conservation and development. One of the largest peat bog formations in Romania plays an important role in supporting natural carbon sequestration, and mitigating climate change [24].

For example- a study conducted by Khatri [25], in the Kulekhani Watershed shows that the concept of PES had been introduced in Nepal in 2003 as a pilot project of the World Agroforestry Centre to compensate and reward upstream community of that Kulekhani watershed. He further stated that the main aim of the PES scheme

Number	Ecosystem service	Ecosystem functions	Examples
1	Gas regulation	Regulation of atmospheric chemical composition.	CO_2/O_2 balance, O_3 for UVB protection, and SOx levels
2	Climate regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global or local levels.	Greenhouse gas regulation, DMS production affecting cloud formation.
3	Disturbance regulation	Capacitance, damping and integrity of ecosystem response to environmental fluctuations.	Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure.
4	Water regulation	Regulation of hydrological flows	Provisioning of water for agricultural (such as irrigation) or industrial (such as milling) processes or transportation.
5	Water supply	Storage and retention of water.	Provisioning of water by watersheds, reservoirs and aquifers.
6	Erosion control and sediment retention	Retention of soil within an ecosystem.	Prevention of loss of soil by wind, runoff, or other removal processes, storage of stilt in lakes and wetlands.
7	Soil formation	Soil formation processes.	Weathering of rock and the accumulation of organic material.
8	Nutrient cycling	Storage, internal cycling, processing and acquisition of nutrients.	Nitrogen fixation, N, P and other elemental or nutrient cycles.
9	Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds.	Waste treatment, pollution control, detoxification
10	Pollination	Movement of floral gametes.	Provisioning of pollinators for the reproduction of plant populations.
11	Biological control	Trophic-dynamic regulations of populations.	Keystone predator control of prey species, reduction of herbivory by top predators.
12	Refugia	Habitat for resident and transient populations	Nurseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds
13	Food production	That portion of gross primary production extractable as food.	Production of fish, game, crops, nuts, fruits by hunting, gathering, subsistence farming or fishing.
14	Raw materials	That portion of gross primary production extractable as raw materials.	The production of lumber, fuel or fodder.
15	Genetic resources	Sources of unique biological materials and products.	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants).
16	Recreation	Providing opportunities for recreational activities	Eco-tourism, sport fishing, and other outdoor recreational activities.
17	Cultural	Providing opportunities for non-commercial uses.	Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems.

Table 1: Different ecosystem services and functions.

was to support the livelihoods of upstream communities for ensuring forest conservation and reducing sedimentation in the Kulekhani reservoir.

PES and Climate Change

Since its introduction in the 1970s (SCEP, 1970), this concept has continued to expand, and nowadays includes socio-economic

and conservation objectives, and has been further popularized by the Millennium Ecosystem Assessment (MEA) in the early 2000s [19], as well as by the "Paris Agreement" reached at the 2015 UN Conference on Climate change (COP21), recognizing ESs roles in mitigating climate change [26]. Considering PES in the context of adaptation to climate change is important for a number of reasons [13]. The loss of forest may also lead to drying out of the climate and increasing forest fires that threaten forest remnants [27].

Anthropogenic climate change is a threat to both ecological and economic sustainability [28,29], but the loss of other ecosystem services may pose dire threats to the economy without threatening a dramatic reconfiguration of global ecosystems [30]. Rural mountain communities in developing countries are considered particularly vulnerable to environmental change, including climate change. Potentially critical global ecological thresholds include climate change, biodiversity loss, and deforestation. As long as greenhouse gasses are emitted into the atmosphere faster than they can be absorbed by ecosystems, atmospheric stocks will accumulate, likely exacerbating climate change.

For example- A case study conducted by [31], shows that it is important that landowners benefit from hydro-electricity plants to ensure the continued conservation of water catchment areas. The linkage between water, renewable energy and climate change mitigation and adaptation is high on the global agenda. South Africa's situation looks grim with respect to its contributions to climate change while not even meeting the energy needs of its population.

As biodiversity conservation, carbon sequestration, and watershed protection benefits are experienced off-site, landholders will not normally take them into account when deciding which practices to adopt [32]. Silvopastoral practices also help mitigate climate change by fixing significant amounts of carbon in the soil and in the standing tree biomass [33,34].

Most rural communities in developing nations are endowed with forests, agro-ecosystems, and water resources and the large array of ecosystem goods and services (EGS) they provide. According to the World Bank, 1.6 billion people depend on the EGS derived from forests for their livelihoods [35].

Case Study I

This is a case study was taken from conducted by Rai., *et al.* [36], and published in SANDEE Working Paper No.: 88 - 14 and cited by Paudel and Basnet, 2018 in FORESTRY-Journal of Institute of Forestry, Npeal Issue No. 15, July 2018. This research was conducted in the Koshi Basin of Eastern Nepal. In this paper, a choice experiment was conducted to examine differences in demand for local environmental services among downstream and upstream watershed users. The question of this study is whether the demand for these local services and sustain any investments that may be required. To address this concern, researchers have used non-market valuation techniques and use this information to derive social benefits from conserving local environmental services. It even highlighted the difference in preferences for watershed services. It even highlighted the difference in preferences for watershed management are 1.4 to 2.2 times higher when estimated in labor terms versus monetary terms. This study suggested that locational differences matter. Down-stream community members, who practice commercial vegetable farming, have a higher demand for watershed services and are willing to pay a third more than upstream farmers for these services. This case study inferred that downstream communities are willing to pay for conservation or management of upstream of watersheds to get sustainable ecosystem services, this clearly indicates that upstream and downstream ecological and hydrological functions should be understood clearly if we are working for the Churia-Terai.

Case Study II

This is another case study presented here with title- LOS NEGROS: where participation and change are ensuring buy-in. This research was conducted by Poudyal [37]. In Los Negros, Bolivia, a PES-type scheme was introduced in response to the practices of poor, upstream farmers chopping down trees and cows entering streambeds, resulting in the pollution and silting up of downstream water sources. Under the scheme, downstream water users pay for water while upstream farmers receive noncash incentives, such as beehives, tree seedlings and barbed wire fencing, in return for controlling their cattle. The scheme involved the municipal authorities and local leaders from the start and was implemented by a local non-governmental organization (NGO), Fundación Natura Bolivia.

It now covers over 4,000 families, protecting more than 200,000 hectares of forest, and the municipal authorities are taking on an ever-greater implementation role. The scheme's decentralized design and its focus on changing behavior and practices have been offered as explanations for its success.

Conclusion

Future research and policy implications

The growing policy interest in PES schemes goes hand in hand with increasing attention in the scientific and policy oriented literature. Government of Nepal, Ministry of Forest and Soil Conservation is formulating a policy on Payment for Ecosystem. In the Sustainable Landscapes component, the Program supported efforts to promote several types of payments for ecosystem services (PES), innovative ways to promote conservation and sound development through payments for services that ecosystems provide [38].

PES is often promoted as a mechanism that can potentially provide both alleviate poverty and provide ecosystem services. PES schemes are also receiving criticism, specially related to institutional and political economy issues.

Some authors have recently raised the concern that PES schemes could turn nature into a commodity and modify the way humans perceive and relate to it, which could be countered productive for conservation purposes in the long run [39-41].

PES is not a silver bullet that can be used to address any environmental problem, but a tool tailored to address a specific set of problems: those in which ecosystems are mismanaged because many of their benefits are externalities from the perspective of ecosystem managers. PES is based on the beneficiary-pays rather than the polluter-pays principle, and as such is attractive in settings where ES providers are poor, marginalized landholders or powerful groups of actors [42]. Much more attention should be given to elaborating theories of change that would allow a more comprehensive understanding of why and how policies are effective or not.

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