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Proceedings of the National Workshop on

Payment for Ecosystem Services: Opportunities and Challenges in Nepal

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About ICIMOD

The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalayas – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.

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Internal Report

Proceedings of the National Workshop on

Payment for Ecosystem Services: Opportunities and Challenges in Nepal

18–19 September 2014, Kathmandu, Nepal

Organized by
Ministry of Forest and Soil Conservation, ICIMOD, WWF, and IUCN

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Report preparation team
Laxmi Dutt Bhatta, Anju Pandit, Ugan Manandhar

Production team
Amy Sellmyer (Editor); Dharma R Maharjan (Layout and design); Asha Kaji Thaku (Editorial assistant)

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Acronyms and Abbreviations

AIT	Asian Institute of Technology
ANSAB	Asia Network for Sustainable Agriculture and Bio-resources
CICERO	Center for International Climate and Environmental Research-Oslo
CFUG	Community Forestry User Group
CN	Curve Number
CV	Contingent valuation
DADO	District Agriculture Development Office
DCE	Discrete Choice Experiment
DDC	District Development Committee
DEM	Digital Elevation Model
DFO	District Forest Office
DG	Director General
DNPWC	Department of National Parks and Wildlife Conservation
DSC	Department of Soil Conservation
DSCO	District Soil Conservation Office
DSCWM	Department of Soil Conservation and Watershed Management
DSS	Data Storage System
ES	Ecosystem Services
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
FNCCI	Federation of Nepalese Chamber of Commerce and Industry
FYM	Farm Yard Manure
HICAP	Himalayan Climate Change Adaptation Programme
ICEM	International Centre for Environmental Management
ICIMOD	International Centre for Integrated Mountain Development
IEE	Initial Environmental Evaluation
IUCN	International Union for Conservation of Nature
InVEST	Integrated Valuation of Ecosystem Services and Trade off
JICA	Japan International Cooperation Agency
KMC	Kathmandu Municipal Corporations
KUKL	Kathmandu Upatyaka Khanepani Limited
MC	Master of Ceremony
MEA	Millennium Ecosystem Assessment
MoFSC	Ministry of Forest and Soil Conservation
MOAD	Ministry of Agricultural Development
MSFP	Multi Stakeholder Forestry Project
MoU	Memorandum of Understanding
NEA	Nepal Electricity Authority
NSE	Nash-Sutcliffe efficiency
NGO	Non-Governmental Organization
NPR	Nepali Rupees
NTFP	Non Timber Forest Product
NRCS	Natural Resources Conservation Service
PA	Protected Area
PES	Payment for Ecosystem Services
REDD+	Reducing Emissions from Deforestation and (forest) Degradation
SALT	Sloping Agriculture Land Technology
SANDEE	South Asian Network for Development and Environment Economics
SNNP	Shivapuri-Nagarjun National Park
SOTER	Soil Information from Soil and Terrain
SRTM	Shuttle Radar Topography Mission
SWAT	Soil and Water Assessment Tool
TEV	Total Economic Value
TU	Tribhuvan University
UNEP	United Nation Environment Program
USAID	United States Agency for International Development
VDC	Village Development Committee
WTA	Willingness to Accept
WTP	Willingness to Pay
WWF	World Wide Fund for Nature

Executive Summary

Well-functioning ecosystems provide reliable and clean flows of water, productive soil, relatively predictable weather, and many other services essential for human wellbeing. People, companies, and societies rely on these services for raw material inputs, production processes, and climate stability. In late 1990s, a group of ecologists and economists began a collaborative effort to assign value to nature's services. The term 'ecosystem services' came into widespread use in the ensuing dialogue and, formalizing the term in a 1997 publication, the Ecological Society of America explained that the term ecosystem services "refers to a wide range of conditions and processes through which natural ecosystems, and the species that are part of them, help sustain and fulfill human life." In short, they are the benefits that people obtain from ecosystems. The Millennium Ecosystem Assessment, a multi-stakeholder study carried out under the direction of the United Nations from 2001 to 2005, categorized these services into provisioning services, regulating services, cultural services, and supporting services.

Global environmental changes, together with drivers of change, are impacting almost all types of ecosystems and their ability to provide ecosystem services. While environmental protection is vital, finance is another fundamental problem facing conservation, especially with respect to the vast amount of the planet's biodiversity that lies outside of protected areas. Payments for Ecosystem Services (PES) can serve as an incentive for land users to properly manage and conserve their natural environment, thus ensuring the flow of ecosystem services (Pagiola and Platiais, 2002).

Recognizing the strong need for an umbrella legislative instrument to ensure both vertical and horizontal coordination for managing ecosystem services on a larger scale, the Ministry of Forest and Soil Conservation (MoFSC) of Nepal, in collaboration with ICIMOD, WWF and IUCN, convened a 'National Workshop on Payment for Ecosystem Services: Opportunities and Challenges'. The workshop, which was held from 18—19 September 2014 at Hotel Shankar, Kathmandu, brought together national experts, professionals and decision makers to discuss and come up with concrete recommendations on various facets of payment for ecosystem services (PES) in Nepal. It was a remarkable workshop both in terms of the number of papers presented on diverse issues of PES and the diversity of participants. There were 74 participants from various sectors and 12 presentations on topics related to the PES policy, assessment and action. The papers and the following discussions helped participants assess their existing efforts and gain better understanding of PES to further Nepal's PES policy formulation process. Rameshwor Khanal, President of Rastrapati Chure Tarai Samrakshyan Sameeti, had inaugurated the workshop and chaired the first session. Representatives of various departments, line agencies, and I/NGOs, development partners, experts, practitioners, academics, research students, private sector stakeholders and journalists actively participated in the workshop.

The workshop was organized to fulfill the specific objectives of sharing evidence-based knowledge on PES from different sectors and deliberate on issues related to PES for conducive policy options and planning. It sought to identify major opportunities and challenges in the implementation of PES in Nepal, and suggest potential research options and priorities on PES. The workshop also aimed to explore possible partnership and collaboration on PES implementation in Nepal.

The workshop was divided into three parts i) opening and inauguration, ii) technical presentation, and iii) panel discussion on PES. The technical presentation, followed by extensive discussion, covered many important topics on PES policy status, assessment, and case studies. The important issues discussed were:

- Ecosystem conservation and development earning are the twin objectives of PES.
- Amid growing realization about the need for ecosystem conservation and participatory biodiversity management and conservation, concrete application of PES has a long way to go.
- Payment is always a difficult issue, so clear communication and proper linkage between service provider and buyer/ upstream downstream community is key to success.

- Concretization and synchronization of various ongoing pilots is necessary to enhance the opportunities and tackle the challenges for PES policy formulation.
- Solo efforts are not adequate, and there is a strong need for multilateral collaboration among the stakeholders.
- The role of private sector and local institution needs to be clarified in the policy.
- A private sector representative proposed a one-window paying mechanism, citing the lack of understanding and bargaining business.
- All the stakeholders and participants agreed on the need for a guiding policy and institutional framework in the sector of PES.

Introduction

Background

Ecosystems provide a number of goods and services for human wellbeing. However, global environmental changes, together with drivers of change, are affecting ecosystems' ability to provide ecosystem services (ES). Over the years, ES have been degraded considerably at both local and global levels (MEA, 2005), impacting all ecosystems (ICIMOD, 2010). The change in land use and land management practices may result in both positive and negative impacts. For example, if upstream communities clear forests, there may be a considerable increase in soil erosion, which 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, this may positively influence downstream water availability during the dry season (Ojha et al., 2009). In other words, changes in the livelihood practices of the uphill farmers, either reducing dependency on natural resources or improving management practices of upstream ecosystem, would make downstream residents better off.

In recent years, many scholars (Merlo & Briales, 2000; Cubbage et al., 2007;) have described the progress of environmental policies in order to achieve multifunctional objectives of ecosystem management. Payment for ecosystem services (PES) is one of those mechanisms that are increasingly and typically used to sustain ecosystem services. 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).

Nepal has significantly achieved its conservation objectives through various community-based management approaches. Nepal's community forestry programme is well acknowledged in the global conservation arena for enhancing governance and livelihood options for rural communities. However, the approach is insufficient if we consider the ecosystem services that they provide. While PES is managed independently on a case-by-case basis, there is a need for a strong PES umbrella legislative instrument to ensure both vertical and horizontal coordination for managing ecosystem services on a larger scale. Therefore, in mountainous and forest-rich Nepal, PES could be a promising mechanism to ensure decentralized ecosystem financing and local conservation initiatives.

In this context, a two-day national workshop on 'Payment for Ecosystem Services: Opportunities and Challenges in Nepal' was organized at Shankar Hotel, Kathmandu on 18—19 September. The workshop aimed to bring PES experts, professionals and policy makers on one platform to discuss the effectiveness of PES and to support PES policy formulation in Nepal.

Objectives of the Workshop

The national consultative workshop on '*Payment for Ecosystem Services: Opportunities and Challenges, in Nepal*' aims to bring together selected national experts, professionals and decision makers in order to discuss and come up with concrete recommendations on various facets of PES in Nepal. This will help Nepal, a regional member country of ICIMOD, to assess the country's existing efforts and provide better understanding on PES for further planning.

The specific objectives were to:

- Share evidence-based knowledge on PES from different sectors, and deliberate the issues related to PES for conducive policy options and planning
- Identify major opportunities and challenges in implementation of PES in Nepal, thereby, suggesting potential research options and priorities on PES.
- Explore possible partnership and collaboration on PES implementation in Nepal.
- Expected outcomes
- Existing knowledge and best practices on PES in Nepal documented (impact: for better policy options): At least 5 key research based technical papers presented
- Priorities for research options and priorities on PES identified (impact: Nepal policy documents)
- Possible collaboration and networking on PES strengthened (impact: knowledge sharing, common understanding).

Inaugural Session

Introductory Remarks

Welcome remarks: Dr Pem Kandel, Director General, DSCWM

Inaugural remarks: Dr Yam Bahadur Malla, Country Representative, IUCN

Keynote speech: Santosh Mani Nepal, WWF

Message: Dr Eklabya Sharma, Director of Programme Operations, ICIMOD

Inaugural speech: Rameshwor Khanal, Chief Guest

Closing remarks: Sharad Chandra Paudel, Secretary, MoFSC

MC: Aayushma Duwa

Rapporteurs: Anju Pandit, Deepa Basnet

Summary

The inauguration was attended by a total of 74 participants, including experts, representatives of various line ministries and departments, development organizations, practitioners, academics, research students, journalists, grassroots organizations, private sector stakeholders and supporting staff. The workshop was inaugurated by session Chair Rameshwor Khanal. In his welcome speech, Prem Kandel, Director General of DSCWM, focused on the necessity of addressing the upstream downstream linkage in PES. He said that the workshop would focus on both opportunities and challenges for PES in Nepal.

In his inaugural remarks, Dr Yam Bahadur Malla, country representative for IUCN, said that PES is being transformed as a major solution to environmental degradation but has not been possible to come with a proper mechanism. He emphasized the need for a policy mechanism to regulate and address the market failure. Dr Malla assured that IUCN would contribute what is needed for PES in the days to come.

Santosh Nepal, Senior Director of WWF Nepal, highlighted the importance of bringing and involving the leading development partners and government on a single platform. He drew attention to work related to sustainability of ecosystem services and said this is a major concern for sustaining the population in the Himalayas.

Dr Eklabya Sharma, Director of Programme Operations, ICIMOD, stressed the role of mountain as storehouse of ecosystem goods and services and called on the participants to join hands for putting mountain agendas together. He said there is a need to rethink proper mechanism of PES and underscored the prospect of provisioning projects in the mountains for the benefit of local communities. Dr Sharma emphasized the need for a proper payment mechanism, framework and appropriate policy to address the PES issues in Nepal.

Rameshwor Khanal, President of Rastrapati Chure Tarai Samrakshyan Sameeti, said that PES sounds good in theory but practical implementation is yet to be channelized. Demarcating PES with the 'polluters pay' principle and presenting numerous examples of hindrances in the payment issues from within and around the region, he reiterated the need for a well-defined payment mechanism. He advised the government to come up with a taxation system and the stakeholders to make collaborative efforts. He talked about the concept of encashment for the environmental resources with prior knowledge investment and research.

The speakers emphasized developing a proper mechanism of PES by incorporating all the sectors. In addition, they also gave successful examples of PES from other countries, and concluded that PES is important for achieving sustaining development and the environment.

Conclusion and the Way Forward

Sharad Chandra Paudel, Hon. Secretary, Ministry of Forest and Soil Conservation, said that with growing realization about the importance of ecosystem conservation, participatory biodiversity management and conservation, concrete application of PES has a long way to go. Mr Paudel focused on concretization and synchronization of various ongoing pilots to enhance the opportunities and tackle the challenges for PES policy formulation. He reiterated that payment is always a difficult issue, with questions like who will pay and how much, and therefore, isolated efforts are not enough. He emphasized that policy development and unified action should go hand in hand to make the mechanism effective. He expressed hope that the two-day workshop would be fruitful in meeting its goal.

Technical Session I

PES Policies

National Policy Perspective: Linking Chure Upstream and Downstream

Rajendra Khanal and Sony Baral, IUCN

Payment for Ecosystem Services: Possible policy instruments for Ecosystem Based Adaptation

Laxmi Dutt Bhatta, and Anju Pandit, ICIMOD

Madhu Ghimire Acharya, Undersecretary, Ministry of Forest and Soil Conservation (MoFSC) presented the policy perspectives on PES in Nepal. Initiating the technical session, Ms Acharya provided an overview of the concept, principles, and existing international commitments in the sector of PES. She elaborated on the existing mechanism, status, government efforts, issues and challenges in the sector of the PES in Nepal.

Dr Prem Paudel, under-secretary at the DSCWM, introduced the PES in the Chure region and its scope and potential. He talked about the PES concept, process and framework with a specific reference to Chure, and gave examples of PES related efforts in other places. He highlighted the present status, opportunities and challenges of the Chure Region, and described the possible upstream downstream linkages and conditionality in PES implementation.

Mr Khanal's paper focused on present issues, opportunities and challenges in the Chure Region. The paper shed light on the background, programme, evolution, implementation status, and the institutional backup of the conservation programme in Chure region. He talked about the key ecosystem services and functions in the region, the degrading ecosystem, and the need to strengthen upstream and downstream linkages for sustainable development. It was pointed out that with growing realization about the importance of conservation and a highly supportive national policy environment, opportunities are opening up for PES implementation in Chure region.

Mr Bhatta's paper provided the status of the degrading ecosystem and changing goods and services. The paper provided several examples of PES cases being practiced in the country, and pointed out key policy issues (lack of clear PES provision in existing legislative instrument, unclear right to claim, lack of legal instrument for contractual agreements, lack of proper benefit sharing mechanism, lack of institutional arrangement, lack of premium for the private sector, and the lack of capacity to implement at all levels) in PES implementation in Nepal. The paper recommended building a consolidated legislative framework for PES, a clear institutional mechanism for ecosystems management, embedding PES in local management plan, and clarifying the role of local government for proper implementation of PES.

National Policy Perspective: Linking Chure Upstream and Downstream

Rajendra Khanal and Sony Baral
IUCN Nepal

Executive Summary

Chure conservation remains a high priority, which is well reflected in various national policies. However, among the actors working in the region, there are problems related to implementation and coordination. In addition, Chure conservation policies and institutions are not sufficient. There is a need to develop a shared vision for Chure conservation, especially at the policy, programme and implementation levels. Likewise, the scientific perspective, especially with regard to geo-morphological characteristics, is not well understood, and policies and strategies still focus on socioeconomic drivers of change. There is a need to integrate science during strategy formulation processes, holistic, integrated planning and joint monitoring. In order to effect this change, local governments should take the lead with active involvement of sectoral agencies. Apart from this, there is a need to introduce 'performance-based incentive mechanisms' among communities living in the upstream areas of the Chure.

Introduction

Nepal's physiography ranges from alluvial plains in the tropical lowlands to very rugged and permanently snow and ice covered Himalayan mountains. Five major physiographic landscapes extend from east to west, including the High Himal, High Mountains, Middle Mountains (or Middle Hills), Chure (or Siwalik), and the Tarai (MoFSC, 2014).

The Chure range, also called Siwalik, corresponds to the outermost range of the Himalayas (MoFSC, 2014). It rises steeply from the Tarai plains along its northern border. The most fragile ecosystem in Nepal, Chure covers 12.78 percent of the country's landmass, including 36 districts in total. The Chure range performs a critical ecosystem function, regulating surface water flow and recharging groundwater, especially in the lowland Tarai. The Chure region has been developed, consisting of human settlements, agricultural land and forests; however, the settlements are scattered and farmland is limited. Despite the relatively minimal development, the Chure ecosystem is degrading rapidly, primarily due to demographic shifts, unsustainable land use practices, unplanned infrastructure development, and sand and boulder extraction. Likewise, forests located in the Chure hills (and, subsequently, watershed conditions) have rapidly degraded due to exploitation for timber, firewood, and non-timber forest products such as bamboo, over-grazing and frequent forest fires (Singh 2010).

The government is highly committed to strengthening upstream-downstream linkages and planning and implementing programmes at the sub-watershed level. While conservation and sustainable use remains a priority in the upstream area, it focuses on ensuring a sustained supply of ecosystem services (13 ecosystems), including climate-induced disaster risk reduction in the downstream area. This paper will discuss the policy perspective on existing opportunities and challenges for strengthening upstream and downstream linkages in the Chure region, and suggests potential ways to improve the upstream-downstream linkages. This paper has been prepared based on the experiences of the IUCN, which is working in collaboration with the Ministry of Forests and Soil Conservation (MoFSC), in developing project proposals for selected watersheds in the Chure region.

Chure Conservation Initiatives

Policy

Conservation of Chure, particularly the strengthening of upstream and downstream linkages, has remained a high priority in national development periodic plans, especially since the ninth development plan. Although Chure conservation has remained a priority in many policies and strategies, particularly in forested landscapes, it has remained poorly integrated in sectoral polices and strategies, especially in operational aspects. Table 1 below presents major policy documents along with conservation priority in the Chure region.

Table 1 shows that different policies and strategies have recognized Chure hills as a fragile and environmentally sensitive ecosystem, designating its protection or conservation as high priority. Chure conservation issues were mainstreamed almost three decades ago in Nepal's national polices. The Land Resource and Mapping project (1986) proposed recommendations for the protection of forests in the Chure region. Following this, the National Conservation Strategy (1988) recommended that Chure be preserved through strict protection of forests against human encroachment, heavy removal of biomass and grazing control. Almost all forest-sector strategies suggested the adoption of protection-oriented forest management in the Chure region, while other sectoral strategies, such as agriculture and land use, prioritized the implementation of effective conservation. Despite these policies, the severity of problems associated with Chure degradation is increasing due to poor policy design or ineffective implementation.

Table 1: **Major policy documents on Chure conservation**

Year	Policy	Chure Conservation Priority
1988	National Conservation Strategy	Preserve Chure; promote protection of forests under government management regime
1989	Master Plan for Forestry Sector	No specific programme for Chure, but includes soil conservation and watershed management to protect land from degradation
1993	Environmental Policy and Action Plan 1993	Chure region to be designated as a protected area under consideration of its fragile and sensitive ecosystem
1995	Agriculture Perspective Plan	Provides for protection of forests and implementation of effective conservation
2000	Revised Forest Policy	Forests in the geologically-fragile Chure region should be managed and protected because runoff from the area helps to recharge groundwater in the Tarai
2002	Tarai Arc Landscape strategy	Promotes soil and watershed conservation
2002	Land Use Policy 2002	Forests of Chure should be allocated as 'protection forests' to control over-exploitation and degradation
2006	Chure Area Programme Strategy	Create an environment in which all stakeholders contribute to Chure conservation and the livelihoods of the resource-dependent people in an equitable manner
2009	President's Chure Conservation Programme	President Programme to restore ecological integrity under leadership of MoFSC
2013	Chure Programme Strategy	Contribute to the conservation of the Chure and improved livelihoods of the inhabitants
2013	Integrated Chure Conservation Planning and Programme Implementation Directive	Adopt integrated, holistic programme planning and implementation
2014	National Biodiversity Strategy and Action Plan	Identify priority areas, and prepare and implement conservation plans for more effective implementation of the Rastrapati Chure programme
2014	Draft Forest Sector Strategy	Conserve environmentally fragile ecosystems and landscapes
2014	Chure area as special ecological conservation zone	Chure region declared an ecological conservation zone and the plan in the making

Today, Chure conservation issues remain a high priority, especially after the President's Chure Conservation Programme (from 2009 onwards). In 2014, the Government of Nepal declared the Chure area as a special ecological conservation zone. The Ministry of Forest and Soil Conservation (MoFSC) is currently revising its 2006 Chure Area Programme Strategy, which had not been implemented effectively; the Chure Area Programme Strategy aims at creating an environment in which all stakeholders can contribute to Chure conservation and to the livelihoods of resource-dependent people in an equitable manner. The strategy advocates for: (a) mainstream policy and legislation to promote a more inclusive participatory process for conservation and improved livelihoods; (b) enhance multi-sectoral and multidisciplinary coordination at central, district and local levels; (c) develop efficient, effective and inclusive institutional mechanisms at implementation level and (d) create an incentive mechanism for conservation and livelihood initiatives. Similarly, the current Draft Forest Sector Strategy envisions a landscape approach to conservation of the Chure region, focused on conservation-oriented management, Integrated Watershed Management (with focus on PES) and forest management geared towards the protection of fragile Chure ecosystems.

Institutions

Until recently, there had not been a single institution designated solely for Chure conservation. Many institutions, including government organizations, local bodies (VDC/DDC) and non-government organizations (NGOs), are focusing on livelihoods and infrastructure development. However, there is poor coordination and collaboration among these agencies while implementing their programmes and projects. Sectoral agencies working in the Chure region focus almost exclusively on their sectoral interests with little priority given to conservation issues. Nevertheless, MoFSC, through its central and field offices, is the only agency currently implementing conservation-related programmes in the Chure region, focusing on forests, biodiversity and watersheds. A large part of the area is classified as national forest, in which the government is enacting protection-oriented management. Likewise, national forests are also handed over to the community, which employ a limited use management strategy.

MoFSC has had a lead role in Chure conservation. After the President's Chure Conservation Programme in 2009, the government entrusted the ministry to coordinate Chure conservation, especially "to restore ecological integrity of the area". Through this programme, MoFSC is implementing several conservation programmes in the region in order to strengthen upstream and downstream linkages, related to: (a) sub-watershed management plan preparation (b) forest management (c) plantation and restoration (d) conservation related programmes. Apart from this, MoFSC is in the process of finalizing the Integrated Chure Conservation Planning and Programme Implementation Directive and Chure Programme Strategy.

In consideration of the region's sensitivity and the urgent measures that need to be taken in order to protect Chure, the government formed a high level, autonomous Rastrapati Chure-Tarai Madesh Conservation Development Board in 2014, with the goal of implementing development programmes that address the concerns of both upstream and downstream areas in the region. This effort can be considered a critical stepping-stone for Chure conservation in Nepal.

Challenges and Opportunities

Problems and Challenges

Table 2 presents the problems and challenges of Chure conservation. The primary challenge is to promote conservation friendly development, particularly in light of problems that include: high migration, dependency on forests for livelihoods, unplanned infrastructure development, and sand and boulder extraction. In addition, there is poor coordination, collaboration and communication among the sectoral agencies and integrated planning is yet to be practised; these factors contribute to the further degradation of resources and promotion of unplanned development in the region. Promotion of pocket area for goat farming near the Chure region by the Livestock Office despite simultaneous control of grazing by the Forest Office is one example of poor coordination. In recent years, several policies and strategies have been prepared for Chure conservation, however, they suffer from a lack

of scientific evidence; specifically, science based decision support systems, especially relating to the study of geo-morphological characteristics, is lacking. Policies and strategies are still prepared with the assumption that humans are the main instigators of Chure degradation without a proper understanding of geo-morphological characteristics brought about by climatic variability. In addition, stakeholders generally have limited knowledge and capacity, including monetary investment.

Table 2: **Major Problems and Challenges of Chure Conservation**

Challenges	Problems
Knowledge building	■ Interdisciplinary studies and assessments to link science and policy ■ Quantifying costs and benefits of ecosystem services ■ Linkages between ecosystem services and human livelihoods
Evidence based policy formulation	■ Lack of scientific evidence during policy formulation ■ Lack of science-based decision support systems ■ Planning still confined at watershed or sub-watershed level
Institutional collaboration	■ Distinct divisions of Chure issues /problems ■ Overlapping jurisdiction ■ Sectoral Development Approach ■ Lack of integrated efforts among stakeholders, fragmented planning
Capacity building	■ Inadequate knowledge and competencies about ecosystem services, including PES ■ Inadequate human resources
Investment	■ Inadequate financial resources/limited investment ■ Scattered and distributive implementation
Conservation friendly development	■ Changing demographic patterns (migration) ■ Unplanned infrastructure development ■ High dependency on forests for livelihoods

Opportunities

Table 3 presents the major opportunities for Chure conservation. In general, there is an enabling policy and institutional environment coupled with strong political commitments. Chure conservation has been recognized as a national priority programme. The government has declared the Chure hills an ecological conservation zone and formed a committee to oversee management and conservation of the area. Likewise, there is an increasing financial flow from the government treasury, donors and conservation partners. MoFSC has recently developed a detailed project report for conservation of the Chure region in several watersheds and has been approaching donors for project implementation.

Table 3: **Opportunities of Chure Conservation**

Opportunities	Evidences
High political commitments	■ Chure conservation is part of the nation's pride programme ■ Environment committee of parliament made a sub-committee to study Chure conservation issues and advise the government
Highly supportive national policy environment	■ Almost all policies recognize the importance of conservation ■ Recent policy emphasizes adoption of landscape approach for conservation and institutionalized payments for ecosystem services
Institutional framework already established	■ Rastrapati Chure-Tarai Madesh Conservation Development Board formed
District and site level plan prepared	■ Watershed level plan implemented, focusing on capacity building, disaster risk mitigation, livelihood improvement and farming system improvement
Increasing financial flow	■ Increasing interest and investment of conservation partners ■ Recognition as part of the national pride programme

Way Forward

Currently, there is a strong policy commitment complemented by an appropriate institutional framework for effective conservation of the Chure region; however, conservation efforts lack a clear vision, and the strategic plan is either yet to be developed or still in the conception stage. Policy recommendations to strengthen upstream and downstream linkages include:

Define the Chure landscape, taking ecosystem services as a basis of upstream and downstream linkages: There is a need to define the Chure landscape or zoning with consideration of the supply and demand of the ecosystem services between upstream and downstream areas. The potential ecosystem services could include groundwater recharge and flood mitigation. It remains to be seen if the newly created Rastrapati Chure-Tarai Madesh Conservation Development Board will indeed expand coverage of the Chure and consider Chure-Bhabar and Tarai as one landscape, as its name suggests. In general, there is a need to demarcate and define the Chure region by taking its ecological functions into account.

Integrate science in policy formulation and programme planning: Scientific elements include geo-morphological characteristics, climate change-related impacts and modeling of uncertainties. However, in general, policy is still strongly oriented towards addressing human-induced impacts such as grazing, unplanned infrastructure development and resource exploitation. In-depth geo-morphological studies under different climate change scenarios should be conducted and findings should be integrated into the design and implementation of Chure conservation policies and programmes.

Develop a shared vision for Chure conservation while strengthening upstream-downstream linkages: MoFSC has been developing the Conservation Planning and Programme Implementation Directive in conjunction with a Chure Programme Strategy. However, it appears that concerned stakeholders have not been adequately consulted in the development of these documents and democratic and deliberative processes are missing. There is a need to follow consultative and collaborative processes during strategy formulation. Likewise, annual joint planning and annual review among the stakeholders, especially the district development committee (DDC) planning framework, should be strengthened. There is also need to strengthen collaboration, coordination and communication among stakeholders in planning, implementation and monitoring of the conservation related programme. Joint monitoring with local level and high-level stakeholders should be promoted in order to understand the policy problems and devise appropriate mechanisms and modalities for effective collaboration.

Introduce sustainable financing mechanism: There is a need to explore potential sustainable financing mechanisms to support the conservation projects over a longer period of time. Likewise, appropriate institutional mechanisms should be designed and implemented. Potential sustainable financing mechanism includes market-based mechanisms (PES, watershed services), generation of funds (government, donor) and increasing investments (taxes, subsidies).

Institutionalize performance based incentives payment: With the goal of changing the behaviour of upstream communities, governments should provide direct cash incentives to the upstream communities to perform sustainable land use practices based on objectively measured performance indicators. The government could generate money through additional use fees or taxes to the downstream communities for use of particular services, such as drinking water, ground water installations or financing through the national treasury. Examples of the implementation of this mechanism exist in China, Costa Rica and a few other countries. However, a detailed feasibility study and operational mechanisms (including piloting) are necessary to develop this scheme.

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Payment for Ecosystem Services: Possible Policy Instrument for Ecosystem Based Adaptation in Nepal

Laxmi Dutt Bhatta and Anju Pandit
ICIMOD Nepal

Introduction

Ecosystems provide number of goods and services to sustainable local livelihoods. Recent global changes, including climate change, directly affecting the ecosystems, and thus, impacting continuous supply of ecosystem services (ES) that they provide for human wellbeing. The Millennium Ecosystem Assessment (MEA, 2005) indicated the considerable degradation of ES at global and regional level, impacting production system various ecosystems, which directly exacerbate poverty in ES dependent mountain communities (ICIMOD, 2010). Nepal has made significant progress in managing its ecosystems, adopting number of participatory management approaches. Community forestry has become popular in Nepal's hilly area, as showcase to global communities, for ensuring local governance and livelihood options for rural population. However, there is a significant gap in streamlining ecosystem systems and services that they provide for local livelihoods. Nepal lacks a concrete umbrella legislative instrument to manage ecosystem services, however, is progressing through various sectoral legislative instrument such a forestry, water, local governance.

Payment for ecosystem services (PES) is considered as market approach to conserve ecosystems for sustainable supply of services that these ecosystems provide (Wunder, 2005). Wunder (2005) further described the various criteria to develop a true PES schemes, namely: (a) a voluntary transaction where (b) a well-defined environmental service (ES, or a land use likely to secure that service) (c) is being bought by a (minimum of one) ES buyer (d) from a (minimum of one) ES provider (e) if and only if the ES provider secures ES provision (conditionality). A ''true" PES, therefore an innovative instrument through which both consumers and providers are guaranteed sustainable supply of ecosystem services without compromising social goals (Engel & Palmer, 2008; Wunder & Albán, 2008;).

However, there are alternative, "PES-like" schemes, which aim for the same goal but adopt slightly different approaches and do not necessarily follow market based approach, as described by Wunder. In particular to developing and mountainous countries like Nepal, a market based PES schemes may not be fully functioning, therefore PES like schemes are designed to increase total social benefits. Therefore, we reviewed various PES like cases in Nepal based on available secondary literature, interviewing with key informants, and limited number of focus group discussions in order to analyse whether these PES like schemes are contributing to long term ecosystem management based on the concept of ecosystem based adaptation (EbA) for larger social benefits.

Conclusions:

We found that there the awareness on sustainable management of ecosystems and their services has been significantly been increased both at the national political and community level. There are number of PES like schemes have been initiated both at national level, supported by law, and community level, through local negotiations, has increased total social benefits. This study also shows high potentiality to establish and implement various PES schemes at larger scale. However, our analyses indicate that an umbrella legislative instrument with concrete institutional mechanism is the fundamental for success of PES in Nepal. A participatory and standard methods and tool to analyze value of various ecosystem services is needed to convince policy makers.

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Technical Session II

PES Assessments

Linking Upstream and Downstream Households through Payment for Ecosystem Services: A Choice Experiment Study in Sardukhola Sub-Watershed in Nepal

Rajesh K Rai, Mani Nepal, Priya Shyamsundar, SANDEE and Laxmi D Bhatta, ICIMOD

Watershed Management for Tourism: A Case Study of Plea Watershed of Western Nepal

Keshav Prasad Khanal, WWF Nepal

Payment for Ecosystem Services in Protected Areas: A Case of Shivapuri-Nagarjun National Park

Rahul Karki, Naya S Paudel, Dil B Khatri, WWF Nepal and Laxman Joshi, Forest Action Nepal.

Payment for Ecosystem Services: Private Sector Perspectives

Pradip Maharjan, Agro Enterprise Center, FNCCI

This session was mainly devoted to the assessment of ecosystem services of various watershed areas based on field research, their integration with PES mechanism, and the perspective of the private sector.

Dr Rai's paper was based on a study on valuation of watershed services. It suggested that the community is willing to pay if they are given reliable options for services. Developing a PES scheme is a rigorous process that requires a right track and approach. Dr Rai stressed that developing a PES scheme with a multi-sectoral approach would increase the welfare of watershed community. Emphasizing the crucial role of local institutions in institutionalizing PES, he mentioned public private partnership (PPP) as an effective model for supporting PES implementation on the ground.

Mr Khanal presented the findings of their study on Phewa watershed in western Nepal. Discussing the ecosystem service assessment of Phewa watershed, he shed light on the economic benefit, involved actors as well as associated problems (siltation/sedimentation, waste/sewage, encroachment, eutrophication, etc.) and challenges of the management plan. He presented an integrated setup of Phewa Lake Conservation and Management Interim Board (PLCMIB), and talked about the formation, role and financial mechanism of the ad-hoc committee in attaining the twin objective of PES.

Mr Karki, presented the findings of the feasibility study on PES in Shivapuri Nagarjun National Park. He presented the PES scheme and possible PES institutional setup for the Sundarijal catchment area.

Finally, Mr Maharjan presented the private sector's perspective on PES. He discussed existing issues such as unclear paying mechanism, lack of understanding, bargaining business, and the hassle of multilayer payment for business companies. He suggested revising the payment system as a one-way payment mechanism to motivate the PES implementation at local and business level. Mr Maharjan emphasized the need for a policy framework but added that it should be decided only after multiple rounds of stakeholder consultations. He further recommended building an alliance between the development partners.

Linking Upstream and Downstream Households through Payment for Ecosystem Services: A Choice Experiment Study in Sardukhola Sub-Watershed in Nepal

Rajesh K Rai[1], Mani Nepal[1], Priya Shyamsundar[1], Laxmi D Bhatta[2]

[1] South Asian Network for Development and Environment Economics (SANDEE), Lalitpur, Nepal

[2] The International Centre for Integrated Mountain Development (ICIMOD), Lalitpur, Nepal

Introduction

Sardukhola sub-watershed of eastern Nepal covers a geographical area of 39.35 km^2 of Bishnupaduka village development committee (VDC), Panchkanya VDC and Dharan Municipality of Sunsari District and Bhedetar VDC of Dhankuta District (IUCN Nepal, 2011). The sub-watershed has 12,383 households with 51,174 people (Central Bureau of Statistics, 2013). The statistics indicate that upstream area has 934 households with 4,044 people. However, this sub-watershed is the major source of drinking water for 27,750 households of Dharan municipality. The sub-watershed also provides other services including food, fodder, energy, irrigation water and flood control (IUCN Nepal, 2011).

The inhabitants of Dharan Municipality in the downstream areas of the catchment are facing acute water shortage, particularly during the dry season (February to May). Only 60% of the water demand is met in the wet seasons and 25% of the demand in the dry seasons (IUCN Nepal, 2011). Besides, use of chemical fertilizer and pesticides in agricultural fields, open defecation and wallowing of livestock in the upstream area are severely affecting the availability of water, both in terms of quality and quantity, for the downstream community.

At the local level, both the upstream and downstream communities have initiated dialogue to form an institutional mechanism to manage the sub-watershed in order to ensure a continuous supply of water in Dharan Municipality. But, these local level efforts have not been fruitful in terms of developing an appropriate strategy to connect the upstream and downstream communities for the watershed management activities. During the consultations, the local communities gave two reasons for the problem. First, community's preferences in both upstream and downstream communities were yet to be ascertained. Second, Nepal Water Supply Corporation has a mandate for water supply and distribution mandate but not for managing and protecting water resources (Government of Nepal, 2007).

Payment for ecosystem services (PES) can help ensure that upstream forest management is oriented towards the welfare of downstream community without compromising the welfare of upstream community. PES can bring both upstream and downstream communities to a common platform, focusing on particular services (Wunder, 2007). Upstream farmers need to be paid for changing their livelihood activities to maintain the uphill ecosystems and downhill farmers should pay for the improved environmental conditions of the watershed. This means an effective PES mechanism can be designed involving local communities in the decision-making and payment processes. This can be done by finding out the downstream communities' preferences regarding their willingness-to-pay (WTP) for improved services and upstream communities' willingness-to-accept (WTA) with regards to changing their livelihood activities. In many developing countries, there is need for a deeper understanding of PES both in terms of payment mechanism and institutional arrangement (Sangkapitux et al., 2009).

This study was designed to assess the potential for managing Sardukhola sub-watershed of Sunsari district of Nepal by linking downstream and upstream communities through the PES mechanism. Water demand in Sunsari is increasing due to population growth in the downstream area. Quantifying the benefits of the programme in terms of WTP and WTA measures provides a complementary perspective on the internal compensation mechanism and help to bring upstream and downstream communities under a common umbrella of watershed management.

Methodology

This study employed both qualitative and quantitative approaches. Stakeholder consultation meetings were carried out to discuss the possibility of creating an institutional mechanism for PES and validate the results. Discrete choice experiment (DCE) was used to determine the preferences of both upstream and downstream communities for watershed management.

Stakeholder consultation meetings were organized twice to share the preliminary findings gathered from focus group discussion and choice analysis, and to discuss the institutional setup for PES mechanisms. Residents of both upstream and downstream areas, officials from local bodies, government agencies and non-government organizations participated in both the consultation meetings. In the first consultation meeting, the study team presented the concept of PES mechanism and preliminary results of focus group discussions on upstream-downstream issues. In the second consultation meeting, the study team presented findings of household survey for validation.

A discrete choice experiment (DCE) was used to determine public preferences for watershed management activities. DCE is a method that elicits public preferences in hypothetical settings. Five focus group discussions were organized with local communities from both upstream and downstream to identify the attributes to be included in the experiment, their current status and the level of change that the community would like to see after the implementation of the PES scheme. After focus group discussions, local experts including officials from the District Forest Office, District Soil Conservation Office, local non-government organizations, Nepal Water Supply Corporation and Dharan Municipality were consulted to finalize the attributes and their levels.

For downstream community, the quality and quantity of drinking water, and protection of land from soil erosion are major attributes. They would like to pay with an increment in drinking water tariff. To bring about improvement, upstream community has to change their activities by banning open defecation, reducing chemical fertilizer and regulating open grazing. For this, upstream community will receive support to increase their household income. Based on these attributes, an experimental design was carried out using statistical software (Ngene).

A face-to-face interview was carried out using a structured questionnaire. The systematic sampling approach was used to select the households in both locations separately. A total of 203 upstream households and 201 downstream households were interviewed. In downstream, five wards of Dharan Municipality (4, 6, 12, 16 and 18) were selected randomly, and then 40 households from each ward were selected using systematic random sampling.

Results and Discussion

The estimated WTP for improved water supply of downstream households is between 1.74 and 2.87 times the estimated total WTA for changing household activities in different scenarios among upstream households. The surplus amount can be used for establishing and operating an institution that would manage the PES programme, and also for supporting awareness raising, environmental activities such as waste management and forest improvement, and coordinating with local bodies such as district development committee and village development committee to mainstream watershed management into the development process. These results suggest a need for a multi-sectoral approach to watershed management to increase the welfare of upstream community, which is consistent with what Heltberg has recommended (Heltberg et al., 2009).

Recent report on forest resource inventory of Nepal indicates that livestock grazing is one of the major drivers of forest degradation (Forest Resource Assement of Nepal, 2014). As upstream farmers are taking their animals for

wallowing and drinking water in Sardukhola, a watershed management strategy focusing on a ban on grazing would not only contribute to improving forest protection in the upstream area but also help to improve water quality (Gary et al., 1983). However, the quality of drinking water seems more important than other attributes to downstream community. Their responses indicate that an increase in water availability and improvement in water quality should go hand in hand to maximize the benefits of watershed communities. Downstream households' emphasis on drinking water quality is expected as water borne diseases are one of the major health problems in Nepal (Shrestha et al., 1998; Bhatta et al., 2007). During focus group discussions and stakeholder consultation meetings, the main issue raised by the downstream community was the contamination of water by sewage and chemical fertilizer used in the farmland.

In general, the successful implementation of PES largely relies on the participation of state and/or community (Vatn, 2010). In the case of Sardukhola sub-watershed, the state has a decisive role since the Nepal Water Supply Corporation has monopoly over water distribution. Legally, the corporation is not responsible for protecting or managing water sources (Government of Nepal, 2007). Therefore, the existing institutional setup cannot be used for implementing the PES mechanism. However, creating a new institution to implement PES will increase transaction costs, which may reduce the amount of support to upstream community. The government's recent decision to form Dharan Drinking Water Board has created hope for capturing WTP of downstream community in terms of increased water tariff. The water board in the proposed PES scheme could act as a service buyer and make an agreement with the upstream committee. The Sardu Watershed Protection Committee, which has representatives from both upstream and downstream communities as well as line agencies responsible for natural resource management, will act as a programme unit.

Conclusion

This study recommends that three local level institutions implement the PES scheme -- ecosystem service consumers, ecosystem service producers, and a body that includes representatives of both consumers and producers as well as representatives of government institutions. In addition, the study also mentions that clear agreement is required between upstream and downstream communities to define watershed management activities and fund flow procedure. It highlights the need for a national level PES guideline in Nepal to ensure multi-stakeholders' involvement in ecosystem management and to build trust between ecosystem service providers and consumers. The study reveals that developing a PES scheme with a multi-sectoral approach would increase the welfare of watershed community. For instance, as the local government and the District Health Office are implementing sanitation programmes in the villages, it would be advisable to link these programmes with the PES scheme to make the scheme effective.

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Watershed Management for Tourism: A Case Study of Phewa Watershed of Western Nepal

Keshav Prasad Khanal
WWF Nepal

Abstract

Tourism is one of the major sources of income in Pokhara Valley. Phewa lake and the catchments of the lake in western Nepal provide different ecosystem services. The lake provides irrigation for farmlands downstream, supports fish farming, and is a popular religious and recreational site for domestic and international tourists. Despite the high importance of the lake, not enough attention is paid to its protection. The size and water holding capacity of the lake is decreasing in an alarming rate due to heavy sedimentation from the upper catchments. This paper aims to document the trend of sediment loads coming from sub watersheds and to explore possibilities for sediment retention in the upper catchments by establishing the Payment for Ecosystem Services (PES) so that the lake dependent tourism could continue for a longer period of time.

The study is based on secondary sources, consultation with stakeholders, field observation, the valuation of the sediment load in Phewa lake carried out using Integrated Valuation of Ecosystem Services and Tradeoff (InVEST) tool. Findings show that major sources of sedimentation in Phewa Lake are landslides, unplanned development activities, and unsustainable land use practices in the seven sub watersheds of Phewa Lake.

Stabilizing landslides by bioengineering techniques, controlled grazing, constructing silt traps, rural green road construction with prior soil management, bench terracing, and strip planting with perennial trees are some of the interventions recommended for the upper catchments. The beneficiaries of Phewa Lake (hotels owners, boatmen, and fishermen) are willing to pay for the sediment retention. In response, communities in upper catchment are willing to change land use practices in their farmland and forests in favour of sediment retention. This study concludes that Phewa Lake could be conserved by reducing the rate of sediment deposition in the lake through an appropriate PES mechanism between the upstream communities and downstream beneficiaries.

Keywords: *PES, Tourism, sediment retention*

Introduction

Phewa Lake is the major tourist attraction of Pokhara Valley. Thousands of national and foreign tourists visit this lake annually. The lake is a major source of livelihoods of local communities. The ecosystem services offered by the lake is valued at over US$43 million per year, out of which around 95% are related to tourism and recreation (Kanel, 2010). Even this is considered to be a conservative estimated as many regulating services have not been included. However, Phewa Lake is undergoing degradation due to various problems like siltation, sedimentation, direct waste, sewage disposal, encroachment and eutrophication. The ecosystem services of the lake are under threat and this directly affects the livelihoods of lake dependent households. This paper aims to document the quantity of sediment loads coming from sub watersheds, and explores possibilities for sediment retention in the upper catchments through establishment of Payment for Ecosystem Services (PES).

Methods

The methodology adopted for the study are: (i) desk review of a wide range of secondary information including studies of payment for ecological services (PES) in Nepal and (ii) focused groups discussion with communities around Phewa lake, sub watersheds and hotspots (iii) consultations with concerned stakeholders including forestry officials, soil conservation officials, hotel association of Pokhara, tourism authorities, DDC officials, fishery officials, boat association, and local non-government organizations (iv) mapping of Phewa sub-watershed with sedimentation transfer in Phewa lake and (v) quantify sediment deposition in the lake from different sub watersheds using the Integrated Valuation of Ecosystem Services and Trade off (InVEST) software.

Results and Discussion

A total of seven sub watersheds covering an area of 11,351 ha feed water into Phewa Lake. The current capacity of the lake is 42.18 million m^3 at the highest water level. A time series map analysis indicates a decrease in area from 10 km^2 in 1956/57 to 5.5 km^2 in 1976 and 4.4 km^2 in 1998. There has been more than 50% reduction in area within a timeframe of five decades (JICA/SILT, 2002). It is estimated that during the period of 1990—1994, annual siltation rate was about 175,000—225,000 m^3 (DSC, 1994). When 80% of the storage is silted up, and if the average sedimentation rate of about 180,000 cubic metres continues, the lake was expected to be filled up with sediments in about 190 years from the year 1998 (Singh, 2013).

Soil erosion from the farmland, landslide and unplanned infrastructure development (mainly village roads) were found to be the major sources of sediment/silt in Phewa Lake. Each village of the sub watershed is connected to a road but the roads are not designed properly. A large amount of soil/sediment flows of these roads get deposited in Phewa lake. Field observation of Phewa sub watersheds shows that a major cause of siltation in the lake is the landslide of Kaskikot and Dhikur Pokhari Village Development Committees (VDCs). Similarly, traditional agricultural system for planting rice, which makes the fields muddy in rainy season, is another source. Harpan stream changes its course, contributing to siltation in Phewa Lake. Increased development activities have augmented a number of construction works (leveling of slopes, soil work for building construction, construction of access roads) without soil management around Phewa Lake, particularly in Pokhara metropolitan city and Sarankot VDC; this has directly contributed to sediment deposit in Phewa Lake (Singh 2013). Table 4 presents the area wise soil loss intensity of the different sub watersheds of Phewa Lake.

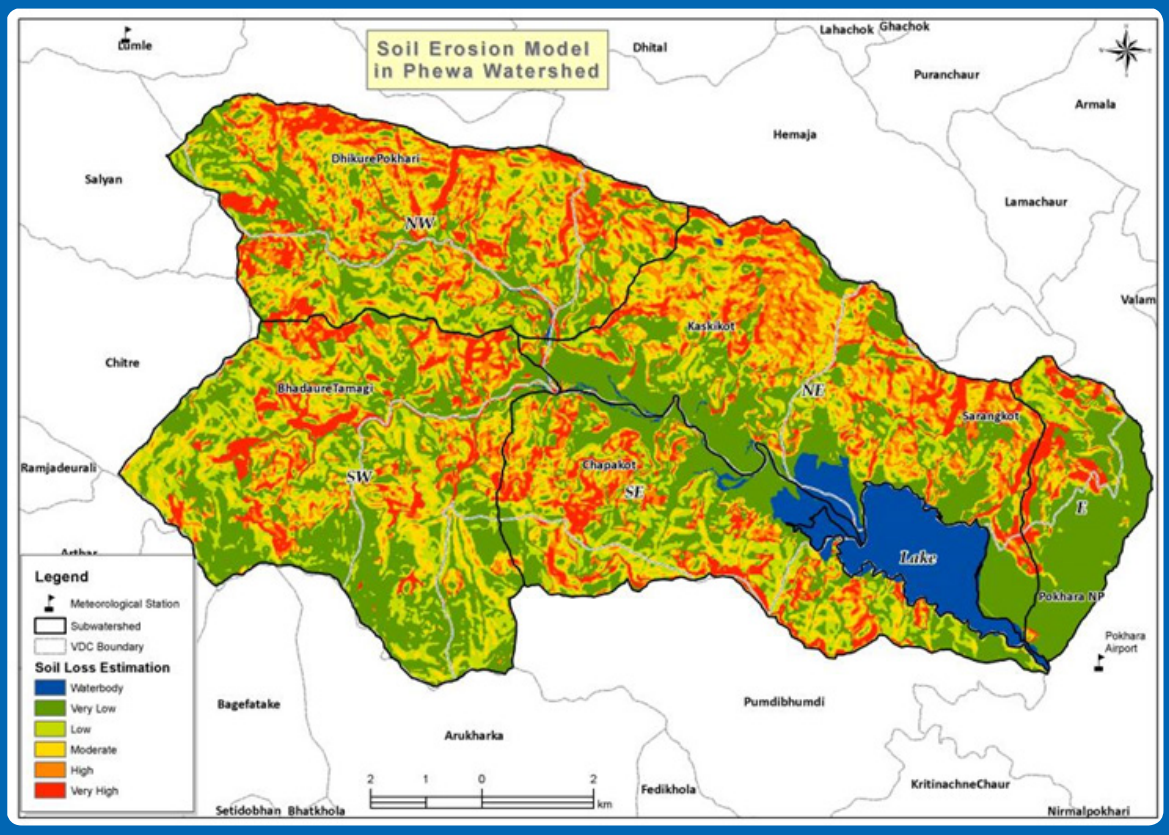
Table 4: **Analysis of Soil Loss from Phewa Watershed Area (hectare and %)**

	East		North East		North West		South East		South West			
Soil Loss	Area	%	Area	%	Area	%	Area	%	Area	%	Total	%
Very Low	548	66.9	1,027	37.3	684	25.7	697	35.8	1,258	39.6	4,213	37.1
Low	81	9.9	345	12.5	508	19.1	441	22.7	762	24.0	2,136	18.8
Moderate	57	7.0	536	19.5	586	22.0	310	15.9	535	16.9	2,023	17.8
High	42	5.1	524	19.0	456	17.2	240	12.3	283	8.9	1,545	13.6
Very High	91	11.1	320	11.6	425	16.0	259	13.3	337	10.6	1,433	12.6
Grand Total	819	99.9	2,752	100.0	2,660	100.0	1,947	100.0	3,174	100.0	11,351	100.0

Source: adapted from Singh 2013

As indicated in Table 4, almost one quarter of the total area of the watershed has high potential for soil loss and about 18 percent of land faces moderate intensity soil loss, while 37 percent of the total area contributes to very low soil loss. The areas with soil loss potential is mapped according to the soil loss and presented in Figure 1.

Figure 1: **Potential Soil Loss in Different Sub-Watersheds of Phewa Lake (source: Singh 2013)**



Sub-watersheds prioritization for management to minimize sedimentation in the Phewa Lake

Based on sediment load deposition in Phewa Lake, sub watersheds could be divided into three priority areas:

Priority 1: The North-East sub-watershed (Sarangkot and Kaskikot VDCs) and Northwest sub-watershed (Dhikur Pokhari VDC) are highly vulnerable and are the main source of siltation in Phewa Lake. These two sub-watersheds experience severe landslides and agricultural landfall.

Priority 2: East sub-watershed that falls in the eastern hill slope of Sarangkot VDC and Ward No. 2, 4, 5, 6, 7 & 8 of Pokhara sub-metropolitan city are main sources of garbage, nitrogen and phosphorus deposit in Phewa Lake. This sub-watershed has largely contributed in eutrophication in the lake due to heavy population pressure and open sewerage coming through Bulaudi and Phirke Khola and Seti canal passing from the Pokhara city.

Priority 3: Northwest sub-watershed that includes Bhadaure Tamagi VDC and northeast sub-watershed which includes Chapakot and Pumdi Bhumdi VDCs. These areas have good forest cover and comparatively less agricultural land. These sub-watersheds contribute comparatively least amount of siltation in Phewa Lake.

Immediate actions are required in Priority 1 sub-watersheds. A survey conducted by the Hariyo Ban Program in 2014 found that agricultural activities such as mono-cropping, cultivation in small terraces and heavy tillage and focus on cereal crops are the main causes of soil erosion in this area. Two types of cropping patterns were observed: in gently sloping areas where irrigation is partially available, the cropping pattern is rice based; whereas in steeply sloping terraces, the cropping pattern is maize based. Most farmers are unable to meet their annual food needs from their production. The proposed action plan for the PES implementation has been designed to provide solutions to problems related to traditional agricultural practices that lead to sedimentation in Phewa Lake.

Sediments in the upstream areas can be retained by improving farming practices. Key best practices in soil conservation include: making use of sediment laden runoff, diverting runoff to bund terraces to prevent loss of soil particle; *in-situ* manuring, plantation of nitrogen fixing plants; terrace riser slicing; and use of compost and farm yard manure (FYM). Similarly, terrace improvement, Sloping Agriculture Land Technology (SALT), hill-side ditch farming to prevent flow of water from accumulating, and promotion of minimum tillage could also help prevent sediment loss. Some of the other recommended activities for sediment retention are strip cropping; multiple cropping and high density planting and mulching.

The above practices will prevent sediment transfer downstream, ensuring clean and pollution free water for communities and reducing threat to the lake. PES for sediment retention could be a feasible option to support the activities listed above. It can help improve livelihoods of communities upstream and improve tourism business for downstream users, mainly hotel entrepreneurs and the whole tourism industry.

To promote the PES mechanism, the study recommended the following action points:

- Establishment of Phewa Lake Conservation and Management Interim Board with membership of upstream community members and Phewa dependent stakeholders for PES decision making process
- Establishment of a payers' association (to collect fund and support upstream communities in PES plan implementation) and a service providers' association to ensure continuous sediment retention service delivery
- A Memorandum of Understanding (MoU) between the upstream communities and Phewa Lake beneficiaries to ensure a sustainable flow of services and payments against the performance
- Provision for Third Party Monitoring and verification of the service

Conclusion

Phewa Lake is the main tourist attraction of Pokhara Valley. Conservation and adoption of appropriate control measures to maintain the size of the lake is very important for sustainable tourism in the valley. The life of Phewa Lake depends on the success of sediment retention in the upper catchments. This study shows that both the upstream communities and downstream lake-dependent communities mutually benefit from the PES, particularly sediment retention, and this can be done by establishing an independent Phewa Management Authority and other appropriate institutions for effective delivery of sediment retention ecosystem service and payments against the performance of the services.

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Payment for Ecosystem Services in Protected Areas: A Case of Shivapuri-Nagarjun National Park

Rahul Karki[*], *Naya S Paudel*[*], *Dil B Khatri*[*], *Laxman Joshi*[**]

[*] ForestAction Nepal, [**]Freelance consultant

Background

Protected Areas (PAs) around the world are well known for biodiversity conservation and are home to many species of wild flora and fauna. Management of most of the PAs around the globe is centered on conservation of mega fauna, whereas other diverse ecosystem services that could be enhanced through the management of those ecosystems have been undermined. Moreover, these services have diminished further due to funding crisis faced by most of the PAs. This problem is even worse in the developing countries in the South. The second problem facing PA management is providing compensation to the local communities for the damage caused by wild animals. The services are enjoyed by a certain group at the cost of conservation, and the needs of the resource managers have been overlooked.

In recent years, stakeholders have increasingly recognized the importance of the diverse services rendered by the PAs and the need to provide economic incentives to the managers of the services. Considering this, a conservation approach called Payment for Ecosystem Services (PES) has been developed and is being practiced in different parts of the world. The notion of the PES is that it would create additional funds for PAs for resource management. This study focuses on the potential of PES within the Sundarijal watershed, which entirely falls within SNNP. The study seeks to answer the following questions: a) What is the value of water services in SNNP? b) Who are the potential buyers and sellers of the services? c) What are the policy provisions on ecosystem services in the protected areas of Nepal?

PES and PA management

In most developing countries, centralized management modality, often with the help of the army, has been a primary means for managing PAs. In doing so, the local communities inside the PAs are normally relocated or forced out of the area. This often sparks conflicts between park management and local communities. This modality also overlooks the fact that PAs maintain and provide valuable ecosystem services useful for human wellbeing, like recreation for tourism, genetic resources, carbon sequestration, regulation of water function and many others (Dudley and Stolton 2003). Management, in this approach, only focuses on charismatic species such as Tiger, Rhino, and Deer among others. Besides, PA authorities in developing countries are normally underfunded. The revenue generated from the park covers a mere 10% of the cost of conservation. Such a limited focus on conservation and limited fund has undermined the potential of holistic ecosystem management that could otherwise offer a wide range of ecosystem services for human wellbeing on one hand and generate substantial financial resources and goodwill of local communities on the other. With all these issues in mind, it has been realized that an alternative mechanism to manage PAs is the need of the hour. The concept of Payment for Environmental Services (PES) is thus emerging in the arena of PA management. The basic concept of PES is that the beneficiaries of ecosystem services make conditional payments to the local land managers who will be required to ensure continuous services to the buyers of those services.

PES has a huge potential to persuade people to conserve their environment. This is important in cases where conservation efforts have to be compromised because of insufficient funding. In addition, PES can be an alternative environmental management tool where other conservation efforts (like fine and fence) have failed (Khatri et al. 2011). PES is not only designed to meet conservation needs, but also perceived to have positive impact on the livelihoods of poor communities . In the context of PAs, the PES mechanism is also perceived to reduce the conflict that arises time and again between the park authorities and the local community.

Value of Ecosystem Services within SNNP

Valuation of ecosystem services is important as it enables us to state the actual value of the service under consideration as well as estimate the amount of payment to the service providers. For this particular study, the value of water services in terms of electricity production and drinking water from the Sundarijal catchment is estimated to be NPR 98.72 million for the year 2008/09 (Khatri et al. 2011). On per unit basis, the value of water service for hydropower is smaller (only service of the water is used) as compared to those from drinking water (the water is consumed as a commodity). On the basis of the catchment area, the value of the water services generated is NPR 62,645/ha of which 13.4 percent comes from hydroelectricity and the rest from drinking water.

From the service provider's point of view, there is a certain cost of conservation (for SNNP) and opportunity cost of conservation (for local communities) that needs to be taken into consideration. The cost incurred by the locals is mostly visible cost in the form of damage to crops and livestock. Opportunity cost is in the form of ban on the access to the forest and limited access to the market. Other costs include problems related to wildlife that have vastly increased after the protection of the forest in the form of national park. The wild animals that are most destructive for crops are wild boars, monkeys, birds, and porcupines. In addition, leopard, wildcat and jackal often predate on livestock and poultry.

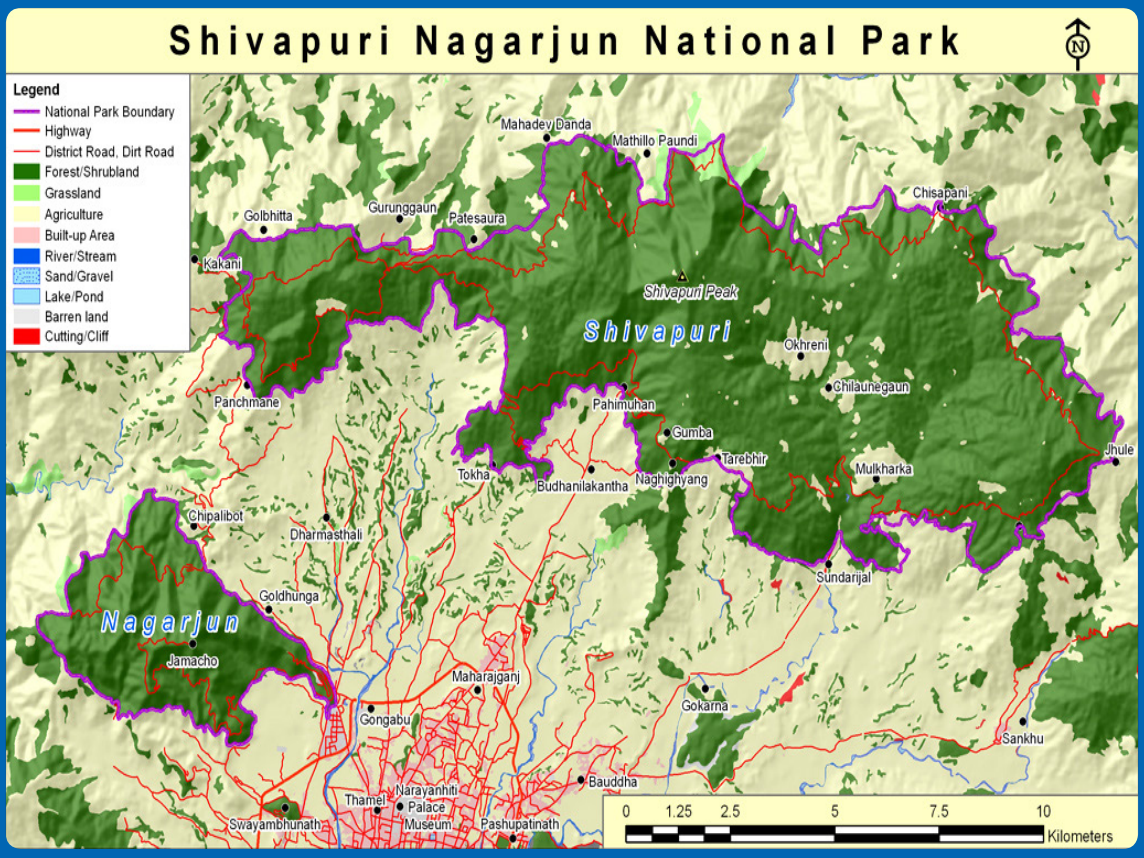
Based on a rapid rural appraisal, Kunwar (2008) estimated the costs of crop damage and opportunity costs of restrictions on forest resources and agricultural markets. As per the estimates reported, on average, crop damage costs are worth around NPR 2,873 a year for each park-dwelling household. Loss of use of park resources due to restrictions on harvesting amounts to some NPR 16,000 a year (comprising timber and NTFP use), and loss of access to agricultural markets incurs average opportunity costs of NPR 8,000 per household per year (Kunwar 2008). These three types of costs amount to a total of NPR 26,873 per household. Though the actual level of payment depends on the negotiation between the service providers and the beneficiaries, considering the total value of the watershed service and the opportunity cost incurred by the services providers, the payment should be higher than NPR 27,000 per household for the upstream community and lower than NPR 62,000 per ha for the electricity and water companies (Khatri et al. 2011).

Scope for PES in SNNP

Shivapuri Nagarjun National Park (SNNP) is the only PA that lies close to the capital city in Nepal. The national park is well recognized for its watershed services, where the water supplied accounts for one-third of the drinking water supply to Kathmandu Valley. The water coming out of the 1,576 ha of Sundarijal catchment, 400 ha of which is farmland and the rest is protected forest, is used for irrigation, hydropower and drinking water (Khatri et al. 2011). Apart from the consumptive use, water supplied from the watershed is used for other purposes like small-scale hydropower generation (4.77 GW), irrigation, small mineral water companies, and other purposes in the downstream. Besides, the park has been generating other valuable services like biodiversity conservation and scenic beauty.

A feasibility study carried out by ForestAction and Integrated Centre for Mountain Development (see Figure 2) showed that there is a high probability of initiating a PES scheme in the region. Till date, the water services are being used for free by KUKL, though the company generates revenue from the ultimate users of the service i.e. Kathmandu dwellers, whereas the national park and local communities incur the cost of conservation. In addition, there are other costs that the local communities have to bear due to restrictions imposed on the utilization of

Figure 2: **Map of SNNP showing the study area**

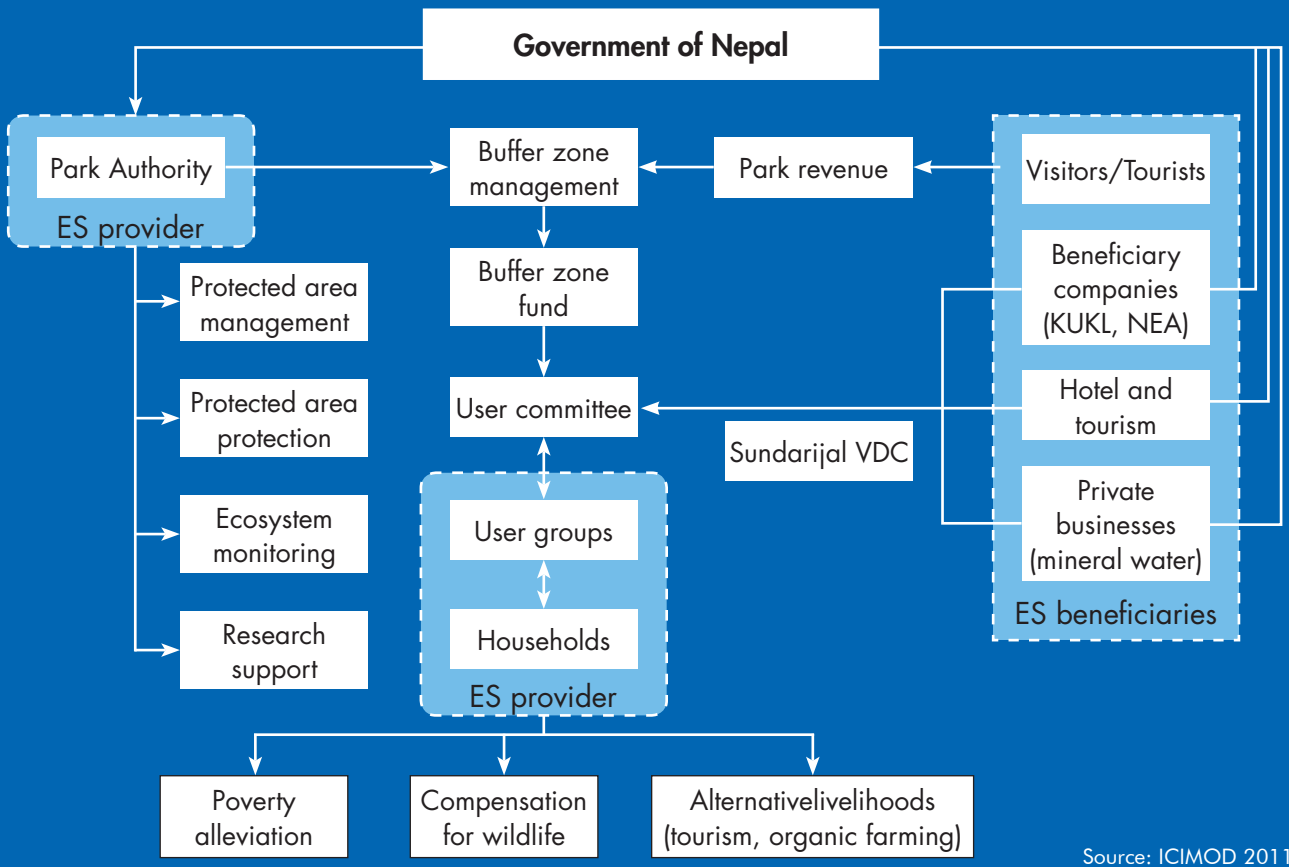


the forest products by the park authorities. People residing in the villages within the PA are already economically disadvantaged; on top of this, they suffer losses due to the damages to their livestock and agricultural products by wild life. With few livelihood options, local people have resorted to making alcohol, using fuelwood collected from the protected area (both being illegal within the park) (ICIMOD 2011). As the actors (beneficiaries and service providers) are clearly defined and the ecosystem service and its value are clearly identified, there is scope for initiating PES in SNNP.

Possible Institutional Arrangement for PES in SNNP

Various institutions have different stakes and interests regarding PES in SNNP. For instance, the beneficiaries of the water service generated by the Sundarijal watershed are Kathmandu Upatyaka Khanepani Limited (KUKL) - the sole supplier of drinking water in the valley, Nepal Electricity Authority (NEA), Kathmandu dwellers, downstream farmers, downstream inhabitants, and small mineral water companies. Among these, KUKL and NEA use the bulk of the water supplied and are the organized consumers of the service. On the other hand, as the owner of the park, SNNP, under the Department of National Park and Wildlife Conservation (DNPWC), and the local communities residing within the park are the providers of the service. Besides defining the key actors (providers and users of the services), various aspects like how the payment is carried out, monitoring on the compliance of rules and actual enhancement of the services need to be taken into consideration. In addition, the provisions of Buffer Zone Management program can provide lessons for the PES institutional arrangement. One mode of initiating PES mechanism would be by collecting payment from different beneficiaries of the service including water distribution companies, hydropower companies, tourism sector, and downstream industries like mineral water companies. The payment that would come from such a mechanism would help provide economic incentives to local people to assist in conservation and park management, reduce conflict between park authorities and local communities, and introduce organic farming in the watershed, among others. Figure 3 shows the possible institutional setup for PES in SNNP.

Figure 3: **Possible Institutional Arrangement for PES in SNNP**



Source: ICIMOD 2011

Way Forward

Developing a PES framework and putting it into practice in PAs is a new initiative in Nepal. As we do not have proper policy and legal provisions on PES, this initiative can be treated as a pilot that can help develop a necessary policy and legal framework in the future. We recommend the following tasks in order to promote PES in SNNP and PAs in general.

- Raise public awareness to garner support for the PES mechanism (understand the willingness to pay/accept)
- Review and develop policies to support PES in PAs in Nepal
- Clarify the roles and responsibilities of concerned stakeholders in PES
- Integrate PES with other ongoing initiatives, for instance, the activities of the high-powered committee for integrated development of the Bagmati watershed
- Piloting of PES schemes, and document and disseminate the processes and lessons with a wider audience

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Payment for Ecosystem Services: Private Sector Perspectives

Pradip Maharjan, FNCCI

Introduction of the Ecosystem /Services of use

Ecosystem services have no standardized definition but might broadly be defined as 'the benefits of nature to households, communities, and economies' or, more simply, 'the good things nature does'. Twenty-four specific ecosystem services were identified and assessed by the *Millennium Ecosystem Assessment*, a 2005 UN-sponsored report designed to assess the state of the world's ecosystems. According to the report, the broad categories of ecosystem services include food production in the form of wild crops, livestock and fish, and in the form of fibre, hemp, nettle, natural medicines, fresh water and air. See Table 5 below:

Table 5: **List of eco-services that are in most common use**

S. No.	Products	S. No.	Products
1.	Fisheries, aquaculture	13.	Fresh water
2.	Wild Foods/grains	14.	Air
3.	Fibre, cotton and hemp, silk	15.	Climate
4.	Timber	16.	Soil
5.	Fruits	17.	Educational
6.	Pests	18.	Pest
7.	Pollination services	19.	Pollination
8.	Crops	20.	Spiritual
9.	Livestock	21.	Religious
10.	Genetic resources	22.	Aesthetic value
11.	Biochemicals	23.	Recreation
12.	Natural medicines, and pharmaceuticals	24.	Ecotourism

However, among these 24 services, the 'big three' are currently receiving the most money and interest worldwide. The demand for these services is predicted to continue growing.

Opportunities in commercialization

A seminal article in the 1997 issue of Nature magazine estimated the annual value of global ecological benefits at USD 33 trillion, which was nearly twice the global gross product at the time.

In Nepal's context, there are ample opportunities to make commercial use of resources while maintaining their sustainability. These opportunities are outlined below:

- Over 80% of mountain ecosystem service providers exist in Nepal (ANSAB report 2006).
- There is a broad base of service receivers (local, regional, global); even in the Gangetic plains—500 million population
- PES is an increasingly recognized concept in Nepal; appreciation of the services
- Current estimates show Nepal has approximately 40,000 MW of economically feasible hydropower potential.
- Potential to develop irrigation facility for 1,766 thousand hectares out of the total 2,640 thousand hectare of agricultural land in Nepal (MOAD).
- Existing and emerging international concerns/demand and efforts to create an effective institutional framework can bring about a conducive environment for PES.

However, despite these opportunities, the country has not been able to harness the water resources to produce more power. Nepal generates only 600 MW of electricity and has irrigation facility for up to only 1,766 hectares.

Issues related to the PES

3(a) Ownership Usury/ Rights: The country's resources legally belong to the state. However, local dwellers have been claiming their usury rights. Moreover, the Community Forestry Act of Nepal has granted Community Forest User Groups legal right for sustainable use of forest resources.

Local government authorities like VDC and DDC impose tax on the extraction of natural resources of sand, stone and forest products in accordance with the Local Governance Act. The central government imposes tax on the forest products as royalty. As natural resources are owned at multiple levels, owners do not prioritize judicious and sustainable use of resources.

3(b) Sharing of the ecosystem services: Present ecosystem service users can be broadly categorized as:

- Upstream users
- Downstream users
- Licensed hydropower companies
- Licensed construction companies
- Hotels, resorts, trekkers/associations, mountaineers
- User groups including CFUGs, clubs, activists

3(c) Who pays whom:

Nepal does not have laws and regulations specifying who pays whom for the use of eco services. Payment for ecosystem services has so far existed in the following forms:

Permits and Fees: Licensed hoteliers, resort owners, trekking and travel associations, mountaineers pay the fees and hydro power companies pays a royalty and other taxes to local and central government – e.g., a royalty of NPR 5 per unit as a license fee. Local people also receive other benefits such as employment and free education, and the hydropower companies provide them free power. Hydropower contractors also make donations and support local clubs and community-based organizations.

Upstream communities who live near the natural resources are more privileged in terms of using the resources than the downstream users. There are no clear legal provisions on the use of resources and benefit sharing. It is basically dependent on the bargaining capacity of the payers and recipients.

Way forward

From the aforementioned situation, it is clear that Nepal needs a national policy to address the issues of PES. Laws and regulations need to formulated to implement the policy once it is made. The following issues need to be addressed before the situation gets worse.

a. Creation of a national policy
b. Awareness building at the national level including among nearby resource dwellers and private sector industries
c. Establish a mechanism for the PES including a mechanism for resource sharing at the local level.
d. Revise the existing royalty/tax system to motivate the PES implementation at the local and business level, e.g., tax incentives, sharing the revenue at the local level, etc.
e. Form a national policy on ecosystem management.
f. Agreed principle – political commitment of the government
g. Establish a regulatory mechanism for payment of ecosystem services
h. Increase awareness and understanding among stakeholders and local communities.
i. Establish a one-window mechanism to render the all PES taxes and charges.

To strengthen the capacity of the institutions engaged in the PES, agencies like ICIMOD and WWF could support the government of Nepal in establishing linkages with regional and international research institutions. Nepal is already blessed with rich natural resources; what we need now is judicial and sustainable use of those resources. The government of Nepal should take steps to ensure this in collaboration with the private sector so that the nation can harness its resources for the benefit of the entire population.


Government of Nepal
Ministry of Forests and Soil Conservation
Department of Soil Conservation and Watershed Management
NATIONAL WORKSHOP ON PAYMENT FOR ECOSYSTEM SERVICES
Opportunities and Challenges in Nepal
Venue: Yeti Shankar, Lazimpat | Date: 18-19th September, 2014
ICIMOD
IUCN
WWF

Session III

PES Case Studies

Payment for Ecosystem Services (PES) in Mid-Marsyangdi Sub-Watershed
Pabitra Jha, Care-Nepal

Payment for Ecosystem Services: Protected Area and Biodiversity Conservation
Hari Bhadra Acharya, Department of National Parks and WIldlife Conservation

Land Use Change-Water-Sediment-Power: Case of Kulekhani Hydropower Project
Wahid S.M, ICIMOD; Shrestha Harshana

Summary

The entire session dealt with the collection of PES case studies conducted in various areas. Like in other sessions, four papers were presented, mainly covering the assessment of PES in hydropower, lessons learned from collective action, cases of payment for biodiversity in protected areas, and a study linking science to policy. Pabitra Jha presented a case of PES in Mid Marshyangdi Watershed. She talked about the potential PES model and institutional setup in the watershed. Reiterating that PES is a new concept, she said that it is challenging to explain it to local people, and therefore, it is necessary to hold further consultations with a larger audience. She said that the current paying mechanism exists in the form of tax, and stressed the need for a national PES policy. She further elaborated on the crucial role of local organizations in addressing issues of willingness to pay and equitable benefit sharing.

Dr Dharma Raj Uprety from MAFP presented a paper that focused on the use of incentive based approach in building environmental sustainability and fostering livelihoods. The paper was mainly based on lessons learned from the PES pilot carried out by Multi Stakeholder Forestry Programme. Explaining the demarcating criteria of PES, PES-like mechanisms and other economic incentives, he said that the status of PES in Nepal remains unclear, and stressed the need to enhance understanding of PES issues. Dr Uprety discussed the overall objectives, indicators, and preparation process of PES, and discussed the role of MSFP as a moderator in the whole process. Finally, he presented the case study of FUG in Dang to illustrate the success of the initiative carried out by MSFP in collaboration with Rupantaran Nepal.

Hari Bhadra Acharya presented the key components of the PES mechanism, including its valuating techniques, and PA-related policies that address PES in Nepal. He demonstrated the comparative valuation of income and revenue from different protected areas in Nepal. Highlighting the importance of the economic valuation process, he recommended increasing the park funding through ecosystem service assessment. He emphasized identification of potential beneficiaries (global communities for biodiversity and carbon sequestration, municipality for water quality) of ecosystem services and exploring funding opportunities in the PA system. Finally, like other presenters, he, too, spoke of the need to provide economic incentives for a participatory conservation programme.

Harshana Shrestha presented the water-based valuation carried out by using a unique tool involving different land use change scenarios. She said there is a need to value all ecosystem services to come up with accurate payment allocation.

Payment for Ecosystem Services (PES) in Mid-Marsyangdi Sub-Watershed

Pabitra Jha, Care-Nepal

Background Information

Hariyo Ban Program is a USAID funded program with a major goal to reduce adverse impacts of climate change and threats to biodiversity. There are three key objectives of the program: reduction of threats to biodiversity; ensuring effective sustainable landscape management with strong emphasis on reducing emissions from deforestation and forest degradation (REDD+); and increasing capacity to adapt to adverse impacts of climate change. Livelihood, governance, and gender and social inclusion are the three crosscutting themes of the program. PES is one of the mechanisms to promote sustainable landscape management. Hariyo Ban Program aims to initiate PES piloting in its working areas. Recently a preliminary assessment for piloting PES was done in Lamjung, one of the working districts of Hariyo Ban Program with enough natural resources. The assessment aimed to review PES relevant national and international policies and practices, provide comprehensive information on existing ecosystem services, their prioritization and valuation, along with recommendations on possible strategies or models for PES initiatives in Lamjung.

Project Area

The PES project area lies within the mid-Marsyangdi sub-watershed area. The sub-watershed is situated between the longitudes of 83° 46′ 28.60″E to 84° 38′ 13.82″E and the latitudes of 28° 9′ 27.63″N to 28° 53′ 49.33″N. It covers an area of 302,143 ha, and extends across Gorkha, Kaski, Lamjung, Manang, Mustang and Myagdi districts of Nepal, while a small part of it also extends beyond the boundary of Nepal. The major portion of the watershed falls under Manang (76.54%) and Lamjung (22.52%) districts. The bulk of land in the area is barren (see Table 6).

Table 6: **Key features of Mid-Marsyangdi watershed area**

Key Features	Description
Total area (ha)	302,143
Coverage	Gorkha (0.21%), Kaski (0.55%), Lamjung (22.52%), Manang (76.54%), Mustang (0.13%), Myagdi (0.02%), and outside of Nepal (0.03%)
Main River	Marsyangdi
Altitude (m)	602.29 to 7,954.62
Average Annual Temperature (°C)	-15.6 to 21.7
Average Annual Rainfall (mm)	374 to 3,171
Land Use Pattern	Agriculture (1.84%), Barren Land (28.16%), Forest (15.30%) Grassland (10.15%), Settlement (0.01%), Grassland (18.46%), Snow (24.26%), Water (0.22%)
Mountains	Annapurna II (7,939 m), Manasalu South (7,937 m), Buddha Himal (6,674 m), Himalchuli (7,647 m) and Lamjungchuli (6,988 m)
Major tourist attractions	Mountaineering, Ecotourism, Trekking and Honey Hunting

Methodology and Key Findings of the Preliminary Assessment

Data required for the preliminary assessment were compiled during formal and informal stakeholder consultations, meetings, and key informant interviews, and from existing databases and other secondary sources. The data thus compiled were processed and then fed into *InVEST model suite* for ES mapping and valuation, particularly water

yield and sedimentation. The study concluded that there is no specific policy at the national level that addresses PES in Nepal. In this context, the experience gathered from PES piloting will undoubtedly contribute to PES policy formulation.

During the assessment, important ecosystem services available in the mid-Marsyangdi sub-watershed were identified through consultations at the village development committee (VDC) level and district level. The identified ecosystem services were prioritized as follows:

Table 7: **List of Ecosystem Services identified during the stakeholder consultations**

List of Ecosystem Services			**Rank**
VDC level stakeholder consultation (Khudi)	**VDC level stakeholder consultation (Udipur)**	**District level stakeholder consultation (Besishahar)**	
Hydropower production	Hydropower production	Hydropower production	1st
Tourism	Non-timber forest products	Tourism	2nd
Non-timber forest products	Tourism	Non-timber forest products	3rd
Agriculture products	Sand and gravel	Soil conservation	4th
Biodiversity	Soil conservation	Transhumance system of livestock rearing	5th
Soil conservation	Carbon sequestration	Horticulture	6th
Timber and fuelwood	Honey production	Commercial management of forests	7th
Carbon sequestration	Mineral	Conservation and protection of endangered indigenous agriculture species	8th

Based on the results, hydropower production and tourism are the top two ecosystem services identified in the mid-Marsyangdi sub-watershed.

For the effective valuation and mapping of ESs, Mid-Marsyangdi Watershed was divided into five sub-watersheds during the assessment. The total annual water yield of Mid-Marsyangdi sub-watershed is 1,253.78 million cu. m. /year i.e., 4,149.65 cu. m. / ha (see Figure 4).

The assessment indicates that sub-watershed 5 (see Figure 5, Figure 6) is of highest priority owing to its sediment retention capacity (10,708.45t/ ha) and sediment export (42.11t/ha). The higher sediment export from the southern sub-watershed can be attributed primarily to the higher rainfall and secondarily to the higher concentration of agricultural land in the area.

The overlay of VDC boundaries onto the sediment export map showed that Bahundanda, Bajhakhet, Balungpani, Bansar, Besishahar, Bhujung, Bhulbhule, Chandisthan, Chiti, Gaunshahar, Ghanpokhara, Hiletaksar, Khudi, Nalma, Puranokot, Simpani, Taghring, Tarku, Udipur, and Uttarkanya VDCs that fall under sub-watershed 5 are losing maximum amount of soil i.e., 42.11 t/ha/yr). However, the result has does not take into account ongoing construction works or other disturbances like landslide

Figure 4: **Mean annual water yield in cubic metre per hectare per sub-watershed**

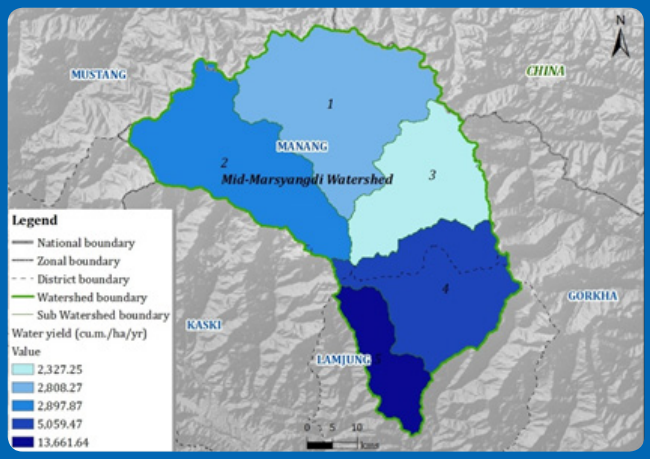
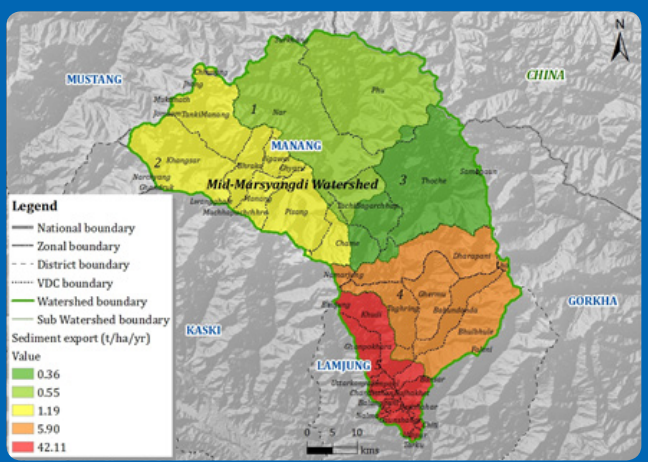
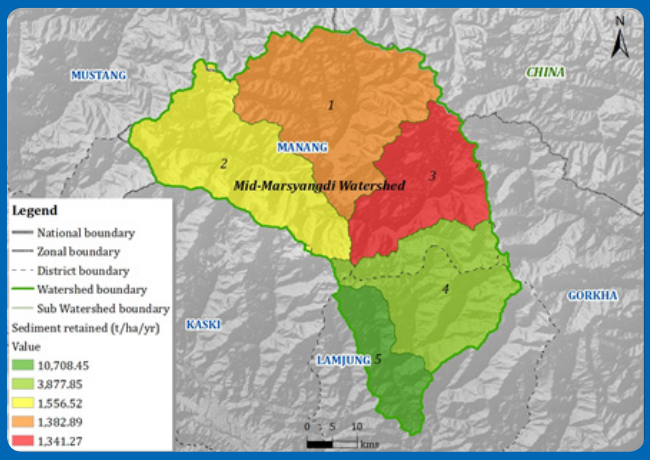


Figure 5: **Mean annual sediment export in tons per hectare per sub-watershed**



in the project area, which may have significantly contributed to soil loss. Ghermu VDC is one of the most vulnerable VDCs, considering the landslides and other unplanned construction works that have increased sediment load in the mid-Marsyangdi River. Therefore, during consultations, the stakeholders also suggested placing this VDC in the priority zone for Pressure State Response (PSR) implementation. The '21 VDCs' delineated as the project area for PSR hence includes Ghermu VDC, along with the aforementioned 20 VDCs.

Figure 6: **Mean annual sediment retention in tons per hectare per sub-watershed.**



Rationale for PSR

Currently, three hydropower projects, namely, Khudi Khola, Mid Marsyangdi and Siuri Khola are in operation in Mid-Marsyangdi Watershed. They have potential to produce a total of 454.38 GWhr of electricity annually, which is equivalent to NPR 3057.98 million. Apart from these three hydropower projects, two new hydropower projects, namely, Radhi Small and Upper Marsyangdi A, are under construction, and several other projects are in the pipeline. This clearly indicates the huge potential of Mid-Marsyangdi Watershed in terms of hydropower production.

However, the increasing sedimentation problem in the Mid-Marsyangdi River thwarts this potential. Records from the Mid-Marsyangdi Hydropower Project showed an increasing trend in silt at intake. This is causing serious damage to the runner blades and other turbine components. In the last fiscal year i.e., 2069/70 v.s. alone, Mid-Marsyangdi Hydropower Project spent more than NPR 8,000,000 in maintenance (Mid-Marsyangdi Hydropower Project records) of dam site equipment and the turbine components. With the increase in the sediment load in the Marsyangdi river, this expense is likely to increase in future.

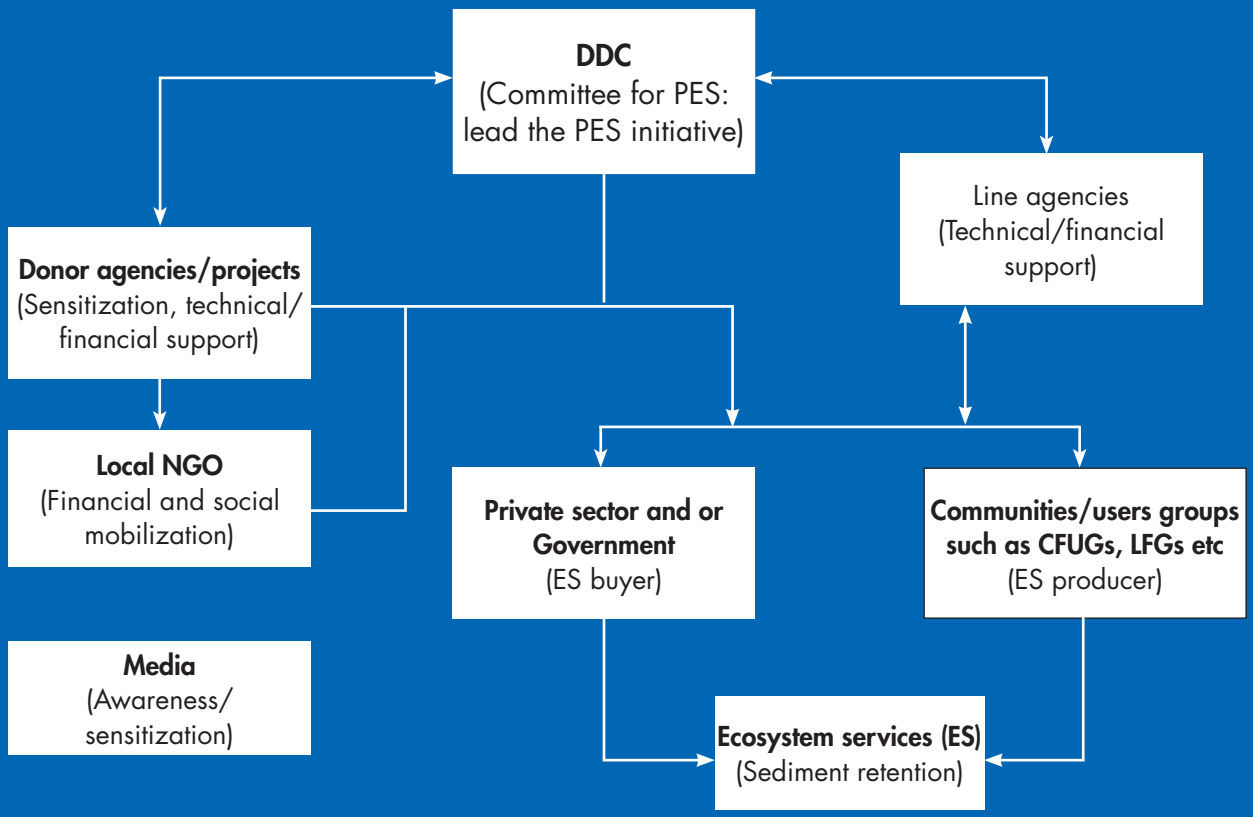
To address this situation, it is important to carry out conservation initiatives in the upstream area from where the sediment load is coming. To implement such conservation activities, it is very important to provide certain incentives and create alternative livelihood options. At present, mid-Marsyangdi hydropower project is the prime beneficiary of sediment reduction. Therefore, payment from the side of the project would be the most effective way to continue the conservation activities in a sustainable way. Then, other hydropower projects and agencies that will receive benefits from sediment retention can also contribute to the payment later. This will help create a basket fund for the payment for sediment retention at the district level. Payment for ecosystem services, particularly sediment retention, is urgently needed in the mid-Marsyangdi sub-watershed area.

Updates on PES in Lamjung

Further, a model for the implementation of PES was designed considering the suggestions provided by the prelimnary assessment and the stakeholder consultations (see Figure 7). They identified sediment retention as a key ecosystem service for PES in the case of the Mid-Marsyangdi Sub-watershed area. Accordingly a number of activities have been recommended. They include:

- Proper implementation of activities prescribed by EIA and IEE undertaken during hydropower project development.
- Green belt along the road.
- Application of Sloping Agricultural Land Technology (SALT)
- Promotion of stall-feeding practices and improved livestock farming
- Block plantation in bare and vulnerable areas
- Promotion of organic farming and agro based tourism

Figure 7: **Potential PSR project implementation model in Mid-Marsyangdi sub-watershed**



However, implementing all these activities may not be plausible. Some of the activities should be prioritized according to their role in enhancing sediment retention. From the consultations with the stakeholders and implementing partners, it was learned that communities prioritize promotion of green belt and plantation in barren area as well as management of forest area for enhancing sediment retention in the priority zone of Mid-Marsyangdi watershed area.

A five-member key stakeholders committee representing the District Development Committee (DDC), District Forest Office (DFO), District Soil Conservation Office (DSCO), District Agriculture Development Office (DADO), and Federation of Nepal Chambers of Commerce and Industry (FNCCI) has been formed to discuss and decide on strategies. A local implementing partner for capacity building activities on PES has also been contracted as per CARE's partnership guidelines; the partner is sensitizing people on the PES in the priority area.

Challenges

As the PES is new concept for the stakeholders in the assessment area, there are challenges in implementing PES in the area. These are related to: building a common understanding among the stakeholders, delineating the PES project area, the hydropower project's willingness to pay an additional amount, equitable sharing of benefits among the poor and marginalized people, and the lack of national level PES policy are the experiences.

Payment for Ecosystem Services: Protected Area and Biodiversity Conservation

Hari Bhadra Acharya, Department of National Parks and Wildlife Conservation, Nepal

Background

Protected area is established primarily to achieve the goal of preserving important ecosystems and biodiversity. It provides an array of ecosystem goods and services having different kind of values—direct and indirect, use and non use, instrumental and intrinsic—for various groups of stakeholders, depending on the location.

The Millennium Ecosystem Assessment (MA, 2005) defines ecosystem services as the benefits people obtain from ecosystems; and they are broadly classified into four categories of *provisioning, regulating, supporting,* and *cultural* services. The term *ecosystem service* is used synonymously with environmental services or ecological services in many literatures.

Natural ecosystems provide a supply of direct and indirect services to the society, a nearly limitless set of valuable attributes; many of their services remain un-priced by the market (Hanley, Shogren, & White, 2007). Because ecosystem services are not fully captured in commercial markets or adequately quantified like economic services and manufactured capital, they are often given too little weight in policy decisions (Costanza, 1997).

Importance of Valuing the Ecosystem Services of Protected Area

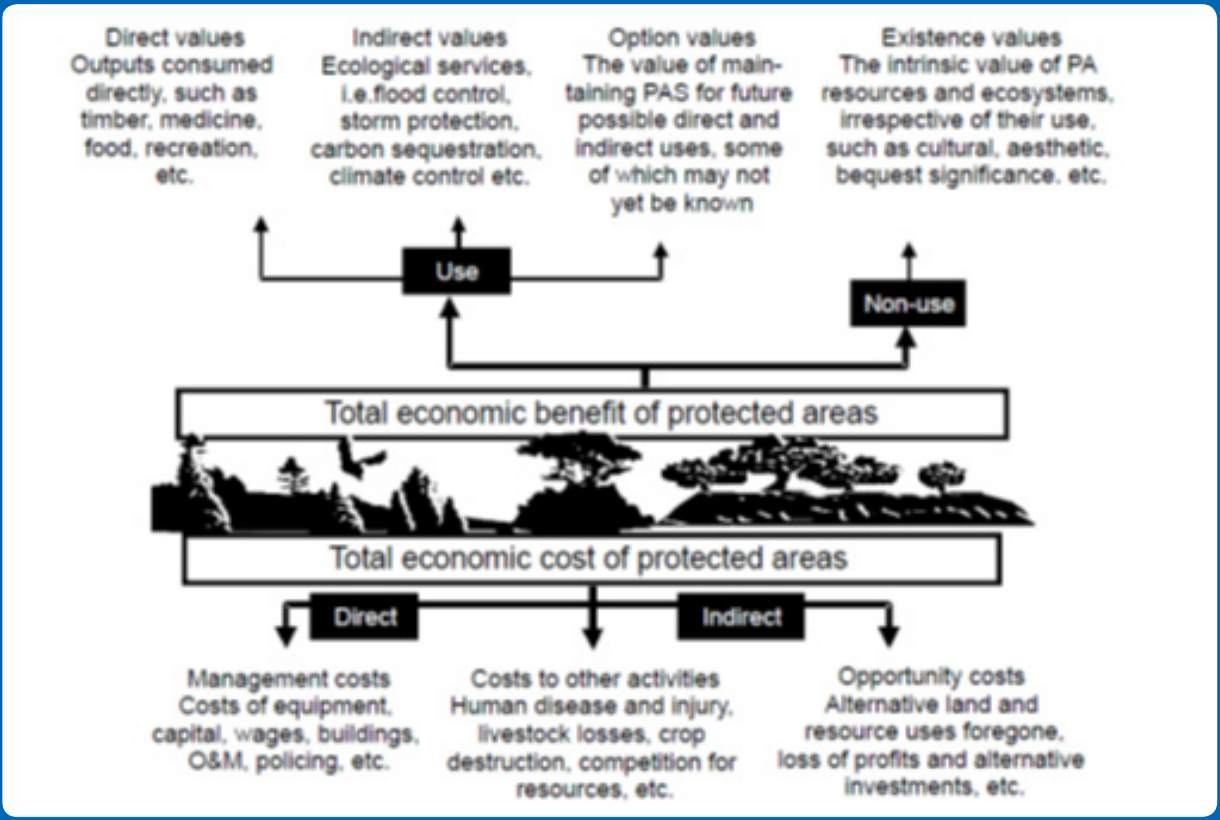
The funding sources of protected areas are increasingly under threat, especially in developing countries. When the budget is tight, the government does not prioritize investment in biodiversity conservation. The PA has multiple costs and benefits that can be analysed based on the economic value of specific ecosystem goods and services, and the cost for maintaining them; however, the stakeholders of the PA are less aware about their economic value. An effective management strategy would be to assess the costs and benefits and explore the potential investment opportunities in the conservation sector as well as to identify the incentives to address the neighboring community's social welfare issues. In fact, benefits from the protected areas are very high, compared to the cost of conservation. For example, Balmfold et al (2002) estimate that the overall *benefit: cost* ratio of the conservation of the remaining wild nature is at least 100:1.

Knowledge of the total economic value (TEV) of conservation programmes can provide a useful conceptual framework for estimating the value of ecosystem services as well as for justifying the importance of biodiversity preservation. While considering the economic value of PA, it is important to include both the economic cost and economic benefit as shown in Figure 8.

On the other hand, the local people might have been facing problems such as human and wildlife conflict, restrictions against using forest resources, limited access to roads and other social services. Supporting local community through buffer zone programmes can be one of the economic incentives. This would ensure sustainable resource utilization while maintaining the ecological integrity, with communities receiving financial support from the revenue collected by the protected areas.

Further, valuation of ecosystem services of PA can help build awareness at the local, regional, and global level and garner additional funds and political support. The beneficiaries of the protected areas, such as urban water consumers and hydropower, tourism, and other industries do not contribute to the management of protected areas. Nor do they provide compensation to the local communities who are often disadvantaged when their area is designated a PA. They face various problems such as economic damage to their crops and properties

Figure 8: **Total Economic Value Framework**



Source: ICEM, 2003

by wildlife and limited road access to markets, hospitals, and other facilities. In economic terms, this is a market failure (ICIMOD, 2011). The economic valuation provides an important basis for garnering support from all the stakeholders for and for exploring the potential opportunities of sharing the costs and benefits of the protected areas.

Valuation Methods

Various techniques are available for economic valuation of ecosystem services. These techniques are either observed behaviour (revealed preferences) toward some marketed good with a connection to the non-marketed good of interest, or stated preferences (during surveys) with respect to the non-market goods (Carson, 1999). Table 8 summarizes the main techniques applied for the valuation of ecosystem services.

Recommendation

When locals are subjected to restrictions on land and natural resources use after the establishment of the park, they should be provided economic incentives as compensation for resources they have been barred from using. The lack of such an arrangement is the root cause of conflicts between locals and park personnel. Local people can pose a big threat to the success of the protected area system if their preferences are not considered in policy decisions. The economic valuation can help analyse local preferences and estimate the value of ecosystem services quantitatively. The results obtained from the valuation can be used for advocating for additional support for ensuring sustainable management of the protected area.

Policy decision makers should have knowledge of specific ecosystem services and their spatial and temporal dimensions to understand how it is distributed, who are getting benefits and who are under pressure from

Table 8: **Techniques of Economic Valuation**

Methodology	Approach	Applications	Data Requirement	Limitations
Revealed preference methods				
Production function (also known as 'change in productivity')	Trace impact of change in ecosystem services on produced goods	Any impact that affects produced goods	Change in service; impact on production; net value of produced goods	Data on change in service and consequent impact on production often lacking
Cost of illness, human capital	Trace impact of change in ecosystem services on morbidity and mortality	Any impact that affects health (e.g., air or water pollution)	Change in service; impact on health (dose-response functions); cost of illness or value of life	Dose-response functions linking environmental conditions to health often lacking; underestimates, as omits preferences for health; value of life cannot be estimated easily
Replacement cost (and variants, such as relocation cost)	Use cost of replacing the lost good or service	Any loss of goods or services	Extent of loss of goods or services, cost of replacing them	Tends to overestimate actual value; should be used with extreme caution
Travel cost method (TCM)	Derive demand curve from data on actual travel costs	Recreation	Survey to collect monetary and time costs of travel to destination, distance travelled	Limited to recreational benefits; hard to use when trips are to multiple destinations
Hedonic pricing	Extract effect of environmental factors on price of goods that include those factors	Air quality, scenic beauty, cultural benefits	Prices and characteristics of goods	Requires vast quantities of data; very sensitive to specification
Stated preference methods				
Contingent valuation (CV)	Directly ask respondents their Willingness to Pay (WTP) for a specified service	Any service	Survey that presents scenario and elicits WTP for specified service	Many potential sources of bias in responses; guidelines exist for reliable application
Choice modeling	Ask respondents to choose their preferred option from a set of alternatives with particular attributes	Any service	Survey of respondents	Similar to those of CV; analysis of the data generated is complex
Other methods				
Benefits transfer	Use results obtained in one context in a different context	Any for which suitable comparison studies are available	Valuation exercises at another, similar site	Can be very inaccurate, as many factors vary even when contexts seem 'similar'; should be used with extreme caution

Source: Pagiola, et al., 2004. Assessing the Economic Value of Ecosystem Conservation

conservation efforts. The valuation can help garner funds by demonstrating that the benefits of ecosystems are higher than the cost of conserving them. This can also help convince the stakeholders to promote conservation and decision makers to allocate more resources for conservation.

The future of the park depends on the support of the growing population in the surrounding area. The existing policy instruments were developed without consulting local residents; however, people who depend on subsistence agriculture need to be provided compensation when their access to resources is curtailed. The PA has a wide range of values which often generate more benefits than the costs to manage it if its total economic value provided by ecosystem goods and services are properly evaluated.

PAs are reliable carbon stores as forests in the protected areas are strictly protected. Therefore, one of the sources of funding can be carbon trades being carried out in the international market under the global climate change conventions and treaties. Moreover, current revenues of the park collected from the entrance fee, recreational

tourism and other sources can also be recycled to fund PA management and community development through the PES mechanism.

There is a need to identify the beneficiaries for potential funding opportunities and to develop funding mechanisms for the management of protected areas based on successful lessons in PES from other countries such as Costa Rica and Mexico, as well as carbon trade under reduced emissions from deforestation and the forest degradation (REDD+) framework.

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Land Use Change-Water-Sediment-Power: Case of Kulekhani Hydropower Project

Shahriaar M. Wahid[1] *and Harshana Shrestha*[2]

[1] International Centre for Integrated Mountain Development, GPO Box 3226, Kathmandu, Nepal, Shahriar.Wahid@icimod.org

[2] Asian Institute of Technology (AIT), harshanashrestha@gmail.com

Abstract

Hydropower production can be strongly affected by land use change in the upland catchment. This study aimed to quantify basin flow and sediment yield due to land use changes, and the resultant effect on hydropower production and revenue in the Kulekhani basin in Nepal. Possible future land use scenarios with conversion of forest land, agricultural land, and barren land were developed based on past trends. A hydrological model SWAT was developed to simulate the land use change scenarios. The model results for flow were then simulated in the reservoir simulation model Hec-ResSim to obtain power output. Power outputs and revenue for the different scenarios were compared with the baseline case.

Keywords: *Land use change, Hydrology, Runoff, Sediment, Hydropower*

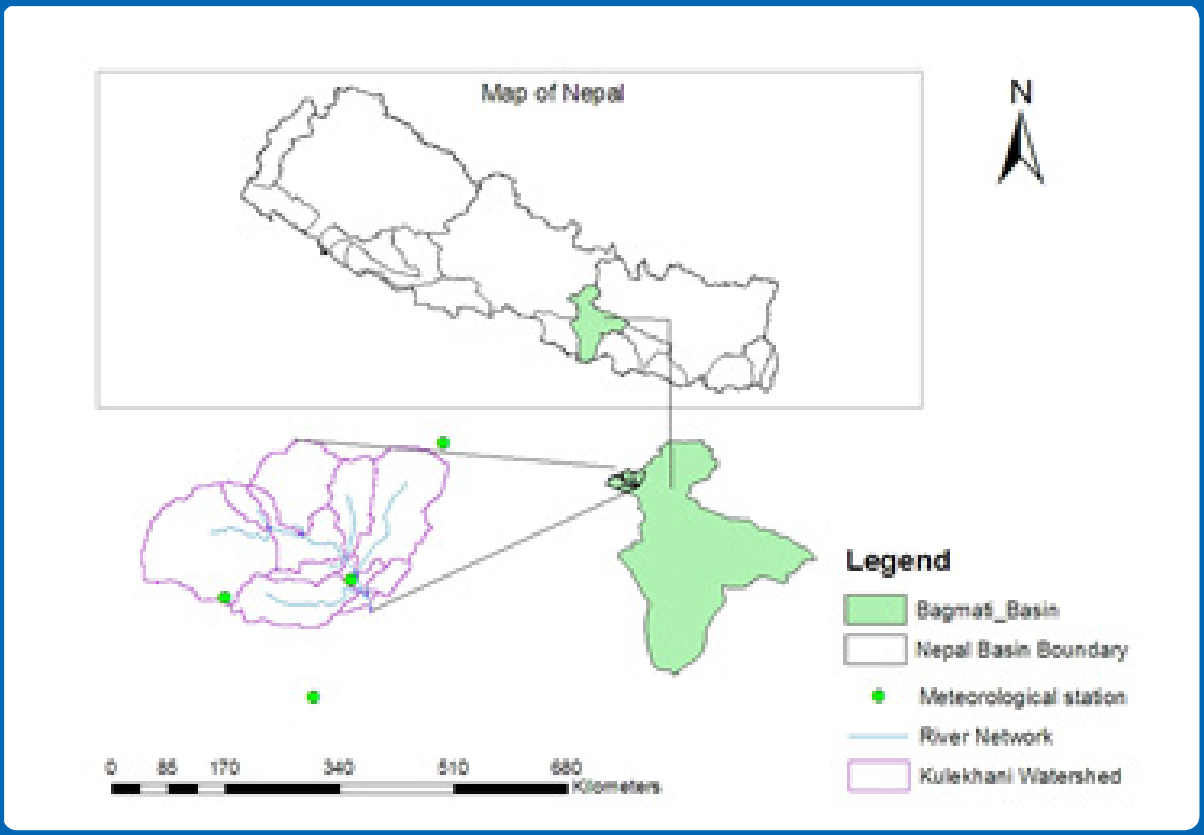
Introduction

In Nepal, meeting the electricity demand remains a major challenge for the government, with planned power outages a regular feature of daily life. Theoretically, hydropower potential is high, but remains to be realized in practice. Most of the hydropower projects in operation are 'run of the river' projects, which are affected by low flows in the dry season as around 80% of annual rainfall falls in the four months of the summer monsoon. In contrast, the Kulekhani scheme is fed from a reservoir, and is designed to contribute in meeting peak electricity demand, especially in the Kathmandu Valley. Although they avoid problems of low flow, reservoir schemes face problems of siltation. The Kulekhani river, a major tributary of the Bagmati river, is the main source of water for the Kulekhani reservoir. However, deposition of sediment transported from the upstream basin area threatens existing and future water resource development for the Kulekhani hydropower project. Excessive siltation can result in a rapid reduction in reservoir volume, which reduces the potential energy production. A greater understanding of soil erosion and sedimentation mechanisms, potential impacts of changes on hydropower production, and possible mitigation measures is essential for the sustainable development of water resources in the region. The present study aimed to quantify basin flow and sediment yield due to land use changes, and the resultant effect on hydropower production and revenue, in the Kulekhani basin in Nepal using a hydrological model and a reservoir simulation model.

Study Area

The Kulekhani watershed has a total area of 126 km^2, of which 118 km^2 contributes flow to the Kulekhani reservoir (Figure 9). The Kulekhani river is a major tributary of the Bagmati, which it joins 9 km downstream of the Kulekhani reservoir. The elevation in the watershed ranges from 1,534 masl at the dam site to 2,621 masl at the peak of Simbhanjyang in the southern part of the watershed. The major tributaries in the watershed are the Palung and Chitlang rivers. The climate is subtropical at lower elevation and temperate at higher elevation. The average annual rainfall is 1,239 mm, with almost 80% of rain falling in the rainy season (June–September), which is the time of maximum seasonal flood. The temperature ranges from 20 to 27°C in summer and 10 to 15°C in winter.

Figure 9: **Location of the Kulekhani watershed**



Soil and Water Assessment Tool (SWAT)

The Soil and Water Assessment Tool (SWAT) is a physically based model for simulating continuous time landscape processes at a catchment scale (Arnold et al., 1995; Neitsch et al., 2005). The catchment is divided into hydrological response units (HRUs) based on soil type, land use, and slope classes that allow a high level of spatial detail simulation. The major model components include hydrology, weather, soil erosion, nutrients, soil temperature, crop growth, pesticides, agricultural management, and stream routing. The model predicts the hydrology at each HRU using water balance equation, which includes daily precipitation, runoff, evapotranspiration, percolation, and return flow components. Surface runoff is estimated by two methods: the Natural Resources Conservation Service (NRCS) curve number (CN) method (USDA-SCS, 1972), and the Green and Ampt method (Green and Ampt, 1911). The percolation through each soil layer is predicted using storage routing techniques combined with a crack-flow model (Arnold et al., 1995). The flow routing in the river channels is computed using the variable storage coefficient method (Williams, 1969), or Muskingum method (Chow, 1959).

Hec-ReSim

Hydropower generation was computed using the reservoir simulation model Hec-ResSim with the runoff for different scenarios from the SWAT simulation. This model can provide reservoir simulation under various operational policies for river routing, water allocation, and flood control. It comprises a graphical user interface, data storage and management, a computational programme for reservoir operation, and reporting facilities and graphics. It has three main modules: watershed setup, reservoir network, and simulation. Storage and retrieval of input/output time series data is performed by the data storage system (DSS) HEC-DSS Vue. Hydropower generation under different land use scenarios, which was computed using Hec-resSim, was compared with the existing generation.

SWAT model setup for Kulekhani Watershed

The SWAT model inputs include a digital elevation model (DEM), land use map, soil map, and weather data. The ArcGIS interface of the SWAT 2009 version was used to discretize a watershed and extract the SWAT model input files. The DEM was used to delineate the catchment and provide topographic parameters such as overland slope and slope length for each sub basin, the catchment area of the Kulekhani was delineated and discretized into nine sub basins using 90m SRTM (Shuttle Radar Topography Mission) images. A land use map with 30m resolution and 14 land use classes was obtained from the International Centre for Integrated Mountain Development (ICIMOD) database. The land use classes were grouped into four land use types, namely forest, agriculture, water bodies, and barren land, the areal distribution (Figure 10).

The soil types in the study area were extracted from the ISRIC World Soil Information from Soil and Terrain (SOTER) database (Dijkshoorn et al., 2009), which has a resolution of 1:100,000 m. There are three soil types, each of which has soil properties given for three layers (0–30cm, 30–100cm and 100–182cm depth). The required soil parameters of each soil type were manually added to the model; their parameters were defined with reference to FAO soil database (Figure 11).

Daily precipitation and minimum and maximum temperature data from four stations (Figure 9) were interpolated spatially over the basin and used to run the model. There is no flow measurement station at the reservoir inlet point, thus the inflows were estimated on the basis of outflow from the reservoir and power production. The monthly reservoir inflow was calculated for 19 years for the average monthly power generation and average water level in the reservoir. The model was run for a 19-year period from 1984 to 2003. The period 1984 to 1986 was used as a warm-up to equilibrate the model between various water storages in the hydrological cycle (Guo et al., 2008). Flow was calibrated for 1995–2003 (nine years) and the validation period 1994 to 1987 (eight years). Sediment was then calibrated by simulating for the three months in 2003 for which field data were available. In order to overlap the date for sediment and flow calibration, the calibration period for flow was reversed.

Figure 10: **Land use map 1990 of Kulekhani watershed**

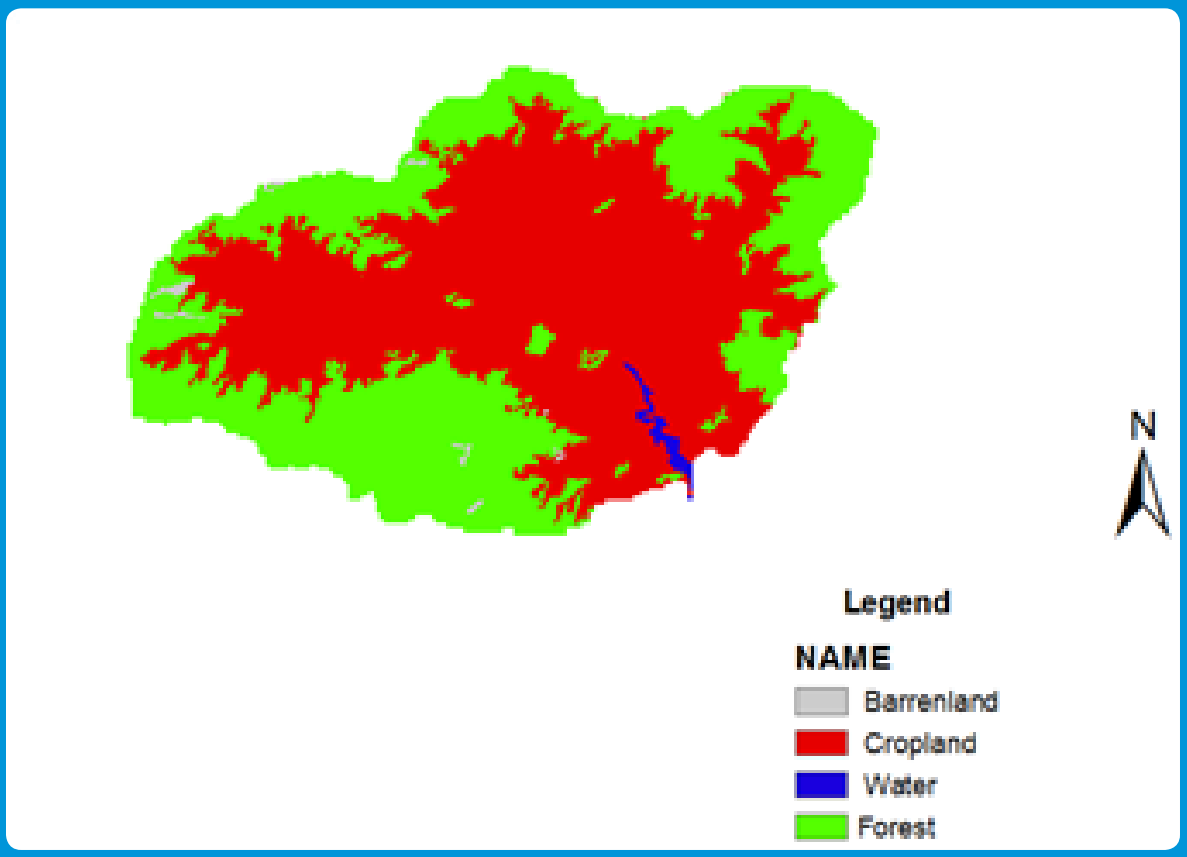
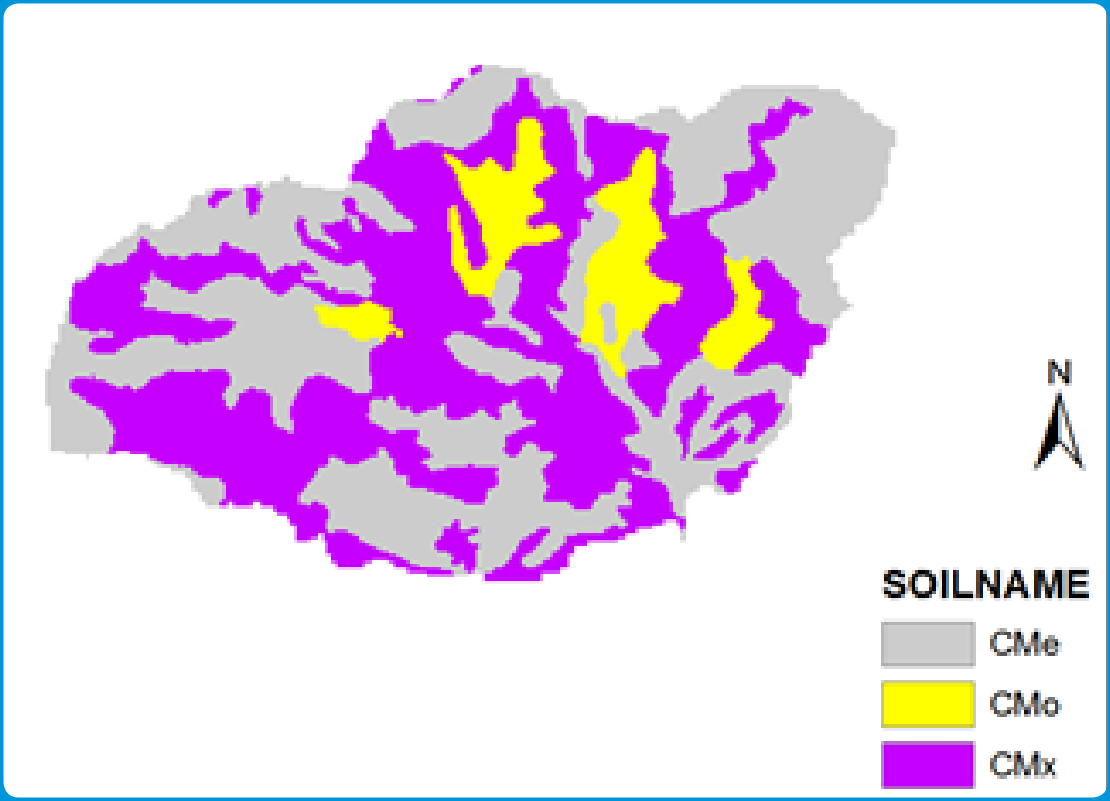


Figure 11: **Soil distributions in Kulekhani watershed from SOTER classification**



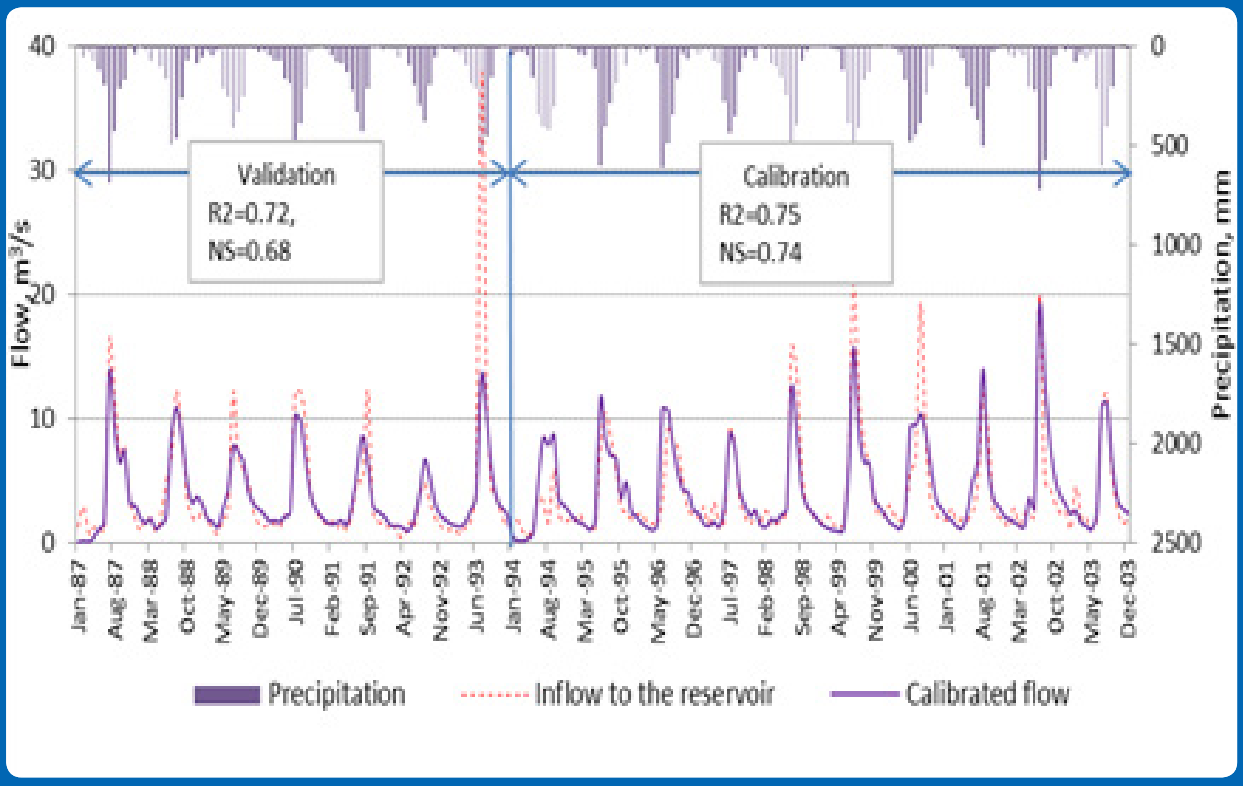
The model performance values were R2 = 0.75, NS = 0.74, and PBIAS = 4.73% (Figure 12). The peaks don't match except in 1997, 2001, and 2003, but apart from this the calibration performance was satisfactory. The errors in peak flow could be due to the observed (interpolated) precipitation data and/or due to errors associated with the calculations of reservoir inflow. In some years, for example, 1994, flow was over predicted, and in 1999 it was under predicted. In 1993, flow was markedly under predicted as a result of an extreme weather event in July, which resulted in flooding, due to which the observed flow was probably overestimated. The sediment data was simulated from the daily sediment data available from 8 June to 20 August 2003. The model calibrated from 8 June to 30 July and validated from 1–20 August 2003. The model followed the general pattern of sediment yield. Overall, the sediment yield was underestimated in the calibration period and overestimated in the validation period. The SWAT model uses Bagnold's equation, which calculates the maximum amount of sediment transported from a reach segment as a function of the peak channel velocity (Neitsch et al., 2005). The peak channel velocity is sensitive to the peak flow rate. Thus any inaccuracy in tracking peak flow will result in an inaccurate peak sediment yield.

The difference in the means for the calibration period was >10% and for the validation period <10%; the standard deviation for both the calibration and validation periods was greater than 10% of the value, and the Nash Sutcliffe (NS) value for both periods was>0.5, which means that the model is satisfactory.

Land use change scenarios

In order to demonstrate how changes in land use might affect flow and sediment yields, it was necessary to model possible land use change under different future scenarios in the watershed. The model was calibrated and validated using baseline land use scenarios and then run to simulate all land use change scenarios. Proposed land use change scenarios were grouped into three: agricultural land expansion, barren land expansion, and forest land expansion, with four scenarios in each group (Table 9). The land use area calculated under the different scenarios after 19 years is shown in Table 1.

Figure 12: **Inflow and Simulated flows at the reservoir inlet point, Kulekhani river with coefficient of determination (R2) and Nash-Sutcliffe efficiency (NSE) values**



Simulation results for land use change scenarios

Effects on Flow

The effects of land cover change on flow and sediment were derived by comparing model simulations for different land use scenarios with the simulation for the baseline period of 1984 to 2008. Conversion of half the area of forest land to agricultural land resulted in an increase in annual flow and rainy season flow, but decrease in dry season flow. This change is interpreted as resulting from the lower water loss by evapotranspiration from agricultural

Table 9: **Land use distribution under different scenarios**

Scenario	Forest area		Agricultural area		Barren land area		Water bodies area		Total area
	km²	%	km²	%	km²	%	km²	%	km²
S0	50.0	42	66.8	56	0.5	0.46	0.65	0.55	118
S1	25.0	21	91.8	77	0.5	0.46	0.65	0.55	118
S2	37.5	31	79.3	67	0.5	0.46	0.65	0.55	118
S3	37.5	31	66.8	56	13.	11.0	0.65	0.55	118
S4	66.7	56	50.1	42	0.5	0.46	0.65	0.55	118

Note: S0 = baseline scenario; S1 = fast forest conversion to agriculture scenario; S2 = slow forest conversion to agriculture scenario; S3 = forest conversion to barren land scenario; S4 = agricultural land conversion to forest land scenario

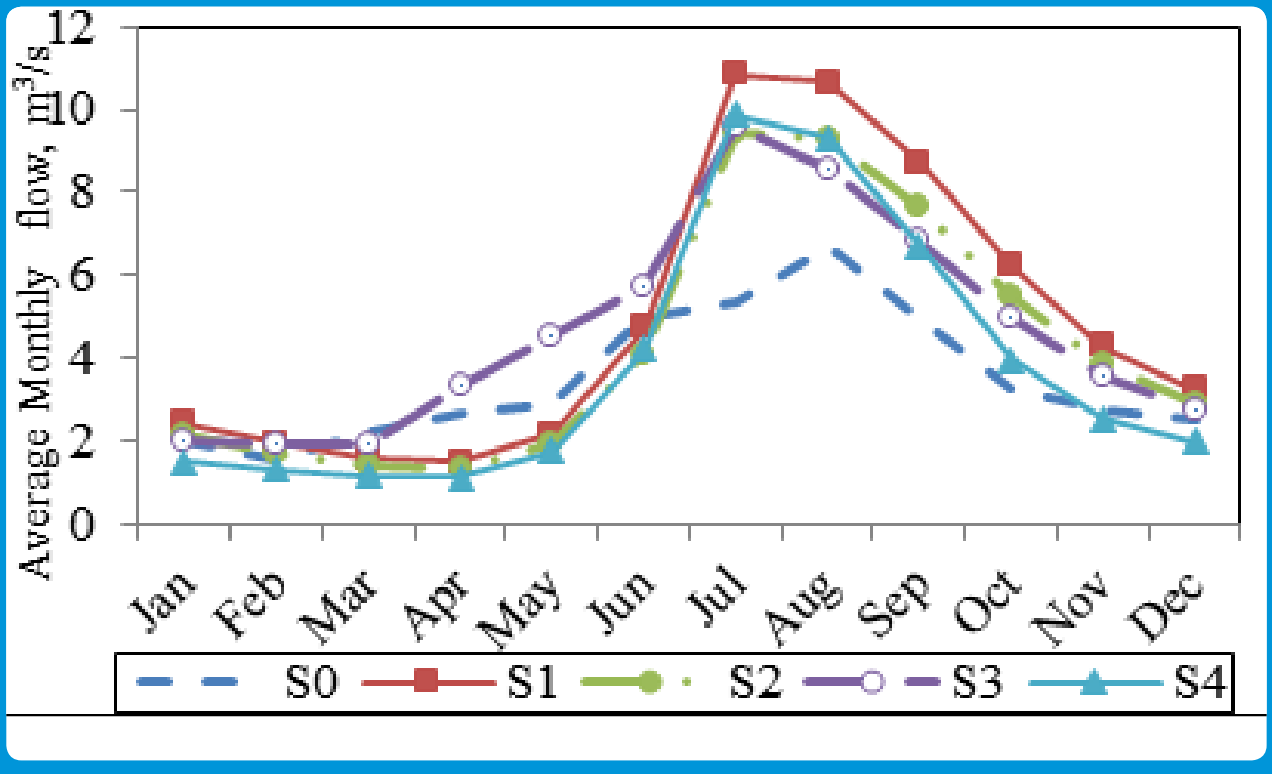
land than from forest land. Guo et al. (2008) suggest that the deeper roots of forest vegetation more easily draw up soil moisture, and at a faster rate, than the short roots of agricultural plants. Secondly, S2 conversion has resulted in increase in annual flow and rainy season flow, but decrease in dry season flow by a smaller amount than under S1. Third scenario S3 has resulted in increase in annual basin flow, rainy season flow, and dry season flow, resulting from the increase in curve number from 59 for forest land to 65 for barren land.

The average monthly flow for scenarios is shown in Figure 13. The results are similar to those found by Guo et al. (2008), reported a 22% increase in annual flow, 23% increase in rainy season flow, and 13% increase in dry season flow, following deforestation in a basin in which baseline forest area was about 50% of the watershed. Last scenario, S4, has resulted in decrease in annual flow, rainy season flow, and dry season flow. This is attributed to increased infiltration of soil due to the deep roots of large trees as well as reduction in large evapotranspiration, resulting from the loss of agricultural land.

Effect on sediment yield

Model simulation was also used to test the effect of land use change on sediment yield from the watershed. S1 conversion has resulted in a nearly 50% increase in annual sediment yield, with increases in both the rainy and dry seasons. The sediment is washed from the exposed agricultural land, which is no longer protected by the deep roots of large trees. The low bed resistance of agricultural land results in a high sediment yield. Secondly, for S2, results in an increase in sediment yield in both seasons and annually, but at a much reduced rate compared to S1. S3 also results in a high sediment yield annually and in both seasons. Barren land has a much lower bed resistance than forest land, which leads to high runoff accompanied by bed erosion and thus sediment yield. Similar results were reported by Ranzi et al. (2012) for the Lo River in Vietnam, where conversion of 35% of forest land to agriculture resulted in a 28% increase in sediment yield. In contrast, S4 led to a 20% reduction in annual sediment yield,

Figure 13: **Average monthly flow under different scenarios for the simulation period 1984 to 2008**



with reduction in both rainy and dry seasons. The average monthly sediment yield for the period 1984 to 2008 for all scenarios is shown in Figure 14. Percentage change in annual sediment yield has increased by 48.6% in S1 compared to base case. The change has increased only by 9.4% and 31.9 % in S2 and S3 respectively with the increment in both rainy and dry season. By contrast, in S4, change in annual sediment yield has decreased by 199%, with a decrease in both rainy and dry season.

Hydropower generation under different scenarios

The Hec-ResSim model was simulated for the reservoir operation rule of guide curve using the input of reservoir inflow under the different scenarios. The exact operating hours are based on the demand; the present study thus focused only on the average annual power generation under the different scenarios with respect to the base case scenario.

Percentage change in annual hydropower generation

The highest power generation was found under S1, with a 25% increase from baseline, followed by S3, and S2. The increased power resulted from the increased inflow to the reservoir, following reduction in the area of forest land. Power generation was slightly reduced under S4 as a result of the decrease in inflow to the reservoir (Figure 15).

Revenue from power generation

The annual revenue under each scenario was calculated for each year of the simulation, together with the annual average over the simulation period, based on the hydropower output and using a constant tariff value. As the annual power output was higher under reduced forest land scenarios, these scenarios also had higher revenues.

Figure 14: **Average monthly sediment yield of scenarios for simulation period 1984 to 2008**

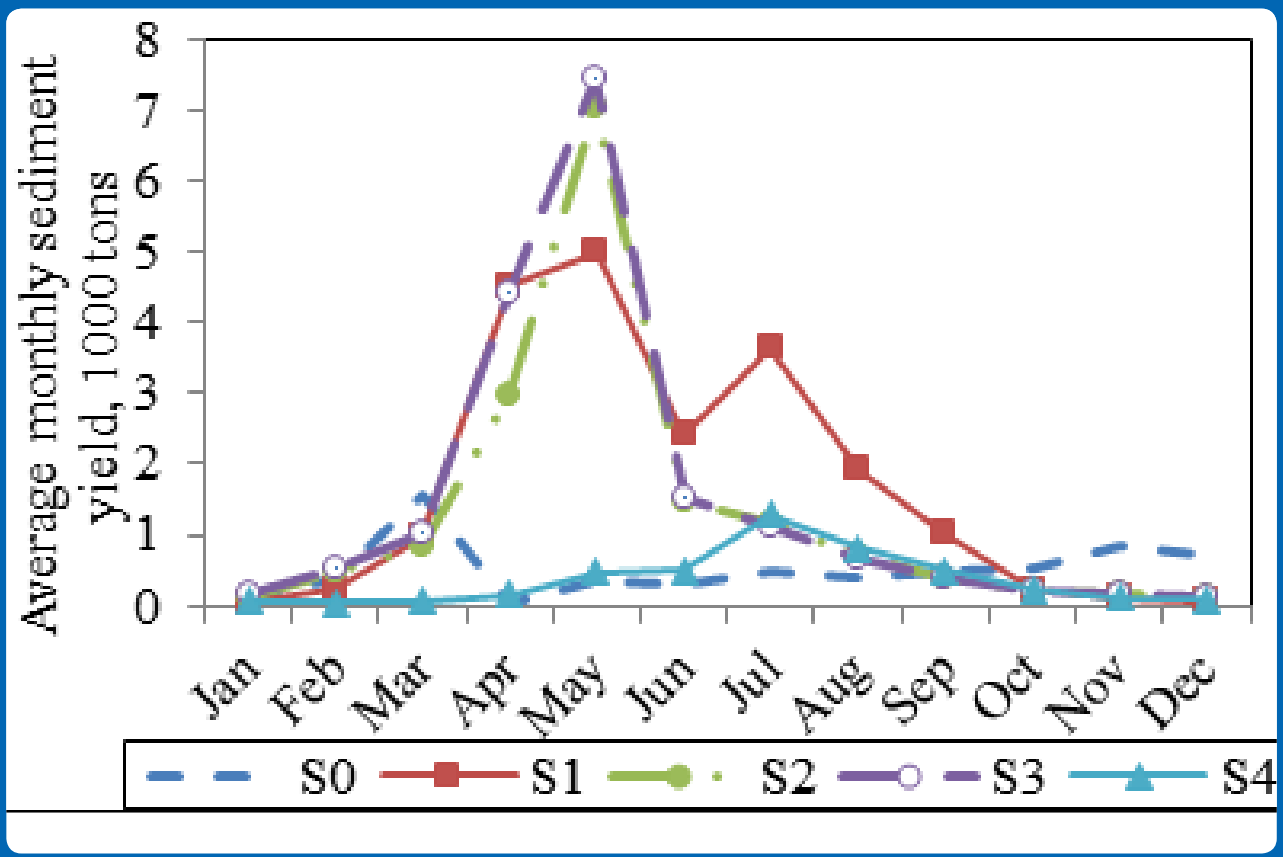
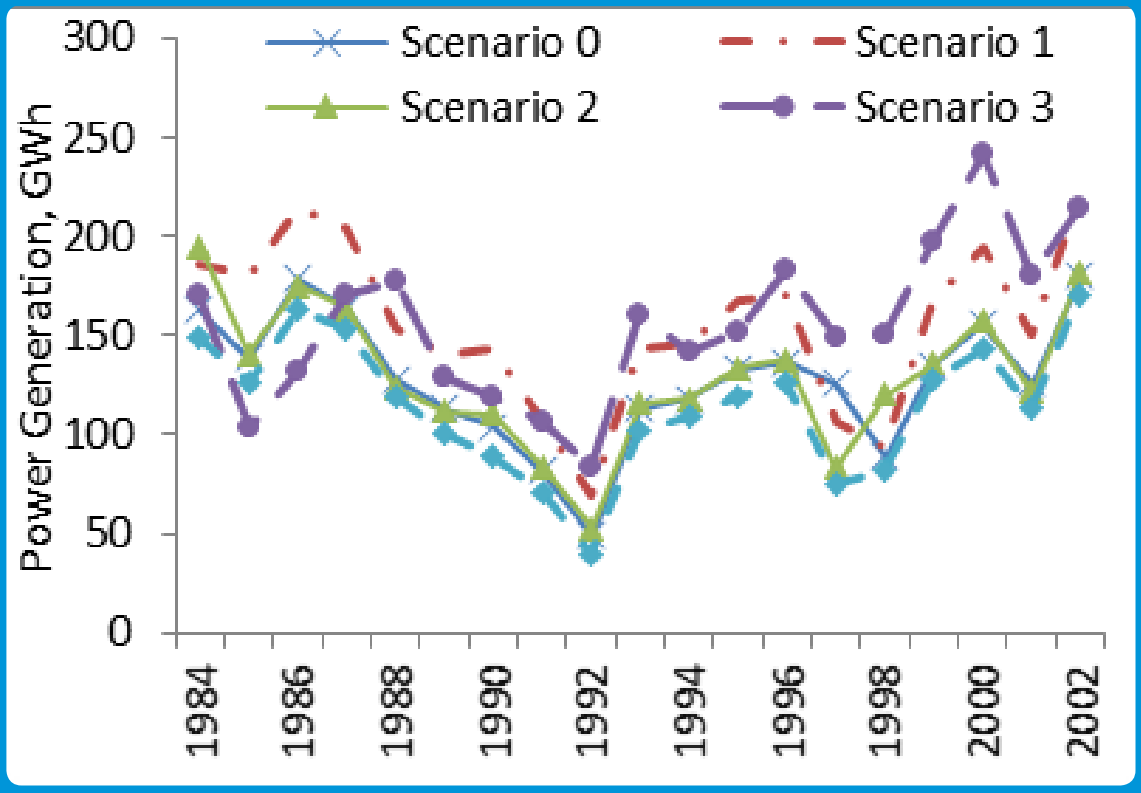


Figure 15: **Annual power generation for scenarios**



Similarly, the lowest revenue was for the increased forest scenario. The revenue calculation is only based on the average annual power generation. However, to calculate the full costs of hydropower, and thus gains and losses following conversion of forest land, it would be necessary to include costs such as operation and maintenance, which are likely to increase as a result of increased flows and high sediment deposition during the rainy season.

Conclusions

In the model simulations, conversion of forest land to agricultural land or barren land resulted in higher flows and higher sediment yields, especially in the rainy season, which could intensify flooding and increase sediment deposition in the reservoir. The conversion also reduced dry season flow, which might exacerbate water scarcity during the dry season and further affect reservoir storage. The afforestation scenario resulted in a slightly reduced annual flow, with a reduction in the rainy season, which could help abate flooding. It also reduced sediment yield, which would help reduce sediment deposition in the reservoir. The forest reduction scenarios show increased average annual power generation, whereas afforestation resulted in reduced power generation. Reservoir sedimentation has only a limited effect on reservoir volume and power generation until the deposition exceeds the dead storage level. The revenue from hydropower generation increased under the forest depletion scenarios, but the calculations were based purely on potential power generation from flow, and did not take other factors such as maintenance into account. Hydropower generation, and thus revenue, was slightly reduced with increased forest area, but not markedly because the decrease in dry season flow was relatively small.

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Discussion

Altogether five participants including representatives from forest department, CARE-Nepal, and university students made various queries and suggestions to the presenters, which covered the issues of research methodology, existing payment mechanism, hidden drivers and opportunity cost of locals. Bijaya Kumar Singh Danuwar said there is good scope for PES implementation in Nepal. Rajan Pokhrel agreed there is a need for clear communication and proper linkage between service provider and buyer/ upstream downstream community. Megh Nath Kafle from Kavre DSCWM focused on policy issues and said it is time to act for a paradigm shift, adding that ecosystem conservation and development earning are the twin objectives of PES. Rajendra Khanal from IUCN also agreed with this point.

With regards to the PES mechanism, Rajesh Rai said that PES should be a market driven mechanism, while the representative from KMC expressed doubt about the market's capacity to decide on an equitable benefit sharing mechanism. Mr Kafle from DCSWM and most of the participants underscored the need for clear rules of the game.

The representatives of KMC and DSCWM retorting the role of local institution and private sector involvement in PES implementation, and raised the premium issues to be addressed in the policy. In concluding remarks, the chairperson highlighted that discussions in the session provided an opportunity to discuss important conceptual issues. They reiterated the need for a guiding policy and institutional framework for PES, and encouraged institutional collaboration and dissemination of the PES concept to a wider audience.

Panel Discussion I

Moving Forward: Policy Priority to Implement PES in Nepal

Panelists

Dr Vijaya KS Danuwar, RCTMB

Tikaram Adhikari, DNPWC

Chevan Guragain, DSCWM

Santosh Nepal, WWF

Rajendra Khanal, IUCN

Dr Rejina Maskey, TU

Existing policies and legislative instruments favorable to PES implementation in Nepal

Santosh Nepal from WWF pointed out the absence of specific and explicit legal documents and institutional framework for establishing and implementing the PES scheme in Nepal. However, some of the existing legislations are supportive and could be the backbone for PES implementation. He said that a lot of issues related to PES (such as tourism, drinking water, upland farming, forest protection and conservation, mining, scenic landscape, hydroelectricity protection, irrigation, etc.) were discussed, but policy issues regarding hydropower/hydroelectricity, tourism, and forest are particularly important. He said there are 15 policies/acts related to water apart from those 5 sets of provisions, but these policies are not put into practice. Regarding PES, he said that hydro issues and policies should be treated separately. He added that despite the significant contribution of nature-based tourism to national economy, the inadequate policy/acts ('Tourism policy 2065', policy on mountain climbing and 'Vision 2020') pose a barrier to the growth of this sector. He spoke of the need to link nature-based tourism with PES by including ecotourism in our PES framework. With regards to forest policies, he said there are currently about 9 acts and 15 policy directives. To ensure effective policy implementation and feedback mechanisms, he said that formal bodies like DDC, VDC, and municipalities should set a standard and create legitimacy while informal groups should act as facilitators and mentors, and support in capacity building.

- Some of the favorable policies are listed below:
- National Park & Wildlife Conservation Act 1973
- National Forestry Plan 1976
- Soil and Watershed Conservation Act 1982
- National Conservation Strategy 1988
- Forest Act 1993 and Regulations 1995
- Environment Protection Act 1995 and Regulation 1996
- Buffer Zone Regulation 1996
- Local Self-Governance Act 1999
- Water Resource Act 1992
- Revised Forest Sector Policy 2000
- Hydropower Development Policy 2001
- Environment Friendly Local Governance Framework 2013

Discussion:

Megh Nath Kafle from DSCWM said we should also pay attention to international policies rather than just national policies, as well as clarify the concept and basic principles for decision making. Fanindra R. Kharel, Joint secretary, DDG, DNPWC, said there is a provision for mandatory payment of a royalty, but also rampant trade of resources in Chure. Dr Krishna Tiwari from IOF stressed the need for a policy of payment to community. Dr Pem Kandel agreed there is a need to formulate prerequisite policy after broad consultation with all stakeholders. The audience also stressed the need for gap analysis, research and capacity building activities in the PES sector.

Does Nepal need consolidated PES policy or can this be streamlined within existing legislative provisions?

The panel member Dr Vijay Singh Danuwar stated that coordination among departments and ministries has been one of the challenges in implementing policies and legal frameworks in Nepal. For this reason, it would be very difficult to streamline PES implementation with existing policies. Citing many examples gathered from local level meetings and seminars, he reiterated that PES should be consolidated within PES policy for improving management mechanisms. The goal of bringing about integrated policy and integrated act cannot be ignored, he said, and stressed the need for policy review and gap analysis. He gave many examples from other countries and existing REDD policy in Nepal to illustrate the role of facilitator and mediator in taking PES to next level. As PES entails

issues of multiple sectors, Dr Singh said these should be examined carefully one at a time rather than collectively in one basket. Hence multi-layered and multi-lateral discussions are needed for building an effective PES framework.

Discussion:

Basanta Adhikari from KMC said he agreed with the panelists' views on overlapping laws, inter-organizational dispute and minimal implementation on the ground. He stressed the need for a specific and separate policy instrument and specific authority for PES implementation. In addition, he emphasized a participatory structure, approach and well-defined mechanism in PES. Bhola Bhattarai held that most of the existing policies and laws do not really fall under the PES model. Hari Bhadra Acharya talked about the complexity of coordination issues (as seen in hydropower production), and disagreed about the need for consolidated policy. Rather, he emphasized the need for specific laws regarding PES. Meanwhile, Sandesh Hamal was in favour of comprehensive policy and an umbrella act to bring momentum in the PES sector.

Key policy constraints in implementing PES in Nepal

Chevan Guragain from DSCWM elaborated on the existing policies in the environment sector regarding PES and the problems of implementation. Talking about the willingness to pay (WTP) in terms of PES, he argued that the willingness to pay will not come about unless the government or the authorities guarantees those services to the poor communities. One solution is to obtain payment through taxation, he said, but without sensitizing local people about the twin objective of PES (ecosystem conservation and benefits for locals) and proper scoping, the new concept cannot be taken forward. He talked about the inadequacies of existing policies and stressed the need for integrated policy for PES implementation. He said people need an answer to the question: "If I am to pay for the services, by when will I receive the services?" The lack of data on cost-benefit analysis is another constraint.

In the follow-up discussion, Prem Kandel mentioned that gap analysis of existing law and policy is necessary for understanding the issue, and that the upstream-downstream linkages need to be addressed. Bhola Bhattarai highlighted the importance of building the capacity of existing institutions and stakeholder engagement in PES implementation. Participants concluded there is a lack of understanding between stakeholders and stressed the need for broad dialogue and consulation. Citing the example of Chure, Dr Prem Paudel put forward the concept of enhancing the goods and services and relating it to upstream downstream linkage in addition to focusing on policy enhancement. Kamal Gautam mentioned that the lack of a mechanism for tracking the payment is one of the constraints in PES implementation in Nepal. Regina Maskey from TU said that we will also need to pay attention to traditional user rights provided by other legislations and the fund mobilization mechanism in the near future.

Nepal's international commitment (CBD, UNFCC) for PES implementation

Rajendra Khanal from IUCN defined the twin objective of PES (as sustainable growth and ecological restoration with the help of economic incentives). He explained that there are more than 300 schemes for PES worldwide, and in Nepal it's still in a preliminary phase. He said there is a need to review those schemes, guidelines, and mechanisms, and identify practices suitable for Nepal. He talked about the legal and policy weaknesses with respect to PES in Nepal, and recommended broad consultation between the ministries working on PES or issues related to PES. The international community could support the country in achieving the goal. He said that PES has now started moving forward with the help of the Ministry of Forest and Soil Conservation. Giving examples of PES implementation from around the world, Mr Khanal said that the PES scheme should focus on labour and institutional framework. Provisions in relevant international instruments can be synchronized with PES implementation practices in Nepal. He concluded that foreign aid, along with incentives for locals, could ensure effective implementation of PES in Nepal.

Dharam Raj Uprety from MSFP talked about the institutional modality of PES in Nepal. He recommended improving infrastructure at the VDC level by making an umbrella level organization for coordination. He said that the projects

being carried out under the DFACC guideline, multi-stakeholder mechanism, and DECCCC could also be helpful in enhancing coordination between ministries and taking PES forward. He spoke in favour of a PES mechanism with more frameworks and less controversy, and suggested starting immediately by following international examples. Meanwhile, Pabitra Jha warned that international examples do not always match the local context.

Are there any policies or programmes that support private sector engagement in PES?

Tikaram Adhikari, DG, DNPWC, said that despite the lack of policies or programmes that directly support private sector engagement in PES, existing laws are highly favourable to private sector involvement. Citing the example of community-led initiative for lake ecosystem conservation at Rupa Lake, Kaski District, and Kulekhani Hydropower, he discussed an implementation scheme resembling PES run by private sector in alignment with existing policies and programmes. Mr Adhikari said that such projects are similar to PES mechanisms for compensating upstream communities (for their effort in conservation).

Methodology, tool, protocol and assess to ecosystem value

Dr Rejina Maskey, Associate Professor at TU, said that although methods may vary across places, methodology, tools and protocols for assessing the value of ecosystem need to be more validated. Given the difficulty of classifying ecosystem values, stronger efforts are needed to define the scope and select the variables. She said academic research is hence necessary, especially as there are only limited studies on the sector Dr Maskey called for mutual collaborative research to take PES forward. She spoke of the need for an overarching framework for PES, and invited development partners like IUCN, ICIMOD, and WWF to play the role of mediators.

In light of the spatio-temporal and social differences in ecosystem and services, Hari Bhadra Acharya stressed the need for academic research to identify an appropriate methodology of ecosystem valuation. He said that as an ecosystem service is not a direct market good, an indirect valuation method would be appropriate for its valuation.

Conclusion:

The session Chair Braj Kishor Yadav, Joint Secretary of MoFSC, gave his concluding remarks and thanked all the panelists and audience for their active participation. Providing a summary of the discussion, he said that theoretically, there is willingness to pay and willingness to accept in Nepal but the compulsory nature of payment in the form of tax makes it different from the PES process. He said that it is possible to guarantee a fair amount of service to people who are willing to pay for the service. He added that there should be consolidated policy with scope for easily implementation on the ground.

Panel Discussion II

Moving forward for action in PES implementation in Nepal

Panelists

Kamal Prasad Gautam, DSCO

Hari Bhadra Acharya, DNPWC

Phadendra Kharel, DNPWC

Dr Kedar Rijal, TU

Meghnath Kafle, DSCWM

Dr Subodh Sharma, KU

Does PES need direct government intervention or should it be left to the market and approached with market-based solutions?

Kamal Gautam emphasized the need for PES policy review before moving ahead on issues of modality and mainstream tools. Citing the results of recent research on voluntary willingness to pay and accept, Dr Rejina Maskey said that government intervention is needed at the local level. She added that VDC/local government bodies and even private parties can serve as mediators in the PES implementation process on the ground. Rajendra Khanal stressed behaviour change in the community as the first and foremost necessary step in the intervention pathway. He further said that social and cultural activities can promote interaction between upstream downstream communities to attain the goal of behavioral change.

Scale for piloting: Micro, Watershed, District, or Landscape, Transboundary?

Panel member Hari Bhadra Acharya said that payment is a mechanism and actions and decision should be taken step by step. Before deciding on payment for ecosystem services, it is important to ensure that the concept of PES is understood by locals and stakeholders. With regards to a voluntary mechanism, he said that benefit sharing is a silent portion of PES, there is a need to access multi-scale values before deciding on the payment mechanism. Service and cost benefit assessment of ecosystem should be conducted before deciding its scale. Citing various examples related to drinking water, hydropower generation, ecosystem use and biodiversity conservation, he discussed possible scales of piloting on different scales – watershed, basin, landscape and global. In this approach, VDC and municipality would the micro-scale institutions, DDC an intermediate implementing institution looking after hydropower, protected areas and watershed management, and the central government would play the role of guiding the overall policy.

Dilip Sangraula emphasized the payment modality in PES should be considered carefully as the hydropower sector is dominated by private sector. Megh Nath Pathak argued that rather than considering geographical and territorial attributes, economic mechanisms like market potential and economic availability should be considered as additional determining factors for piloting and implementing PES.

The role of local government in facilitating PES actions at district or local level. Suggestion: role of local government

Panelist Phanindra Kharel mentioned that PES is a multi-sector and multi-dimensional issue with sustainability as its main objective and behavioral modification as its major agenda. Presenting the scenario of entangled acts and unclear policy, he stressed the need for a clear natural resource management act and multi-planning act for supporting local government in implementing PES on the ground.

Dr Kedar Rijal said that a macro holistic approach with a well-defined role of concerned bodies would help us move towards PES. On the other hand, Basanta Acharya explained the role of local government as a doorstep local body of the central government working closely with the citizens, adding that although the work on PES could be taken through the informal sector, it may not be sustainable unless the formal sector is involved. Including all stakeholders in the negotiation process is the proper way, he said. Taking into account issues of federalism and demarcating local boundaries, he stressed the crucial role of local government as a moderator. Pabitra Jha added that local NGOs currently act as moderators in capacity building, and that they need to act as facilitators to ensure the sustainability of PES.

Possible framework for benefit sharing mechanism at local level:

Presenting the top-down approach (starting from ecosystem services national consensus body at the national level followed by district level line agencies,VDC /user groups, development programme and finally community on the ground), Dr Kedar Rijal discussed a possible framework for benefit sharing mechanism from national to local level.

Pradip Maharjan talked about the market-based approach for PES implementation and called for enforcement of proper benefit sharing mechanism after further consultation with concerned stakeholders. Hari Bhadra Acharya expressed his concern that as people can freely access resources at present, they might not responsd well to WTP and WTA approaches. Therefore, raising the awareness of all the stakeholders about the pros and cons of PES would be the first step in taking PES forward. Desh Bhakta Malik and Krishna Bahadur Khadka added that capacity building and forming an institutional mechanism could lead to an equitable benefit sharing mechanism. As proper communication is important for success of any programme, he emphasized effective communication between upstream and downstream communities for deciding the model of a sharing mechanism.

How are local level interventions linked or should be linked with the overall development processes?

Megh Nath Kafle explained that sustainable development is a major national agenda and PES could be a useful mechanism for addressing issues in sustainable development. To incorporate PES in the national development agenda, it needs to be tied up with equity and local governance under a benefit sharing mechanism. Highlighting the role of micro and macro level linkage, he suggested linking the PES mechanism with local development needs (like disaster and vulnerability reduction, capacity development and local governance enhancement) to ensure successful implementation. Regarding current policy, he emphasized the need for further discussion and debate on contingency policy formulation.

What it is the existing vertical and horizontal coordination mechanism supporting PES implementation? What should be the frame for such an arrangement?

Panel member Dr Subodh Sharma presented three possible dimensions, namely longitudinal, horizontal, and vertical. Considering the river as the base, longitudinal and vertical dimensions are known to everyone; however, for community based natural resource management, the necessary dimension is the horizontal dimension. The universal concept of downstream community as buyer and upstream community as service provider is a drawback of horizontal dimension. Therefore, he stressed the need for a proper feedback mechanism. He said that dons and thugs who dominate the process are also key social factors in the horizontal dimension. Dr Sharma thus emphasized the need to strengthen local bodies and institutions.

Session summary

The session chair Chevan Guragain summarized the second panel discussion, highlighting the dire need for identification and proper assessment of ecosystem services prior to deciding on scale and mechanism. He stressed on a framework that has local level ownership and local bodies' involvement, with well-defined role and responsibility for ground level implementation of PES. Referring to existing social interventions, he spoke in favour of a one-door policy of payment. Further, Mr Guragain underscored the need to bring PES in national accounting through horizontal dimension for successful PES implementation.

Closing Remarks

On behalf of the organizing committee, Pem Kandel from DSCWM highlighted the objectives of the workshop and thanked all the presenters, panelists, participants and guests for their active participation and productive discussion. He summarized the two-day workshop and reiterated the need for a PES modality, intervention and pathway. Mr Kandel expressed his appreciation for the timely discussion on the conceptual, policy, institutional, management and application issues of PES and affirmed the need to expand this discussion to other levels. He further said that technical assistance from IUCN, ICIMOD, and WWF would be important in taking the concept of PES from the ground to the policy level.


Government of Nepal
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NATIONAL WORKSHOP ON PAYMENT FOR ECOSYSTEM SERVICES
Opportunities and Challenges in Nepal
ICIMOD
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International Centre for Integrated Mountain Development
GPO Box 3226, Kathmandu, Nepal
Tel +977-1-5003222 **Fax** +977 1 5003299
Email info@icimod.org **Web** www.icimod.org