Research Article:

POTENTIALITY OF PAYMENT FOR ECOSYSTEM SERVICES IN COMMUNITY FOREST: LINKING UPSTREAM AND DOWNSTREAM HOUSEHOLDS

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ABSTRACT

The characteristics of ecosystem services (ES) and developing a particular mechanism of sharing benefits generated from its uses among its contributors has become a matters of concerns to ecologists, environmentalist and economist. Payment for ecosystem services (PESs) is pursued as one mechanism which is increasingly used to sustain both the natural ecosystems and local livelihoods. A study was carried out in Nawalpur Saraswati-Basamadi Community Forest (NSBCF) in Makawanpur district to assess the potentiality for implementing PES mechanism. This study employed both qualitative and quantitative approaches. Households survey (n=142), key informant interview and focus group discussions were carried out to identify major environmental service and discuss the possibility of creating an institutional mechanism for PES. Discrete choice experiment (DCE) method was used to determine the preferences of both upstream and downstream communities for forest conservation. The study found provisioning, regulatory and cultural services (including forest products, pure and clean drinking water, tourism and recreation etc.) are the major ecosystem services provided by NSBCF and forest products; and pure and clean drinking water being the most important ecosystem services. Community forest was reported as most preferred institution to follow the PES mechanism and indirect payment mechanism got the highest preference among the respondents. Majority of people from both the upstream and downstream community around NSBCF has positive response for willingness to pay (WTP) and willingness to accept (WTA) for ecosystem services. They have strong WTP of NRS. 187.70 per year/HH and WTA of NRS 295.10 per year/HH for the conservation of forest. This shows that both the upstream and downstream communities are willing to conserve the forest and implement the PES mechanism as sustainable conservation approach. Therefore, this study recommends that there are adequate existing institutions at the local level that could play vital role in implementing PES mechanisms. For this the appropriate institution should be identified and their respective role should be fixed. Furthermore, capacity building and awareness program among the upstream and downstream user is essential for the successful implementation of PES mechanism.

Key words: Community forest, downstream, ecosystem services, payment, upstream

INTRODUCTION

The Millennium Ecosystem Assessment defines ecosystem services (ES) as the outputs, conditions, or processes of natural systems that directly or indirectly benefit humans or enhance social welfare such as food, fiber, Fuelwood, timber, clean water, medicinal herbs, and climate regulation. (MEA, 2005). The notion of ES first appeared in the 1980s (Gómez-Baggethun et al., 2010) and gained increased recognition following groundbreaking paper by Costanza and his group in (Costanza et al., 1997). Costanza et al. (1997) first estimated the worth of the world's ES at US $33 trillion (in the range of US $16-54 trillions), almost 1.2 times more than the total global gross domestic product in 1995. Moreover, this estimate increased

to US $145 trillion in their 2014 update (Costanza et al., 2014). Other notable works on ES include the Millennium Ecosystem Assessment in 2005 and The Economics of Ecosystem and Biodiversity (TEEB) in 2010. The concept of ES has now drawn considerable attention from a wide spectrum of researchers and analysts interested in environmental changes including natural resource management, biodiversity conservation, environmental policy and accounting (Gómez-Baggethun et al., 2010; Costanza et al., 2014; Pasgaard et al., 2016).

More than 60 to 70 percent of the world's ecosystem services have been degraded considerably at the local, regional and global level in the last half decade (MEA, 2005). Unsustainable management and degradation of ecosystem services can be attributed to demographic, economic and climate change impacts in conjunction with lack of appropriate conservation models and inadequate investment into the conservation of these services (Farley & Costanza, 2010; Karami et al., 2020; Yang et al., 2018). A growing scarcity of ecosystem services and decreasing interest in conservation led to a flurry of conservation innovations over the past decade in the form of payment schemes (Adhikari & Agrawal, 2013; Wunder, 2007). Mechanisms of this kind have been linked explicitly to the provision of specific ecosystem services through the concept of Payments for ecosystem services (PES) (Ferraro & Kiss, 2002; Wunder, 2007).

PES is regarded as a free-market-based approach designed to conserve the environment, in which the users of ES pay producers (or managers) to maintain or (adopt) environment-friendly activities to ensure the long-term supply of such services (Wunder, 2007). As described by Wunder (2007) a PES scheme depends five major criteria: (i) a voluntary transaction where; (ii) a well-defined environmental service, or a land use likely to secure that service; (iii) is being bought by a (minimum of one) ES buyer (iv) from a (minimum of one) ES provider (v) if the ES provider secures ES provision (conditionality). These five criteria are the basis for a 'true' PES scheme, an innovative instrument through which participants are guaranteed a continuous supply of ESs without compromising social goals (Engel & Palmer, 2008; Wunder & Albán, 2008). Over the last decade, PES became very valuable transfer mechanisms to internalize positive environmental externalities, and generate revenues for sustainable development.

Forest is among the ten major ecosystem categories that the Millennium Ecosystem Assessment identified because of its rich ES needed for human wellbeing (MEA, 2005). The community based forest management (CBFM) model is the dominant forest management regime in developing countries like Nepal. Currently, about 511 million hectares of global forests (almost 15.5%) are either owned or managed by such communities (Ghimire & Lamichhane, 2020; Paudel et al., 2017). The contribution of forest ecosystem to the livelihood of resource-poor rural people, particularly those in developing countries, is critically important (Christie et al., 2012; Bhatta et al., 2014). In developing countries, environmental income accounts for approximately 28% of the total household income, and the forest share of environmental income is almost 77% (Angelsen et al., 2014). Recent study also shows that forest-based ES provide approximately 20% of the income of rural households both through cash and by meeting subsistence needs (Wunder et al., 2014). About 75% of poor people in developing countries are heavily dependent on forest-based ES (FAO, 2018). To resolve environmental problems, decentralization of natural resources and community-based forest management are important factors, and PES schemes are gaining popularity among local governments and communities that appreciate PES as vital economic development pillars (Fauzi & Anna, 2013; Stapp et al.,2016). In the developing countries like Nepal, where the country's investment in conservation is inadequate, the PES mechanism seems to have a broader scope to develop as an incentive mechanism for better resource conservation and livelihood enhancement. In this context, this study attempts to investigate the feasibility PES mechanism in community forest linking upstream and

downstream community for sustainable management of forest resource.

MATERIALS AND METHODS

Study Area

The study was carried out in the Nawalpur Saraswati-Basamadi (NSB) Community Forest (27° 25'N, 85° 02' E)) of Hetauda sub metropolitan city of Makawanpur (Fig. 1). The CF situated in ward number 11 of Hetauda Sub-metropolitan city covering an area of 234.21ha with elevation ranges from 510 m above mean sea level to 950 m in the north (NSBCFUG, 2015). For the study this CF is selected because it represents both the upstream and downstream communities for the conservation and management of forest.
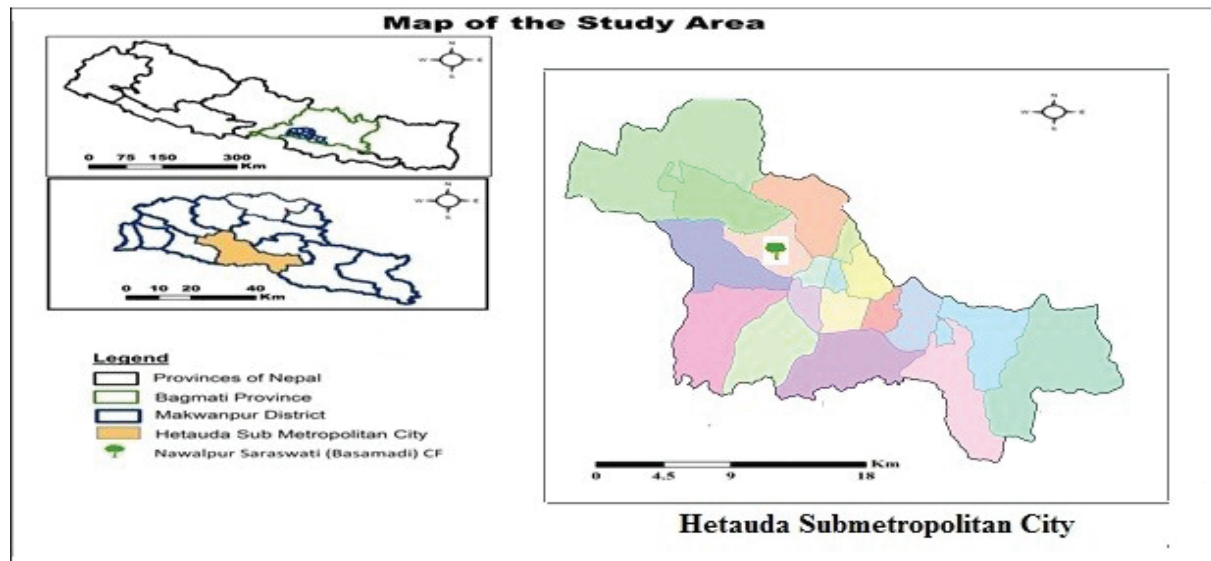

Fig. 1. Map showing the study area

Data Collection and Analysis

The study employed both qualitative and quantitative approaches. Household survey, key informant interview and focus group discussions were carried out to identify major environmental service and discuss the possibility of creating an institutional mechanism for PES. The study surveyed 142 respondents (upstream =71 + downstream =71), about 10 percent of the total household of the CF for both upstream and downstream community using simple random sampling. Field observation was also performed to validate ecosystem services, existing land use and resource use pattern.

A discrete choice experiment (DCE) method was used to determine willingness to pay (WTP) and willingness to accept (WTA) of both upstream and downstream communities for conservation of forest ecosystem and resources. Two 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, preferred payment mechanism and possible institutional involvement for the implementation of the PES scheme. Further, the collected data were analyzed using Microsoft Excel and Statistical Package for Social Sciences (SPSS). Descriptive statistics was used to analysis the demographic information of the respondents. Friedman test was used to compare the mean ranks of ecosystem services.

RESULTS AND DISCUSSION

Ecosystem Services Provided by NSB CF

Being one of the world's most productive natural ecosystems, forests ecosystem provide wide range of goods and services to the communities. Diversified forest products and services with major four categories of ecosystem services are classified according to Millennium Ecosystem Assessment (MEA, 2005). From the field observation and consultation with forest users it is reported that NSBCF also provides all major types of ecosystem services including supporting, regulatory, cultural, and provisioning services; forest products and pure and clean drinking water being the major ecosystem services (Table 1).

Table 1. Various ecosystem services identified in CF

Ecosystem Service Type	Services Provided by CF
Supportive services	Biodiversity conservation
	Habitat for wildlife
	Hydrological cycle
Regulatory services	Carbon storage
	Control of erosion
	Natural purification of water and air
	Climate regulation
Cultural services	Landscape beautification
	Recreation and ecotourism
	Education
Provisioning services	Food, fiber and fodder
	Timber and fuelwood
	Clean water
	Medicines

Ranking of Ecosystem Services provided by CF

NSBCF provides various types of ecosystem services and the importance of those services differs with the perspective of people. Various factors such as respondent's occupation and dependency on the sources for sustaining their livelihood determine the preference of the services. Respondents were asked to rank the ecosystem services from 1 to 6; 1 being the most important and 6 being the least important. Both upstream and downstream respondents ranked forest products and pure and clean drinking water as first and second priority ecosystem services (Fig. 2). A study by Prachhain et al. (2019) also reported forest products and water providence services are major ES in Resunga forest in western hill, Gulmi district.

While downstream respondents ranked carbon sequestration as third ranked important services provided by CF where as upstream communities ranked recreation and tourism as a third important service. Various socio-economic factors such as occupation, use of resources, income, and knowledge about ES could be the determining factors for difference in choice of services which is in line with Poudyal et al. (2021) who reported occupation, income, and knowledge of respondents are major factor for choice of ES in Begnas lake watershed, Kaski district.
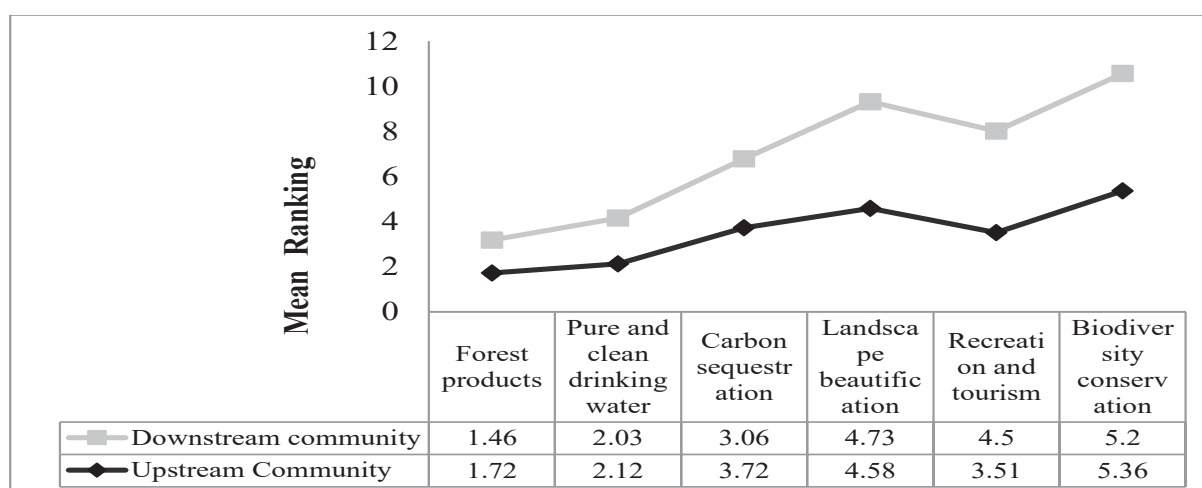
Fig. 2. Ranking of ecosystem services

Friedman test also shows the significant differences in the choice of important ecosystem services (Upstream: N=71, =197.76, df=5, p=0.000; Downstream: N=71, =242.75, df=5, p=0.000).

WTP and WTA for Ecosystem Services

Regarding the issue on WTP for compensation paid by the downstream beneficiaries; about 72% of the respondents are ready for pay, whereas about 17% are not ready to pay as compensation. In this connection 11% respondents have an opinion that government should be responsible for overall management of the natural resources (Fig. 3). The value of WTP ranged from NRS 75 to 500 with a mean of NRS 187.70 per year/HH.
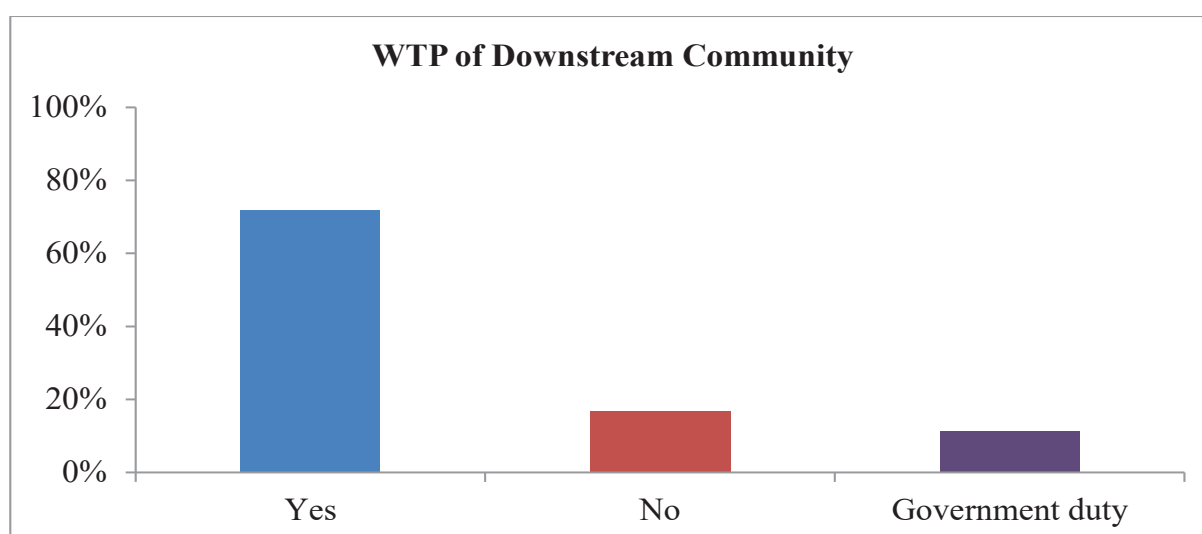

Fig. 3. WTP of downstream community for ES

Likewise, about the issue on WTA compensation for providing ES by upstream land managers, more than three fourth of the respondents (80%) are ready for WTA compensations whereas about 16% have the voice that they can manage resources by their own and few (4%) respondents are not interested to accept or receive any compensations (Fig. 4). The value of WTA ranged from NRS 100 to 700 with a mean of NNRS 295.10 per year/HH. Analysis of WTP and WTA for ecosystem services is major instrument to implement PES for resource conservation (Lamsal et al., 2015; Rai et al., 2016).
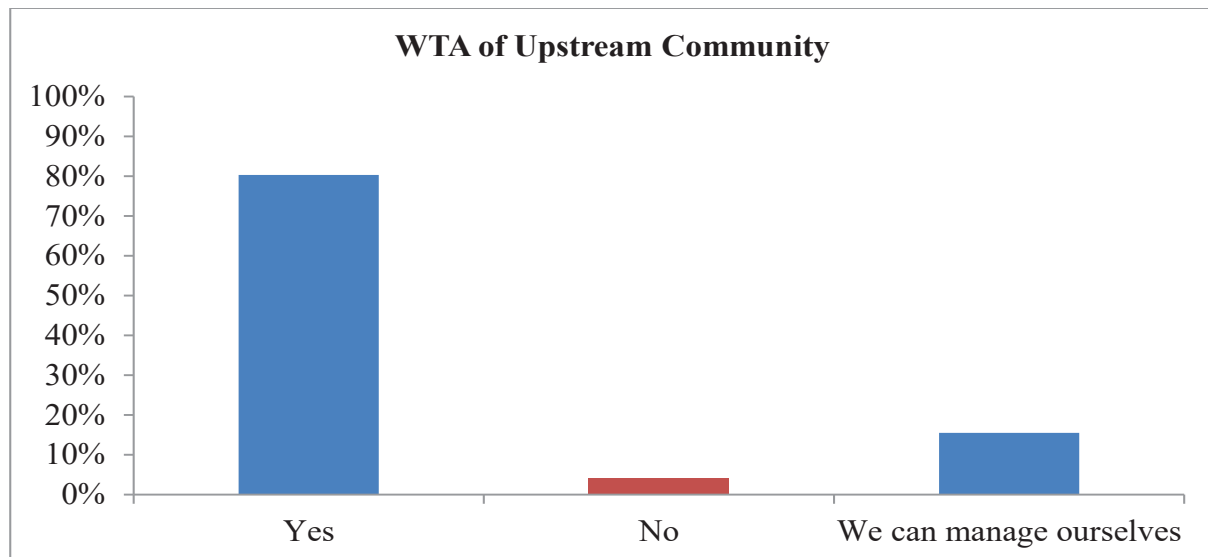
Fig. 4. WTA of upstream community for ES

Potential Buyers and Seller of Ecosystem Services

Discussion with both upstream and downstream respondents and key informants following major ESs, and their potential buyers and sellers are identified in NSBCF (Table 2).

Table 2. List of major Ecosystem services and their potential buyers and sellers in CF

Major Ecosystem Services	Potential Buyers	Potential Sellers
Forest products	Forest management communities, Divisional Forest Office, water resource conservation communities, private forests owners etc.	NSB CFUG and Divisional Forest Office.
Pure and clean drinking water	Downstream communities; mainly urban population; drinking water supply committee, and irrigation water corporation.	Upstream communities including forest user group and other community.
Carbon sequestration	Local, regional, and global communities.	NSB Community forest users group
Beautiful landscape	Local communities, national and international tourists.	CFUG, local communities and Government.
Recreational use	Domestic and foreign tourists.	CFUG, Government, local farmers, and local community around CF.
Biodiversity Conservation	Local, regional, and global communities.	CFUG, Local communities, Department of forest, farmers around CF.
Fresh and healthy environment	Community around NSB CF and national and global communities.	NSB CF, Divisional Forest Office, Private forest owners.

Potential Compensation Mechanism for ESs

More than Fifty percent (51.41%) of the total respondents (n= 142) responded that there should be an indirect payment (like community development, school scholarships, etc.) as a means of compensation. While 30.28% think of contribution on community forest conservation. Merely 8.43% of the respondents preferred direct cash payment to the community members (Fig. 5). A study by Poudel et al (2021) reported indirect payment mechanism (such as community development, scholarship for school/college students, promotion of plantation programmes etc.) as the preferred choice of respondents while initializing PES mechanism in Begnas Lake watershed, Kaski.
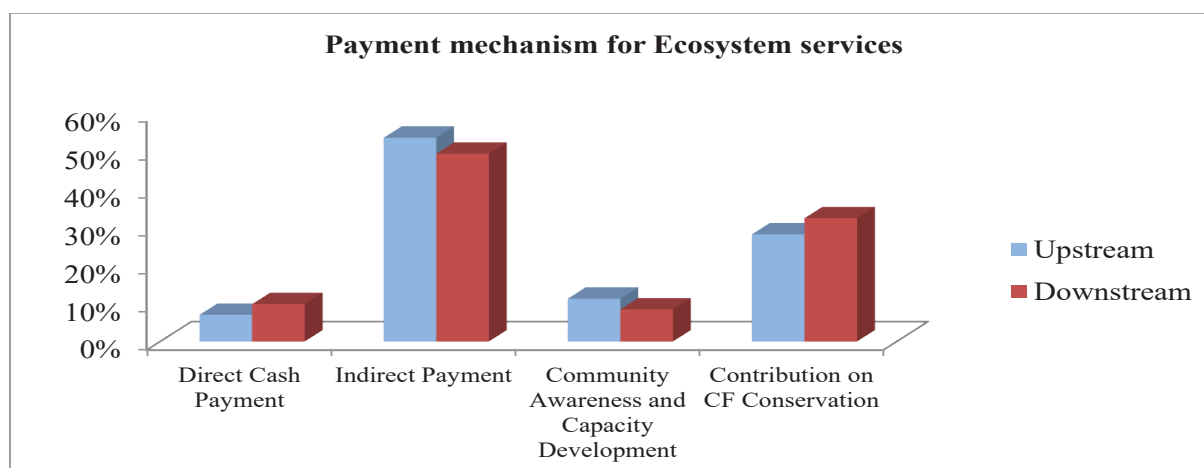
Fig. 5. Potential compensation mechanisms for implementation of PES

Preference of Institution for Implementation of PES Mechanism

After discussion with key informants and upstream and downstream households, different types of institutions were reported actively involved in the study area. Tole improvement committee, Women's group, Youth club, Drinking water user's committee, Community forestry user group, and financial cooperatives were major existing institutions working in the study area. Community forestry was the most preferred institution to implement the PES mechanism. Out of the total respondents 38.73% preferred community forest users' groups followed by 28.17% preferred governmental organizations such as the Divisional forest office as preferred institution for implementing PES mechanisms (Fig. 6). Furthermore 19 % respondents agreed to establish new institution for implementation of PES mechanism.
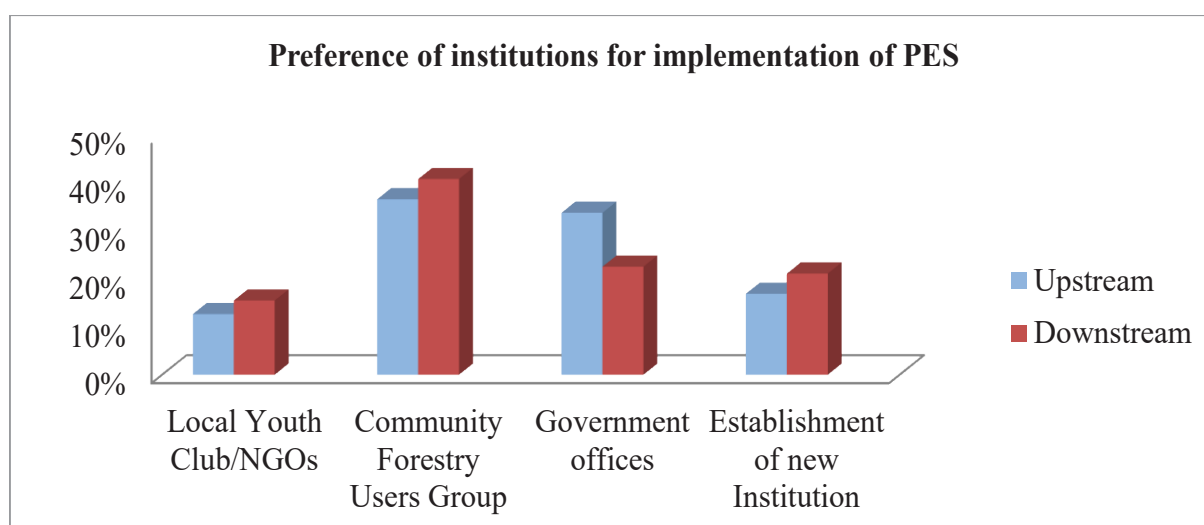

Fig. 6. Preference of potential institutions to implementation PES mechanism

Institutions play a critical role in any PES mechanisms since the PES scheme cannot work in a vacuum (Fauzi & Anna, 2013). Successful implementation of policy and strategy is the key purpose of any institution; therefore, the successful execution of a PES scheme requires an effective institutional framework. The majority of respondents preferred community forest user groups to lead the implementation of PES mechanisms mostly because this has proven to be the most successful institution for forest resource management in Nepalese hill (Baynes et al., 2015; Stapp et al., 2015; Paudyal et al., 2017). Community-based resource management has successfully managed, conserved, and enhanced ecosystem goods and services in rural Nepal.

CONCLUSION

The provisioning, regulatory and cultural services are the major ecosystem services provided by NSB CF. Mainly local communities have benefited from the water. Primarily local communities have benefited from the forest products and pure and clean drinking water and water use for irrigating agricultural field. Majority of respondents (72%) in the downstream beneficiaries have shown their willingness to pay, if they are assured to get ESs. Similarly, 80% of the upstream respondents have shown their willingness to accept compensation for land use management conservation if they are assured to get payment from downstream users. This shows that both the upstream and downstream communities are willing to conserve the forest and implement the PES mechanism as sustainable conservation approach. Community forestry was found most preferred institution to follow the PES mechanism and indirect payment mechanism got the highest preference among the respondents. Thus, implementation of PES mechanism can be a strong recommendation in NSBCF for sustainable management of forest resources which can benefit both the upstream and downstream communities.

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REFERENCES

Adhikari, B., & Agrawal, A. (2013). Understanding the social and ecological outcomes of PES projects: A review and an analysis. *Conservation and Society, 11*(3), 359–374.

Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N. J., Bauch, S., Börner, J., Smith-Hall, C., & Wunder, S. (2014). Environmental income and rural livelihoods: A global comparative analysis. *World Development, 64*(S1), S12–S24.

Baynes, J., Herbohn, J., Smith, C., Fisher, R., & Bray, D. (2015). Key factors which influence the success of community forestry in developing countries. *Global Environmental Change, 35*, 226–238.

Bhatta, L. D., Van Oort, B. E. H., Rucevska, I., & Baral, H. (2014). Payment for ecosystem services: Possible instrument for managing ecosystem services in Nepal. *International Journal of Biodiversity Science, Ecosystem Services & Management, 10*(4), 289–299.

Christie, M., & Rayment, M. (2012). An economic assessment of the ecosystem service benefits derived from the SSSI biodiversity conservation policy in England and Wales. *Ecosystem Services, 1*(1), 70–84.

Costanza, R., Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., & others. (1997). The value of the world's ecosystem services and natural capital. *Nature, 387*, 253–260.

Costanza, R., De Groot, R., Sutton, P., van der Ploeg, S., Anderson, S. J., Kubiszewski, I., Farber, S., & Turner, K. R. (2014). Changes in the global value of ecosystem services. *Global Environmental Change, 26*, 152–158.

Engel, S., & Palmer, C. (2008). Payments for environmental services as an alternative to logging under weak property rights: The case of Indonesia. *Ecological Economics, 65*(4), 799–809.

Food and Agriculture Organization (FAO). (2018). *The state of the world's forests 2018—Forest pathways to sustainable development.* FAO Publishing.

Farley, J., & Costanza, R. (2010). Payments for ecosystem services: From local to global. *Ecological Economics, 69*(11), 2060–2068.

Fauzi, A., & Anna, Z. (2013). The complexity of the institution of payment for environmental services: A case study of two Indonesian PES schemes. *Ecosystem Services, 6*, 54–63.

Ferraro, P., & Kiss, A. (2002). Direct payments to conserve biodiversity. *Science, 298*(5599), 1718–1719.

Ghimire, P., & Lamichhane, U. (2020). Community-based forest management in Nepal: Current status, successes, and challenges. *Grassroots Journal of Natural Resources, 3*(2), 16–29.

Gómez-Baggethun, E., De Groot, R., Lomas, P. L., & Montes, C. (2010). The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. *Ecological Economics, 69*(6), 1209–1218.

Karami, O., Yazdani, S., Saleh, I., Rafiee, H., & Riahi, A. (2020). A comparison of Zayandehrood River water values for agriculture and the environment. *River Research and Applications*, 1–7.

Lamsal, P., Atreya, K., Pant, K. P., & Kumar, L. (2015). An analysis of willingness to pay for community-based conservation activities at the Ghodaghodi Lake Complex, Nepal. *International Journal of Biodiversity Science, Ecosystem Services & Management.* https://doi.org/10.1080/21513732.2015.1055338

Millennium Ecosystem Assessment (MEA). (2005). *Ecosystems and human well-being: Synthesis.* Island Press.

Nawalpur-Saraswati (Basamadi) Community Forest User Group (NSBCFUG). (2015). *Operational plan of Nawalpur-Saraswati (Basamadi) Community Forest.* Makawanpur District, Nepal.

Pasgaard, M., Van Hecken, G., Ehammer, A., & Strange, N. (2016). Unfolding scientific expertise and security in the changing governance of ecosystem services. *Geoforum, 84*, 354–367.

Paudyal, K., Baral, H., Lowell, K., & Keenan, R. J. (2017). Ecosystem services from community-based forestry in Nepal: Realizing local and global benefits. *Land Use Policy, 63*, 342–355.

Poudyal, B., Upadhaya, S., Acharya, S., & Khanal Chhetri, B. B. (2021). Assessing socio-economic factors affecting the implementation of payment for ecosystem services (PES) mechanism. *World, 2*, 81–91.

Prachhain, I. B., Khanal, B., & Mandal, R. A. (2019). Assessing payment for ecosystem services in Resunga Forest Hill, Gulmi, Nepal. *Open Access Journal of Environmental and Social Sciences, 4*(3). https://doi.org/10.32474/OAJESS.2019.04.000186

Rai, R. K., Shyamsundar, P., Bhatta, L. D., & Nepal, M. (2016). Designing a payment for ecosystem services for the Sardhukhola Watershed in Nepal. *South Asian Network for Development and Environmental Economics (SANDEE), Working Paper, 108–116.*

Stapp, J. R., Lilieholm, R. J., Upadhaya, S., & Johnson, T. (2015). Evaluating the impacts of forest management policies and community-level institutions in the buffer zone of Chitwan National Park, Nepal. *Journal of Sustainable Forestry, 34*(5), 445–464.

Stapp, J. R., Lilieholm, R. J., Leahy, J., & Upadhaya, S. (2016). Linking attitudes, policy, and forest cover change in buffer zone communities of Chitwan National Park, Nepal. *Environmental Management, 57*(3), 1–11.

The Economics of Ecosystem and Biodiversity (TEEB). (2010). *Mainstreaming the economics of nature: A synthesis of the approach, conclusions, and recommendations of TEEB.* Geneva, Switzerland.

Wunder, S. (2007). The efficiency of payments for environmental services in tropical conservation. *Conservation Biology, 21*(1), 48–58.

Wunder, S., & Albán, M. (2008). Decentralized payments for environmental services: The cases of Pimampiro and PROFAFOR in Ecuador. *Ecological Economics, 65*(4), 685–698.

Wunder, S., Angelsen, A., & Belcher, B. (2014). Forests, livelihoods, and conservation: Broadening the empirical base. *World Development, 64*(S1), S1–S11.

Yang, H., Yang, W., Zhang, J., Connor, T., & Liu, J. (2018). Pathways from payments for ecosystem services program to socioeconomic outcomes. *Science Advances, 4*(7), 1–8.