

FEASIBILITY OF PAYMENT FOR ECOSYSTEM SERVICES IN KHAGERI SUB-WATERSHED, CHITWAN, NEPAL

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ABSTRACT

The study entitled “Feasibility of payment for ecosystem services in Khageri sub-watershed, Chitwan, Nepal” was undertaken in Chitwan district focusing to explore the major ecosystem services and their potential services buyer and seller and to determine willingness to pay for the ecosystem services and willingness to accept for ecosystem services and . For this, household survey was done in both upstream and down streams communities to understand people perception on WTP and WTA for ecosystem services. In addition, Focus group discussions and key informant interview was done in both upstream and downstream community to identify the major ecosystem services by using the snowball technique and their potential services buyer and service sellers. The study show majority of people of upstream and downstream community around Khageri watershed have strong WTP and WTA for ecosystem services. Thus they have strong WTP and WTA for ecosystem services. Most of the respondents have preferred community group as potential institutions for collecting and providing compensation.

Thus, Developing a PES in Khageri sub watershed is socially acceptable and financially feasible. For this the proper institution should be identified and their respective roles should be fixed and developing a national PES policy is needed. Conducting of capacity building and awareness program among the upstream and downstream is required for the successful implementation of PES mechanism.

Keywords: *Ecosystem services, Khageri sub-watershed, Willingness to accept, Willingness to pay*

INTRODUCTION

Nepal is a mountainous country, which is covered by several watersheds and thousands of sub watersheds. A watershed, often called a catchment area, is a topographically delineated area drained by a river system and differentiated from another river basin. A watershed is a hydrological unit that has been described and used as a physical as well as socio-economic or political unit for management of natural resources (Dhakal, 2014). watershed contain physical-biological features as well as social-economic and political features.

PES is a market-based approach to conservation based on the twin principles that those who benefit from environmental services (such as users of clean water) should pay for them, and that those who generate services should be compensated for providing them (Pagiola et al., 2007). Payments for ecosystem services (PES) occur when the beneficiaries or users of an ecosystem service make payments to the providers of that service. In practice, this may take the form of a series of payments in return for receiving a flow of benefits or ecosystem services (Fripp, 2014). PES concept in these days, denote not only pure market based

approaches but also it is used to denote increasingly broad range of plot for administer direct incentive (both economic and materials) to research manager. Nowadays, development organizations are increasingly using such schemes as a tool to promote the twin goals of conservation and development. PES is not a silver bullet that can be used to address any environmental problem, but a tool tailored to address a specific set of problems(Engel et al., 2008). PES has been as an alternative sources of financing for conservation program in developing countries .Reflection on such international trends can also be made in Nepal, which is geographical focus of this study. The concept of PES had been introduced in Nepal in 2003 as a pilot project of the World Agroforestry Centre to compensate and reward upstream community of that Kulekhani watershed(Bijaya et al., 2018).

This research building on the knowledge of PES, aims to understand how the twin objective of ecosystem conservation and rural development have been translated into the practical. Watersheds are a source of economic goods that are vital to livelihoods and

economies, and provide spaces for recreation and cultural heritage (PEDRR, 2011). The total available water in a watershed mainly depends on precipitation and internal renewable resources, which are replenished by rainfall. In many places, human activities are causing watersheds to deteriorate thereby affecting water supply and its quality. Khageri sub-watershed lies in Chitwan district which play important role in livelihood of people .Khageri sub-watershed play important role to sustain the life of people. Thang Khola, rani khola and khahare Khola is the main sources of the water whereas there are other different type of supportive resources like Mulsyangdhi khola, Amili Pani Muhan, Bung khahare khola, batter khola, Thulo syangdi, Bhoti khola etc.

Moreover Availability of water in famous tourist destination place i.e. Beeshazari Lake directly depends on the water flow of Khageri canal.

MATERIALS AND METHODS

Study area

Khageri sub-watershed is situated in Chitwan district of Bagmati province no '3' which lies in upper Siwalik and Inner Terai (Dun valley) in Northern and Eastern fringe of the Barandabhar forest corridor on both sides of the Mahendra Highway. It lies within latitude and longitudinal co-ordinates: 27°35'45"-27°47'04" and 84°27'37"- 84°35'06" respectively. It has an altitude range from 180m to 1307m above the sea level. Similarly the sub watershed extends over the large area from Ratnanagar municipality, Bharatpur Metropolitan. A seasonal monsoon streams Thang Khola, Rani Khola, Khahare Khola, Panchanadi, Mani Khola is the main inlet stream to the Khageri sub watershed. Small seasonal namely Mulsyangdhi Khola, Amili Pani Muhan, Bung Khahare Khola, Tirtire Dhara, Batter Khola, Thulo syangdi, Sano syangdi Khola and Bhoti Khola are the supporting inlet to a Khageri watershed and its outlet is Rapti Khola and Bhadrani.

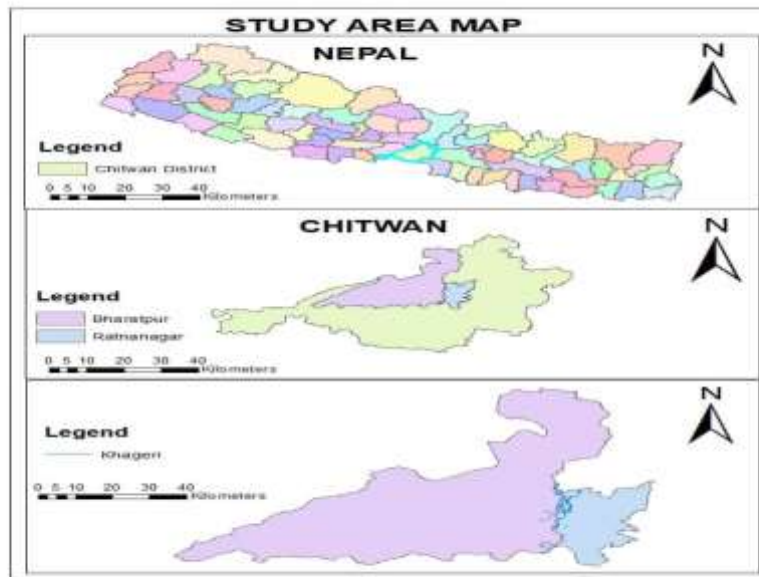


Figure 1: GIS Map of Study Area

Methods of study

Data collection

The main aim of this research was to explore the feasibility of payment for ecosystem services in Khageri Watershed, Chitwan, Nepal. This research was of exploratory type, so most of the information was collected in qualitative form. Therefore a significant volume of information was required which were collected from both primary and secondary information sources.

Primary data collection

The primary data collection were generated through various tools like key informant interview, focus group discussion, questionnaire survey, direct observation.

Key informant Interview

Key Informant Interview was conducted with the Khageri irrigation board, panchakanya CFUG, Bharatpur water supply management board, buffer zone community forest user group and other CFUG. More than the six key informant's representing the local communities in the term of their social status, ethnicity, economic well-being, knowledge and ecological regions were selected for the interview by the snowball technique.

Focus group discussion

Two-group discussion was carried out where people from various sectors were involved as participants. Community forest users group, old people, teachers, governmental professional, local community were

gathered and group discussion to know the feasibility of payment of ecosystem services in Khageri watershed.

Schedule survey

Schedule survey was conducted to identify the problem and conservation status as well as the perception of people. The household survey with the willing to pay and willing to accept was carried out. Snowball sampling technique was used to select the responded for the schedule survey or household survey.

Direct observation

It involved observation of study areas and the prioritized natural resource there in (biodiversity, watershed, Landscapes and stock of carbon). Observations were focused on assessing their status and trends, existing land use and resource use patterns and their impacts. Moreover, efforts were also made to meet, discuss on various aspects of PES with Schedule survey to collect their aspirations, and perspectives towards the PES.

Secondary data collection

Related documents (secondary information) was collected and reviewed from the different literatures of watershed, Khageri irrigation management board, Buffer zone community forest user group, Newspaper, journal paper, published and unpublished Reports or any concerned authorities.

Data analysis

Microsoft office –Excel 2013, was used to analyze the date obtained from schedule survey. Arc GIS.10.4 was used to make map of study area. The data were logically interpreted along with average mean, simple tables' charts, Pie-chart and graphs.

RESULTS

Social- economic context

This section presents the social- economic condition of the respondents, which include caste, educational Status, occupation, and economic status of survey households involved in different occupation. Total number of respondents in upstream community (services provider) was 30 and downstream user (Beneficiaries) was 30 .PES is a context specific phenomenon determined by the existing social-economic factors so considerations of these factors are necessary for realization of the scheme. These backgrounds of the respondents may have role in the measurement of perception regarding payment for ecosystem services mechanism.

Respondent educational status

Among the Upstream respondents 16.67% people were totally illiterate, 46.67% people were literate with basic ability to read and write, 26.67% people completed grades 12 or higher education and 10% people had education qualification of either bachelor or master i.e. university education whereas 26.67% of the respondent in downstream were illiterate, 36.67% were literate, 23.33% got higher education and only 13.33% have University education.

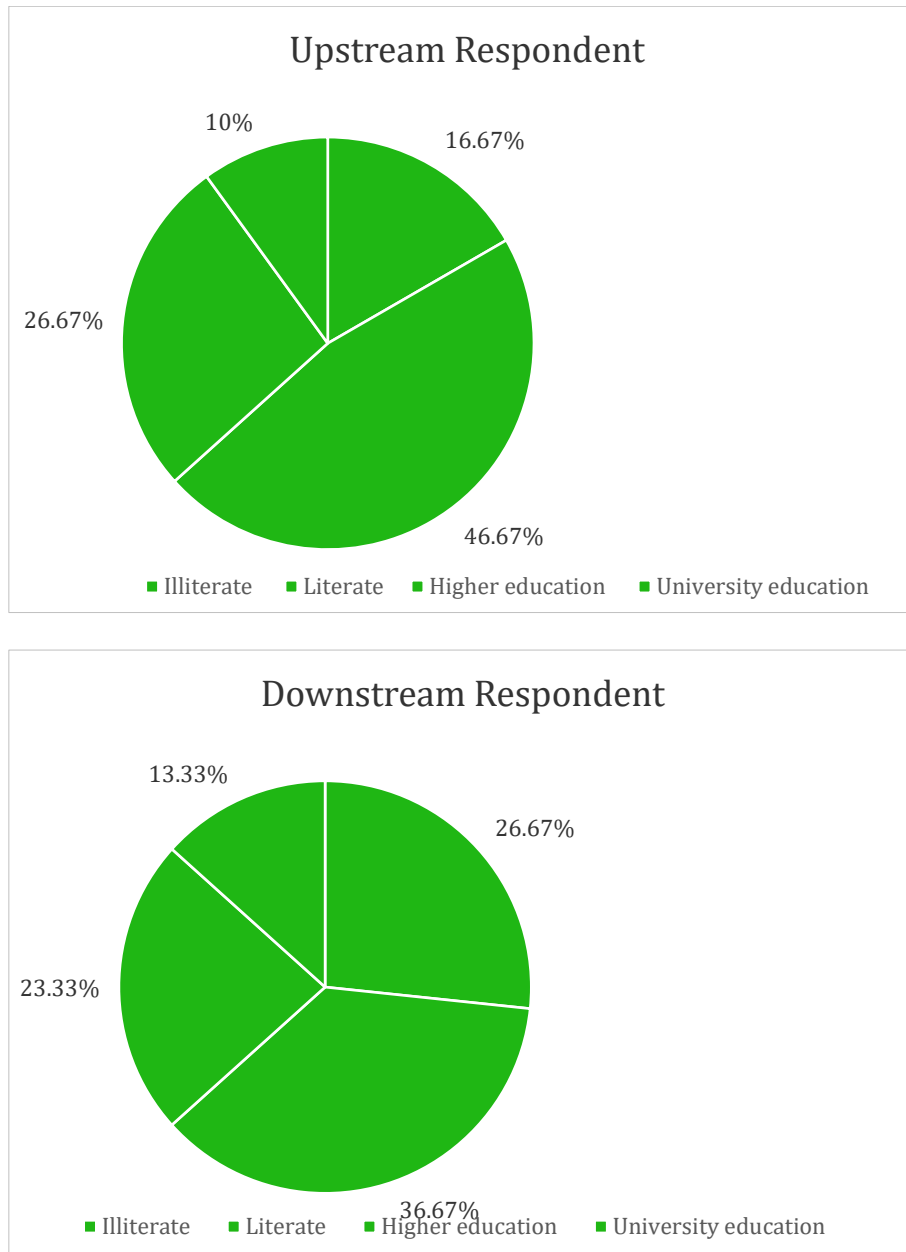


Figure 2: Respondents education status

Occupation of respondents

33.33% of total upstream services provider respondent were farmer, 13.33% respondent doing business, 26.67 % respondent doing the private job, 16.67% have government job, and 10% were students. While, 40% of the total respondent of downstream users was farmer, 23.33% respondent doing business, 13.33% respondent doing the private job, 16.67% have government job and 6.67% were students.

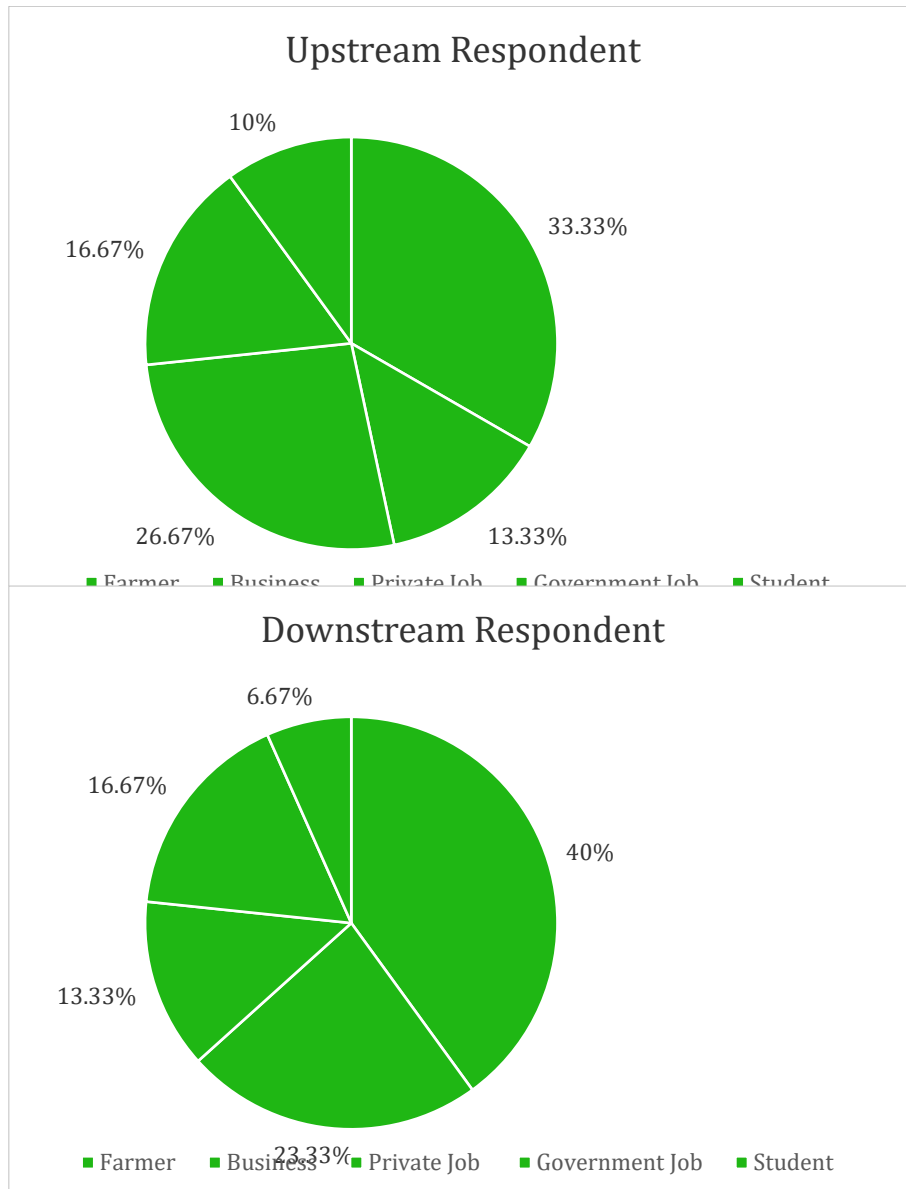


Figure 3: Occupation of respondents

Caste of respondents

In upstream communities chhetri constitutes the large social group of respondents i.e. 40% and followed by Brahmin, janajati and Dalit with 23.33%, 20% and 16.67% while in downstream 30% were janajati, 26.67 % were Brahmin, 23.33% were Dalit and 20% chhetri.

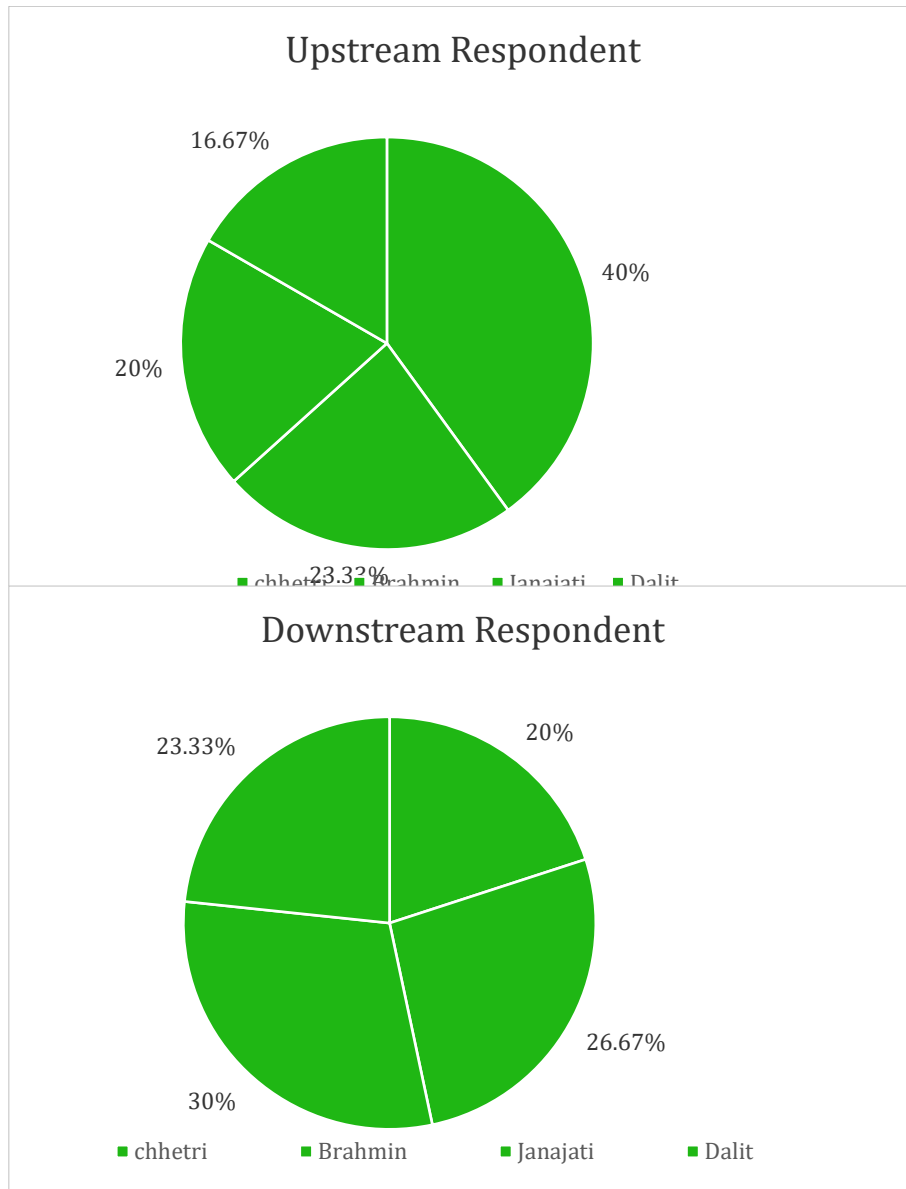


Figure 4: Caste of upstream and downstream respondents

Monthly income of respondents

In the upstream area, 26.67% respondents reported to earn less than NRs 10,000 monthly income whereas household with NRs 10,000-20,000 income were 33.33%. Households with NRs 20,000 -30,000 monthly income were 16.67% and households with monthly income more than NRs 30,000 were 23.33% whereas in downstream area 33.33% respondents reported to earn less than 10,000 monthly income whereas Household with NRs 10,000-20,000 income were 26.67%. Household with NRs 20,000-30,000 monthly income were only 23.33%, and Household with monthly income more than NRs were only 16.67%.

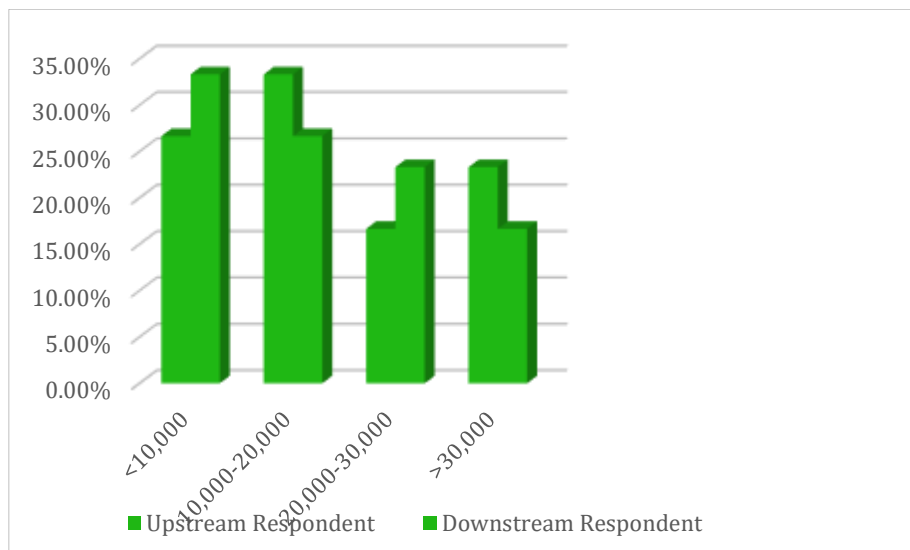


Figure 5: Monthly income of upstream and downstream respondents

Land holding size of respondent

The overall landholding size per household of upstream services provider according to type was 14 Biga (280 kattha) for khet and 1.65 Biga (33 kattha) for Bari.

While overall land holding size per household by downstream user according to type was 5.8 Biga (116 kattha) for khet and 1.25 Biga (25 kattha) for Bari.

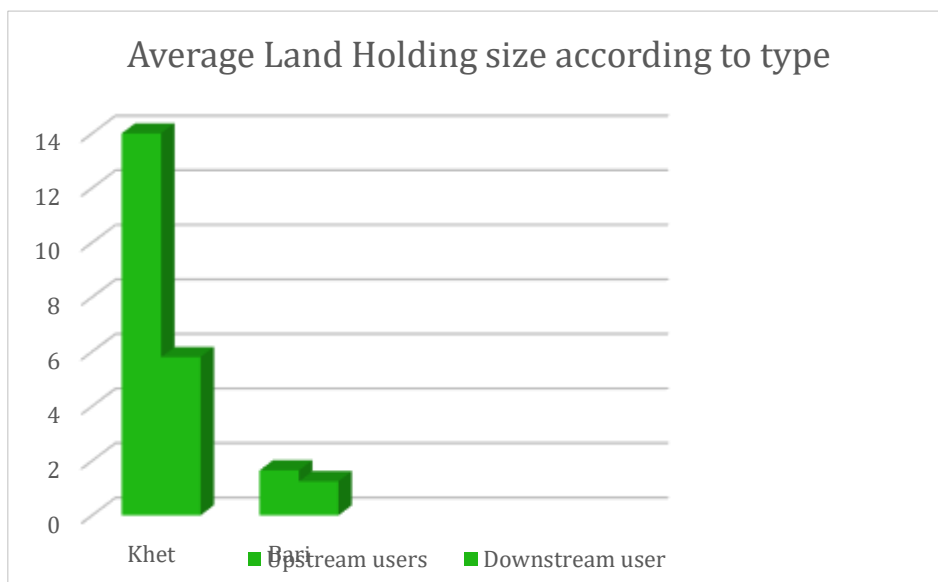


Figure 6: land holding size of respondents

Ranking of Environmental services

Regarding there are many type of environmental services people are getting from watershed instead some of services according to the people benefits are mentioned below and Ranked. Respondent have ranked

environmental services on the basis of their perception and priority basis. Weightage mean (score) was calculated and ranked was determined on the basis of the weightage mean. Here, Fresh environment is mostly available in upstream in comparison to the downstream .so it is ranked in first by the upstream respondents and second by downstream respondents. Similarly Irrigation /drinking is ranked first by the downstream respondent while fourth by the upstream respondent. Moreover conservation and Biodiversity or habit for wildlife is ranked as second and third by the upstream and downstream respondent. Furthermore, downstream Respondent ranks Beautiful Landscape on third by upstream and on fourth. Upstream respondent while fifth by the downstream respondents ranks clean and siltless water as sixth. Soil sediments or nutrient retention is ranked as the last one by the downstream respondent in the Khageri watershed but upstream respondent ranks it as fifth.

Ranking of environmental services

Table 1: Ranking of environmental services

Environmental services	Upstream services provider		Downstream beneficiaries	
	Weightage mean	Rank	Weightage mean	Rank
Fresh Environment	1.5	1	1.67	2
Conservation and Biodiversity/Habit for wildlife	1.16	2	1.17	3
Beautiful landscape	0.83	3	0.83	4
Irrigation /Drinking	0.67	4	0.67	1
Soil sediment /nutrient retention	0.5	5	0.5	6
Clean and siltless water	0.33	6	0.17	5

Major ecosystem services and the potential buyer (user) and sellers (provider) of such Ecosystem services of Khageri watershed

Table 2: Major ecosystem services and the potential buyer (user) and sellers (providers) of such Ecosystem services of Khageri watershed.

	Major Ecosystem services	Salient features	Potential seller	Potential Buyer
Provisioning services	Water	Water from the Khageri watershed is used for drinking and irrigation purpose.	Bharatpur Water supply Management Board, panchakanya	Local communities, Beer factories, coca cola factories etc.
	Fish	Khageri watershed provides habitat for different fishes, which is the major food for the local community.	Irrigation system, Narayani lift Khageri irrigation canal, local community.	
Supporting services	Clean and siltless water	Regulation of flow- the Maintenance of dry seasonal flows and flood control, maintenance of water quality – Minimization of Sediment load, nutrient load, chemical load and salinity; control of erosion and sedimentation; maintenance of aquatic habitats.	Upstream communities Including forest management and other community.	Downstream community mainly urban population, drinking water supply corporation and irrigation water corporation.
	Fresh environment	Forest trees and soil can store on a carbon long-term basis. This represents major global services.	Forest Management community like: panchakanya community forest user group, Tikauli buffer Zone CFUGs,	Community around Watershed area and global community also.

			chaturmukhi CFUG,	
	Beautiful landscape	Give a nice view to a place.	Local community, Chitwan district and government	Local communities
Cultural services	Recreational use	It promotes the traditional value of that place.	Local community around the watershed	Local, regional community.
Regulating services	Biodiversity conservation	Biodiversity conservation, both of wild and domesticated plants and animals. The entities of biodiversity generally include ecosystem, species and population. Biodiversity is required both for goods such as food, fiber, and genes for gene products, and services. With the loss of species, ecosystem processes are adversely affected.	Local community, CFUGs, farmer around the watershed.	Local, regional and Global community.

Willingness to pay (WTP) and willingness to accept (WTA) for ecosystem services

WTP by downstream beneficiaries

Regarding the issues on WTP compensation paid by downstream Beneficiaries. About 86.67% of the respondent is ready for WTP, whereas 13.33% of the respondent is not ready to pay as compensation.

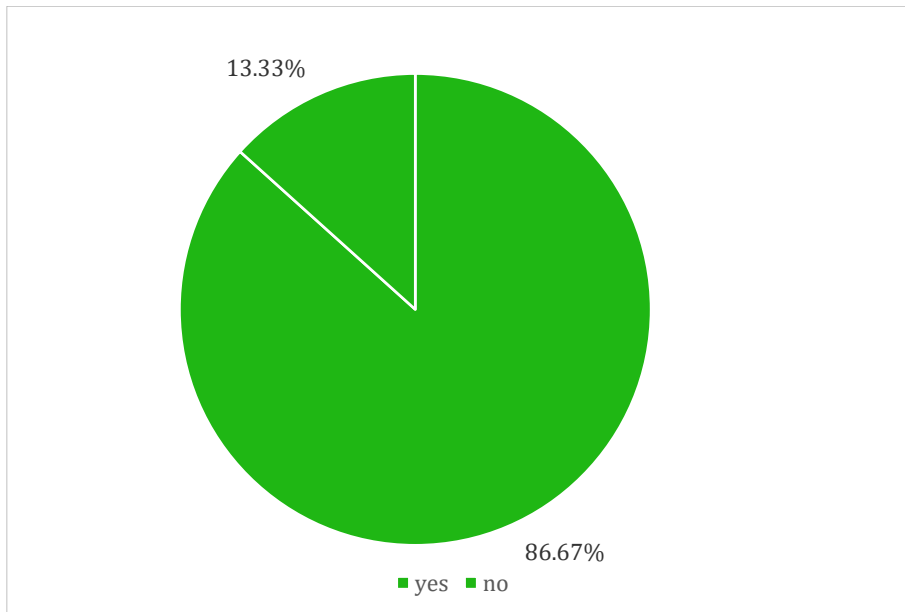


Figure 7: Willingness to pay for services

WTA by upstream land managers

Regarding the issues on the WTA compensation paid by the downstream beneficiaries. About 93.33% of the respondent is ready for WTA, whereas 6.67% of the respondent is not ready to accept as compensations.

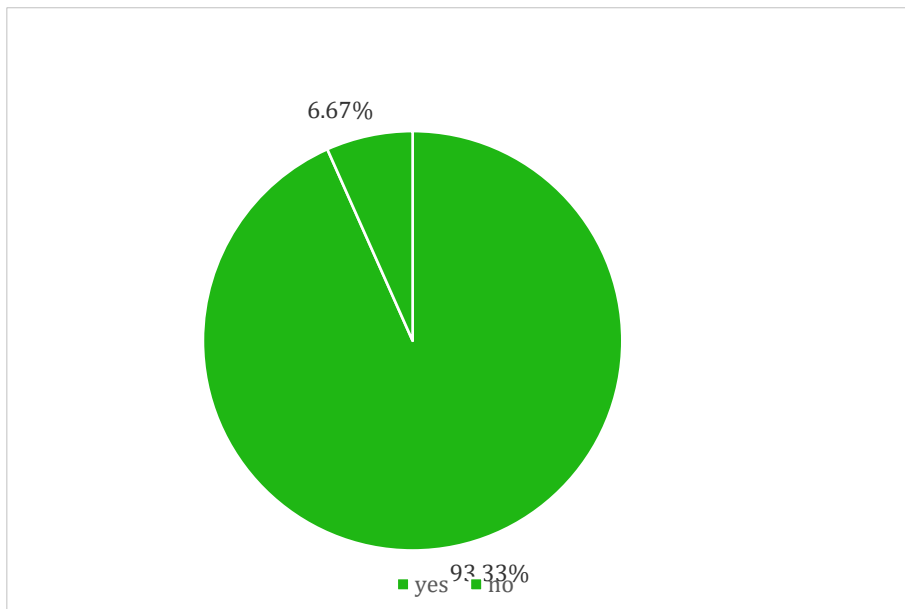


Figure 8: willing to accept for services

Reason for lack of WTP and Reason for lack of WTA as compensation

13.33% out of the total downstream respondent lack WTP for compensation. Among them about 76.67% respondent agree that its government duty, 13.33% respondents prefer the current situation, 10% of the

respondent don't have enough income to compensate while, 6.67% out of total upstream respondent lack WTA for compensation. Among them about 56.67% respondent agree that its government duty, 16.67% respondent prefer the current situation, 26.67% respondents don't have enough income to compensate.

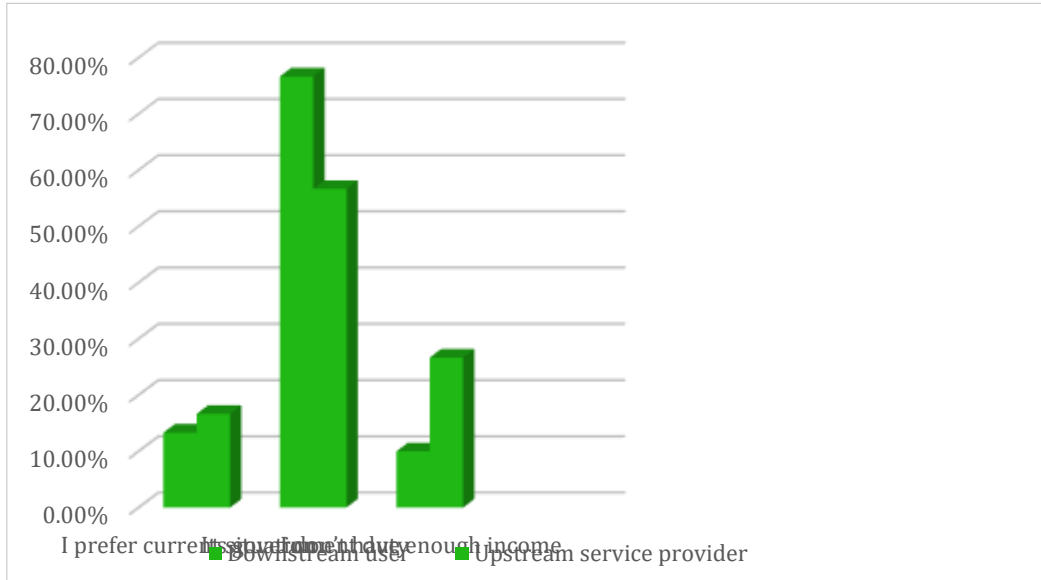
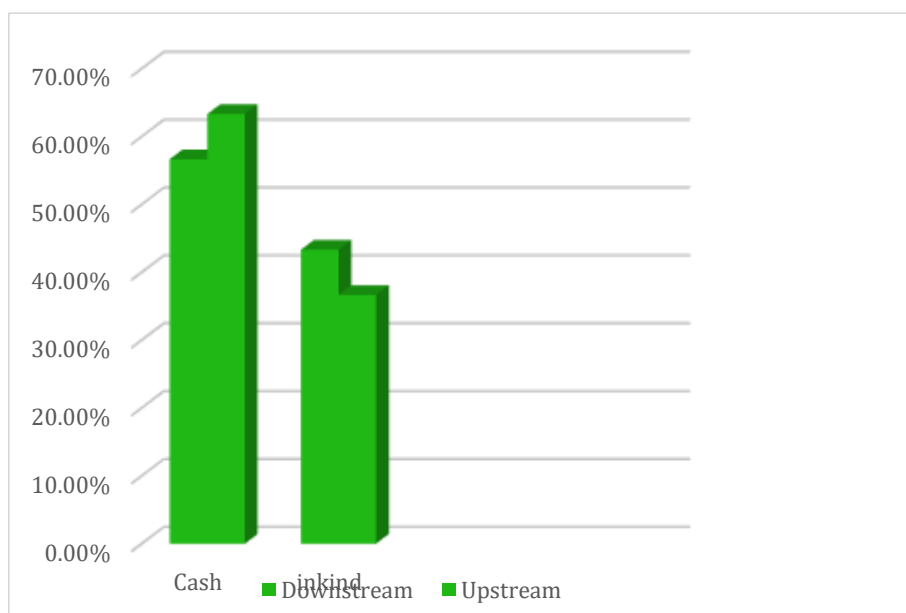


Figure 9: Reason for Lack of WTA and WTP

Compensation type

Downstream users are WTP compensation as cash by 56.67% of respondents whereas remaining 43.33% are WTP compensation as in-kind services. Similarly upstream services providers are WTA compensation as cash by 63.33% of respondents and remaining 36.67% of upstream respondent are WTA compensation as in-kind.



Figures 10: compensation type

WTP and WTA cash on basis of land use pattern

Among the respondents WTP compensation as cash, 33.33% were willing to pay NRs 50 /kattha /year/HH, and 26.67% were willing to pay NRs 100 /kattha /year/HH, and 23.33% were willing to pay NRs 150 /kattha /year /HH and 16.67% were willing to pay NRs 200/kattha /year/HH.

While the respondents WTA compensation as cash, 6.67% were willing to accept NRS 50/kattha /year/HH, 36.67% were willing to accept NRs 100/kattha /year/HH, 43.33% were willing to accept NRs150/kattha /year/HH and 13.33% were willing to accept NRs 200/kattha /year/HH.

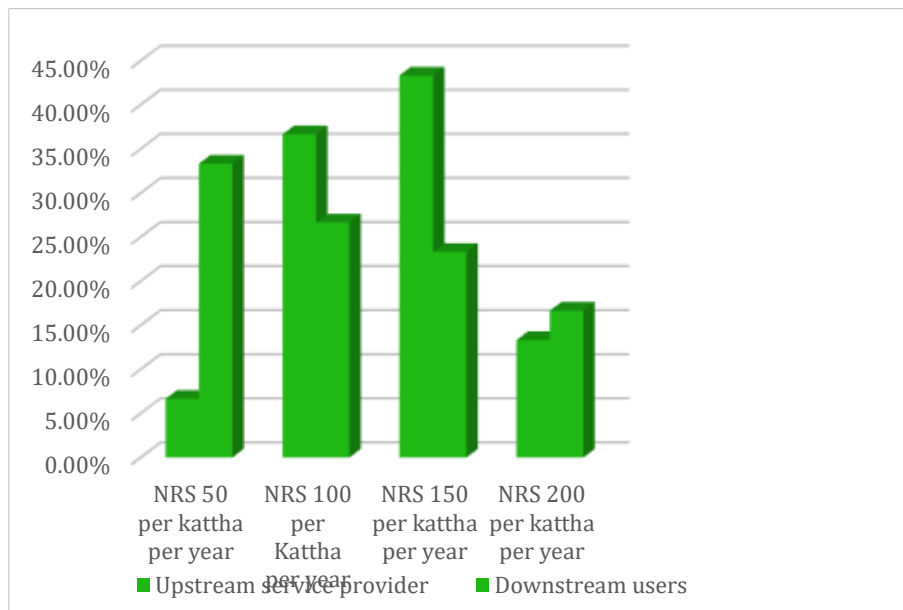
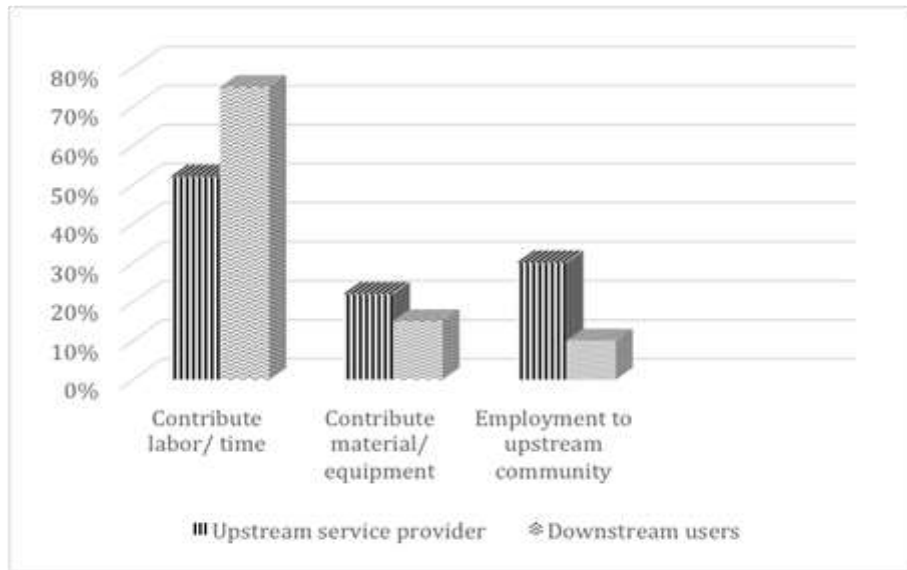


Figure 11: WTP and WTA cash on basis of land use pattern

WTP and WTA on the basis of in-Kind services

Here in the figure we can see that about 52% of upstream respondents are WTA compensation as contribution of labor/time, 22% are WTA compensation as contribution of materials /equipment and 30% are WTA as employment to their community.

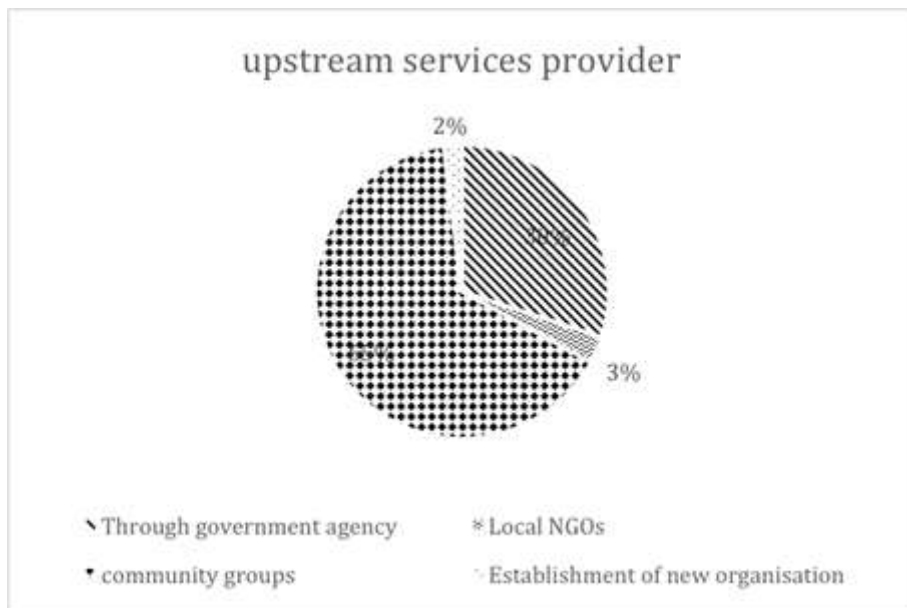
Similarly in 75% downstream beneficiaries are WTP compensation by contribution of labor/time, 15% are WTP as compensation by contribution of material/equipment and 10% by providing employment to upstream community.

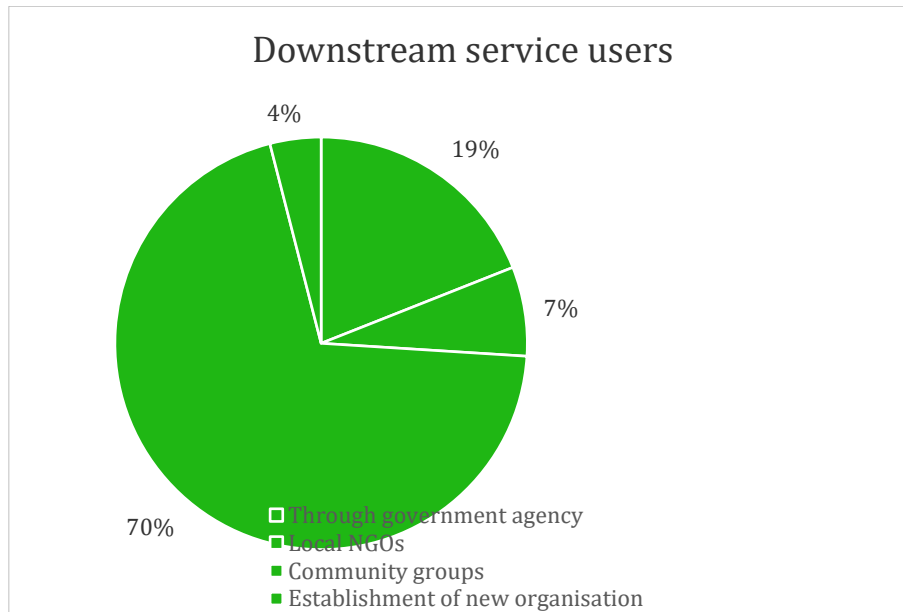


Figures 12: WTA and WTP on the basis of in-kind services

Preference of potential institution for Compensation

Both upstream services providers and downstream service user preference is high for community group for potential Institution for compensation. i.e 65% and 70% by upstream services provider and downstream users respectively and preference is followed by government agency 30% and 19% by upstream service provider and downstream services users respectively. Only 3% for local NGOs and 2% for establishment of new organization preferred by respondent of upstream services provider. Similarly 7% for local NGOs and 4% for establishment for new organization preferred by downstream service users.





Figures 13: preference of potential institution for compensation by upstream services provider and downstream services user

DISCUSSION

This study showed that majority (86.67%) of downstream users of the respondent are ready to pay for ecosystem services to the upstream/services providers and similarly 93.33% of the upstream/services providers of respondents are ready to accept the payment for providing ecosystem services to downstream. The positive attitude of the majority of respondents of upstream and downstream community for WTP and WTA respectively. Among the respondents WTP compensation as cash, 33.33% were willing to pay NRs 50 /kattha /year/HH, and 26.67% were willing to pay NRs 100 /kattha /year/HH, and 23.33% were willing to pay NRs 150 /kattha /year /HH and 16.67% were willing to pay NRs 200/kattha /year/HH. While the respondents WTA compensation as cash, 6.67% were willing to accept NRS 50/kattha /year/HH, 36.67% were willing to accept NRs 100/kattha /year/HH, 43.33% were willing to accept NRs150/kattha /year/HH and 13.33% were willing to accept NRs 200/kattha /year/HH .AS similar study in Dhankuta Municipality showed the WTP of NPR15/month/tap and in shardu khola watershed of approx. NPR 22/month/tap. This study focus on overall major ecosystem services .A detail valuation and assessment of ecosystem services is needed to determined WTA and WTP for specific ecosystem services.

Similarly, in both upstream and downstream majority of respondent's education status was found to be literate. And mostly people are engaged in farmer. And many people in upstream belong from chhetri caste group while janajati was found to be more in downstream. Comparing to the upstream and downstream monthly income downstream people have good income than upstream. Likewise, Reason for lack of WTA and WTP by both upstream and downstream was that they think it's a governmental duty. The result showed community group are mostly preferred institution as potential institution for facilitating the payment for upstream and downstream communities. This can be due to the community groups such as women's group and community forest user group are successfully managing the forests of Nepal to some extent which gives some evidence to advocate on its behalf while taking about the institutional application of PES in Nepal.

There are still debates on the capacities of the community group while taking about issues and it might be another burden to run PES schemes without any technical and financial assistance. There needs to be a governmental body to secure the sustainability of the purposed approach and also to provide some financial and technical assistance to enhance the capacity of the institutions .Not only this, it also helps to increase the accountability of the institution. Despite high level of benefit, there are significant level of costs imposed on upstream /services providers for providing ecosystem services by conservation and management the environment to PES can a major tool to link upstream and downstream communities for managing and providing quality and quantity of ecosystem services.

CONCLUSION

The major ecosystem services of Khageri watershed are provision services i.e. water and fish, supporting services are clean and siltless water, Habitat for fish and wildlife, Beautiful landscape similarly regulatory services are Biodiversity and conservation, Erosion control, whereas cultural services are Recreation. Similarly, the positive attitude of the majority of respondents of upstream community (93.33%) toward WTA and Downstream community (86.67%) for WTP. While Most of the respondent of upstream services provider and downstream users prefer community group as potential institution for providing compensation. Community forest, Land owner, farmer, local community were found to be ESs providers as an upstream users and Bharatpur water supply management board, Khageri irrigation management board, government and non-governmental institutional, downstream people were beneficiaries of ESs. Conducting of capacity building and awareness program among the upstream and downstream user is required for the successful implementation of PES Mechanism.

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