ASSESSMENT OF FACTORS AFFECTING WILLINGNESS TO PAY/ACCEPT: A STUDY FROM BEGNAS WATERSHED, NEPAL

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Abstract

This study prioritized five major ecosystem services from the watershed which included clean and silt less water, conservation and biodiversity, fresh environment, tourism, and beautiful landscape. Among these ecosystem services, the fresh environment was ranked first based on respondent's importance. We conducted multiple focus group discussions, key informant surveys, a household survey, and performed statistical analysis to derive results. About 120 respondents were surveyed, out of which 60 were from upstream and 60 were from the downstream community. The majority of the respondents agreed to participate in the PES mechanism for the conservation of watersheds. The present study has estimated average WTP NRs 114.51/ropani/year/HH and WTA of NRs 118.18/ropani/year/HH for conservation of watershed. The probit model was adopted to identify the factors affecting people to pay or accept for ecosystem services. Respondent's socio-economic characteristics such as gender (female), household income, higher education level, and people involved in agriculture and tourism had a positive impact on willingness to pay in downstream community, while the variables occupation (agriculture and tourism) and property size only had a positive relationship with a willingness to accept in upstream community. Our findings showed the feasibility to initiate and implement the PES mechanism in this watershed and the result of this study could also be used to design a long-term wetland management plan in the future to preserve the wetland. Moreover, time and again studies on the monetary values for ecosystem services are also recommended to assess the varying behavior of the people with time and development.

Keywords: Begnas watershed; Payment for Ecosystem services; Probit model; Willingness to accept; Willingness to pay

Introduction

The Millennium Ecosystem Assessment (MEA) defines ecosystem services (ES) broadly as "the benefits people obtain from ecosystems" and has categorized ES as provisional services, regulating services, supporting services, and cultural services (MEA, 2005). Payment for environmental services (PES) is one of the outstanding examples among the environmental policies that are intended to encourage the supply of those services. PES has become an attraction worldwide because of its innovative approach to converting the ecosystem values into monetary incentives for the people (Engel et al., 2008).

The major idea of PES is to provide a framework to promote a sustainable land-use system by rewarding the responsible land user who generates ecosystem services (Mayrand et al., 2004). PES prioritizes the management of natural resources by putting in order the individual and/or collective land-use systems. It does so by creating incentives through the exchange of resources among the social actors (Muradian et al., 2010). PES provides economic support to people who play roles to protect a particular resource with the major goal of conserving ecosystem services. It offers financial support schemes, to implement land-use practices as well as protection of the ecosystems (Khanal and Poudel, 2012). PES is a novel market-based tool that implies that people on the receiving end of the ecosystem services should compensate those who provide them such services (Pagiola, 2007). PES scheme includes five basic components: Voluntary transactions, Service users, Service providers, Conditionality on agreed rules of natural resource management, and Generating offsite service (Wunder, 2015).

It is important to understand the relationship between ecological functions and the resulting ecosystem services. But more importantly, one should be fully aware of the role of indigenous communities and their perception of the benefits and trade-offs of PES strategy; for an effective system design (Kinzig et al., 2011; Simelton and Dam, 2014). While selecting suitable ecosystems service indicators, comparing management alternatives through ecosystem services ranking, and approving such management options; the participation of local stakeholders becomes significant (Ananda and Herath, 2009; Seppelt et al., 2011). Moreover, before initiating a PES scheme as a policy alternative, it is important to learn about the behavioral and governance aspect of local communities (Muradin et al., 2010). In Nepal, PES concept in watershed management has to receive attention at the policy level for the sustainable management of watersheds and forests. Thus, this concept makes more sense in the context of Nepal (Thapa et al., 2020, Khatri and Paudel, 2013; Regmi et al., 2009). Thus in this case it is necessary to understand factors to link upstream community and downstream community sustainably. We couldn't calculate the monetary values of numerous natural services made available by wetlands (Roberts 1997), thus risking a chance to recognize its benefits by undervaluing its actual

values. One of the possible mechanisms would be PES for different determinants of WTP and WTA for the conservation and sustain ecosystem services.

This research explored the ecosystem services of the Begnas watershed based on people's preferences. It also aims to determine the WTP and WTA in cash as well as factors influencing WTP for downstream communities and WTA for upstream communities. In doing so, this study seeks to answer the following key questions: (1) What are the major ecosystem services in the Begnas watershed? (2) What are the factors affecting WTP and WTA for watershed conservation? (3) What is the actual amount of respondent's WTP and WTA for watershed conservation?

Materials and Methods

Study area
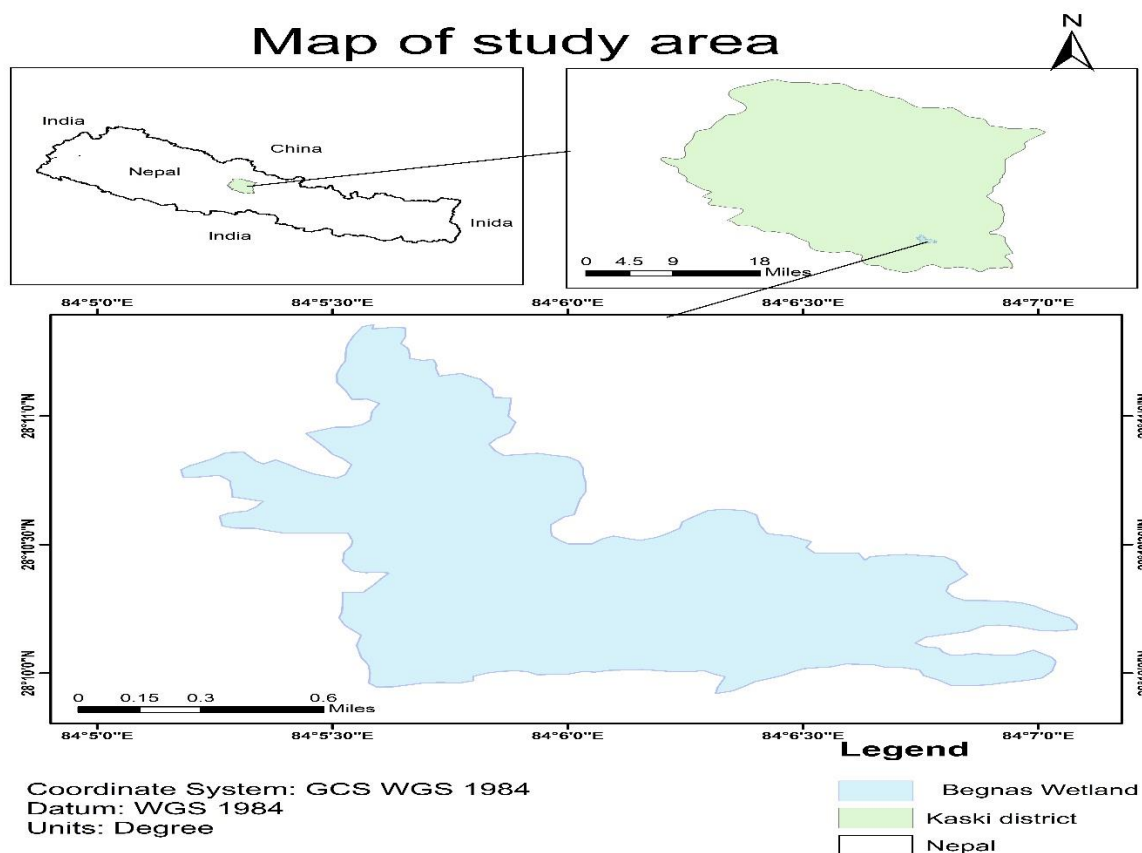
Begnas Lake is a freshwater lake situated in the Pokhara Metropolitan of Kaski district. It is the second-largest lake among the lake cluster of Pokhara valley. It is designated as one of the country's wetlands of international importance (Ramsar, 2016). It extends between 28° 7'N to 28°12'N latitude and 84 ° 5 'E to 84 ° 10'E longitude. The average depth of water in the lake is estimated to be 6.6 m with the water surface elevation 655.7 m above mean sea level. The total area of Begnas watersheds that feeds water and sediment to the lake is 49km^2, which includes ecologically and culturally diverse landscapes, natural resources, and settlements of people (NLCDC, 2010). After the recent reclassification of local administrative units by the government,

watershed areas lie in wards 28, 30, and 31 of Pokhara Metropolitan City (PMC). A seasonal monsoon stream *Syankhudi Khola* is the major inlet stream to the lake. Small seasonal streams namely *Lipdi, Maladi, Majhikuna* are the other supporting inlet to the Begnas Lake. The monsoon rainfall occurred from May to September, the climate of Begnas Lake is sub-tropical and humid with varying microclimatic conditions depending upon orientation, slopes, and location. The seasonal cycle of temperature is cool-warm to hot-warm with peak temperature in July and August (35.5°C) but falling to 13.2°C in January (Shrestha, 2015). The annual rainfall is 4000 mm and average temperature is 21ºC (Gautam et al., 2020) with peak monthly rainfall in July (886 mm) and lowest in November and December (13mm). Evapotranspiration is lowest in December (53 mm) and highest in May with an average of 171mm (Oli, 1996). Regarding the geology of the area, this area is primarily comprised of slate and phyllite zone with beds of calcareous conglomerate and gravel deposits. The prominent type of soil in this area is clay loam and medium-textured alluvial silt (Parajuli, 2011).

Model Specification

Residents were asked about their probability of willingness to pay for the hypothetical watershed conservation program. A probit model was designed to determine whether the respondent was willing to pay for the watershed conservation program (Green, 2006).

For the WTP decision of the respondent, discrete choice format questions were designed to investigate whether the respondent was willing to pay for conservation of BWS, as follows in equation 1. Kindly note every equation must be in the text cited.

$$\text{Prob (WTP = Yes/No)} \qquad 1 = \text{willing to pay, } 0 = \text{not willing to pay} \tag{1}$$

Where, the probability of choosing to pay for conservation (Yes, No) is conditional on outcomes from program implementation through the set of attributes.

$$\text{Prob (WTP)} = \frac{1}{1 + e^{-Zi}} \tag{2}$$

Where, Prob (WTP) is the probability of saying yes for willingness to pay for the ith respondent and Zi is a function of explanatory variable denoted as in equation 3

$$Zi = \beta_0 + \beta_1 \text{Gender} + \beta_2 \text{Age} + \beta_3 \text{Education} + \beta_4 \text{Ocupation} + \beta_5 \text{Income} + \beta_6 \text{Landsize} + \epsilon \text{rror} \tag{3}$$

The probit model will be as in equation 4

$$\frac{Prob\ (WTP)}{1 - Prob\ (WTP)} = \beta_0 + \beta_1 \text{Gender} + \beta_2 \text{Age} + \beta_3 \text{Education} + \beta_4 \text{Ocupation} + \beta_5 \text{Income} + \beta_6 \text{Landsize} + \epsilon \text{rror} \tag{4}$$

Where, β_0 is an intercept and β_i are the estimated parameter of all the explanatory variables. Since, the conditional distribution of the outcome variable follows a binomial distribution with a probability given by the conditional mean Prob (WTP). We applied the similar model to determine factors affecting WTA in the upstream community.

Data collection

Before data collection, the oral consents were acquired from participating households and stakeholders. The determination of the Sampling procedure, Sample size, and Data collection were done after consultation with experts and local environment activists and with due consideration to the limitations of time, budget, and human resources. This study was based on the questionnaire survey, key informant interview (KII), and focus group discussion (FDG). We considered people living on the northern side of the lake area who were involved in agriculture and forestry activities and living far from the Begnas lake were categorized as an upstream community whereas people living close to the lake on the eastern and southern sides of the lake who were directly involved in making benefits from the lake i.e. fisherman, hotels, boaters were categorized as downstream community. In total, 120 households were selected for the household survey, out of which 60 respondents were from the upstream community and 60 respondents were from the downstream community. Each household from the upstream and downstream community was sampled using transact survey procedure where the main road was assigned as survey route and households near to the road were surveyed till 60 households were completed. The household head available at the time of the survey was selected for the interview. Similarly, we conducted key informant interviews using structured and semi-structured questionnaires. 5 KIIs were conducted with officers of the municipality, members of the Begnas youth club, members of the local women's group, officers of the fish research station, and members of the boatmen committee. Likewise, 3 FGD was organized with various levels of stakeholders separately in the study area to supplement and triangulated the information gathered from other sources. Information on socioeconomic status, people preference on ES, perception on WTP/WTA was obtained from household survey.

In order to estimate WTP and WTA, respondents were asked how much they would be willing to pay for conservation of ecosystem services of Begnas Lake. This method was also used in the similar study that explored respondents WTP for ecosystem services conservation (Bhandari et al., 2018).) Respondents were asked to WTP and WTA both in cash and kind (labor) but we determined average WTP and WTA based on cash only.

Variables description

Explanatory variables were selected through the literature review and used to explain the variability in the dependent variables (Table 1). Before running the model, a detailed study of the correlations between the explanatory variables was carried out to avoid possible co-linearity. Household characteristics are key factors since they influence decision-making as to whether or not to pay or accept for watershed conservation. WTP or WTA of respondents in watershed conservation programs may vary according to their socio-economic and demographic backgrounds, such as gender, household size, educational level, age, land tenure status (Zhou and Li, 2015).

Table 1: Description of variables used in the model

Variables	Description
Dependent variable	
WTP	Respondent's willingness to pay for a watershed conservation program. Binary variable: 1 if a respondent is interested to pay for the program, and 0 otherwise
WTA	Respondent's willingness to accept for a watershed conservation program. Binary variable: 1 if a respondent is interested to pay for the program, and 0 otherwise
Independent variable	
Gender1	Respondent gender: Binary variable 0 if male and 1 for female
Age2	Respondent's age in years. Continuous variable
Education3	Formal education was completed in several years. Categorical variable: 1 if a respondent is illiterate, 2 for under SLC, 3 for Higher Secondary and 4 for University level
Occupation4	Respondent occupation. Binary variable: 1 if the respondent is involving in agriculture or boating or both, and 0 otherwise
Income5	Respondent annual household income. Continuous variable ($)
Land6	Private property area owned by the respondent in a hectare. Continuous variable

Results

Socio-economic profile of respondents

The results showed that the number of male respondents was higher than female respondents in both communities. Most of the respondents' educational level was under S.L.C and only a few respondents attended university-level education in both downstream and upstream communities. Higher numbers of respondents were involved in agriculture and tourism business (e.g. hotel, fishing, and boating, trekking services) than other occupations (government job, teacher, and labors) in the downstream community whereas the majority of the respondents were involved in other occupations (government job, teacher, labors) rather than agriculture and tourism in the upstream community. Respondents who were in close proximity to the lake, who were considered as a downstream community in this study have opportunities for fishing, boating, hoteling, and trekking services. Thus, respondents from the downstream communities have higher monthly incomes than respondents from an upstream communities (Table 2).

Table 2: Respondents socio-economic profile of respondents

Variables	Factors/Levels	Downstream		Upstream	
		Frequency	Percentage	Frequency	Percentage
Gender	Male	39	65	35	58.3
	Female	21	35	25	41.7
Age (years)	18 – 24	10	16.7	3	5.0
	25 – 34	17	28.3	12	20.0
	35 – 44	12	20.0	20	33.3
	45 – 54	12	20.0	16	26.7
	55 – 64	9	15.0	9.0	15.0
Education level	Illiterate	4	6.7	12	20.0
	under SLC	44	73.3	35	58.3
	Higher Secondary	11	18.3	10	16.7
	University level	1	1.7	3	5.0
Occupation	Agriculture and tourism	44	73.3	28	46.7
	Other	16	26.7	32	53.3
Monthly income (US$)	<9999	19	31.7	35	58.3
	10000-19999	25	41.7	13	21.7
	20000-29999	10	16.7	9	15
	>30000	6	10.0	3	5
Land holding (hectare);	0-0.49	53	88.3	60	100
	0.50-.99	5	8.3	-	-
	1-1.49	2	3.4	-	-
Cast of respondents	Brahmin	24	40	32	53.3
	Chhetri	11	18.3	10	16.7
	Janjati	4	40	5	25
	Dalit	1	1.7	3	5

1 hectare= 19.60 *ropani*

For global readers: 1 NRs = 112.32 USD (2018/09/02)

Ranking of environmental services

Among the top selected good and services, the individual respondents were asked to assign 1 for highly prioritized service and 5 for least one based on their perception and importance to them. The ranking of selected ecosystem services were done by calculating weightage mean (score) value. This was done to rank the services with highest importance for respondents in upstream/downstream communities which is presented in Table 3. Fresh environment was ranked first by both upstream and downstream communities, Followed by beautiful landscape, conservation and biodiversity and tourism on second, third and fourth rank by upstream community respectively (Table 3). Similarly, conservation and biodiversity, tourism and beautiful landscape were ranked second, third and fourth respectively in downstream community (Table 3).

Table 3: Respondents' responses for ranking of environmental services in the Begnas watershed.

Environmental services	Upstream		Downstream	
	Weightage mean	Rank	Weightage mean	Rank
Tourism	2.53	4	3.25	3
Fresh environment	3.86	1	4.01	1
Beautiful land scape	3.13	2	2.38	4
Clean and slit less water	2.41	5	1.96	5
Conservation and Biodiversity	2.85	3	3.58	2

Willingness to pay and Willingness to Accept

Of the total sampled respondents, 41 (63.3%) respondents were willing to pay, while 19 (36.7%) respondents were not ready to pay. Similarly, 50 (83.3%) respondents were willing to accept, while 10 (16.7%) respondents were not ready to accept. Of residents who were interested to pay for watershed conservation, 95.1% of residents stated that they would pay in cash only, 4.9% in-kind (labor contribution). Among the total respondents who were willing to pay, 43.9% were willing to pay to assure tourism services, 29.3% for maintaining or improving ES for future use, 9.7% for the continuation of wetland ES over time, and 17.1% for getting a better quality of goods. Similarly, among refusing to pay, more than 50% thought the protection of watershed comes under the government's responsibility.

Of residents who were interested to accept watershed conservation, 48 (96%) respondents stated that they would accept in cash only, 2 (4%) in kind (labor contribution). Among the total respondents who were willing to accept, 32% were willing to accept to assure continue wetland ES overtime, 68% were for maintaining or improving ES for future use. Similarly, among refusing to accept, 50% thought the protection of watersheds comes under the government's responsibility, and the remaining 50% preferred the current situation (Table 4). This study has estimated mean WTP NRs 114.51/ropani/year/HH and WTA of NRs118.18/ropani/year/HH based on the number of cash respondents are ready to pay and accept for conservation of watershed (Table 4).

Table 4: Respondents' responses for paying/accepting or not paying/accepting for the conservation and management of BWS.

Variables	Factors/Levels	Frequency	Percentage
Reason for WTP	Get better quality of goods	7	17.1
	Continue wetland ES overtime	4	9.7
	Maintain/improve ES for Future use	12	29.3
	Tourism	18	43.9
Reason for WTA	Continue wetland ES overtime	16	32
	Maintain/improve ES for Future use	34	68
Reason for not WTP	Prefer Current situation	4	21.1
	Its Government duty	10	52.6
	Don't have enough income	5	26.3
Reason for not WTA	Prefer Current situation	5	50
	Its Government duty	5	50

Factors affecting respondent willingness to pay/accept for watershed conservation

Table 5 presents factors influencing respondents' willingness to pay for the watershed conservation program of downstream communities. Gender (female resident), education level, occupation (tourism and agriculture), and household income had positive relation, whereas the resident age and landholding had negative relation on the WTP. The positive sign on gender denotes that female residents were correlated with a higher propensity to pay for sustainable watershed conservation. Similarly, the positive sign on income suggests that a greater income was correlated with a higher proclivity to pay for sustainable watershed conservation. Similarly, the positive sign of the variable related to occupation shows that residents associated with tourism business and agriculture have a propensity to pay more for watershed conservation than residents associated with other businesses. Likewise, the negative sign on age and landholding indicates younger residents with less land owned are associated with a higher propensity to pay for sustainable conservation of watershed. Furthermore, the socio-economic characteristics of respondents such as occupation, education, and income were statistically significant with the probability of WTP.

Table 5. Probit model to determine the effects of various socio-economic factors on the decision of respondents' willingness to pay in watershed conservation program (downstream)

Variables	Coefficient	Standard error	Marginal effect
Gender1 (Male)	0.8419	0.6925	0.1154
Age2	-0.0003	0.0247	-0.0001
Occupation3	2.345***	0.8643	0.3215
Education4	0.7736*	0.4308	0.1061
Income6	0.0122**	0.0052	0.0017
Landsize7	-1.0625	0.9123	0.1457
Constant	4.5245	2.0143	
Observations	60		
Log likelihood	-15.045		
Likelihood ratio	44.83		

*** p<0.01, ** p<0.05, * p<0.1

Table 6 describes factors influencing respondents' willingness-to-accept to the watershed conservation program of upstream communities. Occupation (tourism and agriculture) and landholding were positively associated with the probability of WTA. Likewise, Gender (female resident), education level, age, and household income had negative relation to the WTA. The positive sign on occupation and landholding denotes that residents who were associated with tourism and agriculture business and those who owned more private land were related with a higher propensity to accept compensation for conserving watershed. Similarly, the negative sign on age and education indicates younger residents with less educated were associated with a higher propensity to accept compensation than older and educated respondents. The respondents with less household income were associated with a higher proclivity to accept compensation for ecosystem loss.

Table 6. Probit model to determine the effects of various socio-economic factors on the decision of respondents' willingness to accept in watershed conservation program (upstream)

Variables	Coefficient	Standard error	Marginal effect
Gender1 (Male)	-0.3059	-0.3095	-0.0177
Age2	-0.0946	0.0598	-0.0054
Occupation3	.1311	1.8423	0.0075
Education4	-0.2167	1.2779	-0.0124
Income6	-0.0266**	0.0129	-0.0015
Landsize7	2.2357	3.4853	0.1281
Constant	9.6672	5.8481	
Observations	60		
Log likelihood	-6.374		
Likelihood ratio	41.32		

*** p<0.01, ** p<0.05, * p<0.1

Discussion

Begnas watershed provides a number of ecosystem services for human wellbeing. The economic benefit generated from the Begnas watershed was worth about US$ 3.91 million year^{-1} which is equivalent to US$ 650.67 per household and US$ 799.79 per hectare (Thapa et al., 2020). In this study, a fresh environment was ranked first based on importance to the respondents. Respondents' WTP for watershed conservation seemed to be influenced by individual's socioeconomic status, such as gender, age, education level, income, property size, and type of occupation. In terms of the WTP and WTA amount, the average amount that respondents were willing to pay for watershed conservation was NRS 115 ropani^{-1}year^{-1} household^{-1} which is similar to the findings of Lamsal et al (2015). Similarly, the average amount that respondents were willing to accept to sustain conservation activities was NRs 118 ropani^{-1}year^{-1} household^{-1}. As the WTA of the landowners and WTP amount of the beneficiaries were likely to be the same which showed the feasibility of implementing PES mechanism in the study area. The study conducted by Bhatta (2017), in Dhankuta municipality and the study conducted by Rai et al. (2016), in Sardu watershed in the Sunsari district of Nepal to establish a drinking water supply for local people showed NRS 180 year^{-1} tap^{-1} and NRS 270 year^{-1} tap^{-1} WTP. Both of these studies were feasible to implement PES to establish a drinking water supply. The WTP for watershed conservation was greater for younger (adults). This was consistent with the finding of Bhandari et al. (2018). WTP for watershed conservation was more for educated residents similar to findings of Bhandari et al. (2018) and KC et al. (2013). Similarly, female residents were more eager to work for conservation activities for the conservation of watersheds. This finding is in line with the study conducted by Thapa et al. (2021), Bhandari et al. (2018), Paudyal et al. (2015), and Khanal et al. (2010). The variable household income was positively and significantly related to the WTP. Thus, the household with a high income had a higher proclivity to pay for the conservation of watersheds than households with a lower income. This finding is similar to Paudyal et al. (2015), Bhandari et al. (2018), and Bhandari et al. (2016). Residents associated with tourism business and agriculture have a propensity to pay more than others because tourism industries were directly dependent on ES obtained from the Begnas watershed as agriculture was dependent on irrigation obtained from the water of Begnas lake.

Similarly, WTA for conserving watersheds had a higher propensity to accept compensation for residents involved in agriculture and tourism and those who own more landholding size. Likewise less educated and younger residents were associated with a higher propensity to accept compensation than older and higher educated respondents. The household with less household income had higher proclivity to accept compensation for ecosystem loss than the household with high household income in the upstream communities. Gustavson and Kennedy (2010) concluded that the demonstration of monetary worth of wetland helps to model wetland management attempts and public investments to preserve and intensify the

services from the wetlands. Understanding of monetary values of certain ecosystem services to the local people can give a vision for decision-makers that can sooner or later help to assess the prevailing resource management policies (Wistowsky, 2009). Overall, this study also helped to provide information for policymakers and conservation practitioners to design a management plan for the Begnas watershed. Furthermore, analysis on WTP and WTA in a different frame of time incorporating more services may be conducted to assess the varying behavior of the people with time and progress, and additionally encompass people's understanding to promote people's engagement in the planning and implementation of strategies to conserve wetlands.

Conclusion

The BWS has been offering significant economic, environmental, social, and cultural services to local communities. Fresh environment, clean and silt less water, biodiversity conservation, tourism, and beautiful landscape are currently available services in the Begnas watershed. This study estimated average WTA was about NRs 115/ropani/year/HH and average WTP was about NRs118.18/ropani/year/HH respectively. The precise amount of willingness to pay may not be appropriate or satisfactory. But it manifests that, provided applicable support, the concerned people are willing to be active participants in any meaningful attempt to conserve wetland. Factors; gender (female resident), household income, education level, and occupation (tourism and agriculture) were positively influenced on respondents' decision for WTP, whereas the resident age and landholding had negative relation to the WTP. Similarly, Occupation (tourism and agriculture) and landholding were positively associated with the probability of WTA. Likewise, Gender (female resident), education level, age, and household income had negative relation to the WTA. This study can be used to develop a favorable PES mechanism in the Begnas watershed. Thus, the government should formulate strategic plans to protect and stabilize the watershed resources to maintain ecosystem services sustainably in Begnas lake. It is also suggested to conduct similar studies in the other wetlands of the Kaski district which can help policymakers to design a policy and ensure the long-term conservation of the wetlands of the Kaski district as a whole.

Author's contribution statement

Sanjay Poudel: Conceptualization-Lead, Data curation-Lead, Methodology-Equal, Formal analysis-Equal, Project administration-Lead

Suman Bhattarai: Writing-review & editing-Equal

Siddhartha Regmi: Writing-review & editing-Equal

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Conflict of interest statement

There is no conflict of interest among the authors.

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