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Payment or Incentive: Public Perception on Payment for Ecosystem Services at the Time of Climate Change in Nepal

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ABSTRACT: Understanding community preferences and perceptions of ecosystem services is needed to generate local-level financing through Payment for Ecosystem Services. Local-level financing is crucial for both ecosystem management and also helpful in climate change adaptation actions. This research focuses on community perceptions of payment for ecosystem schemes and their preferences to generate local-level financing. The study was carried out in Dhankuta and Dasarath Chand municipalities, representing Koshi and Sudur Paschim provinces of Nepal. We applied social science research methods using focus group discussions, key informant interviews, and community surveys. The study indicates that community-perceived payment for ecosystem service schemes can be instrumental in generating local financing, and their preference is more towards in-kind or project-based payment mechanisms. While climate change is largely impacting ecosystems and community livelihoods, project-based payment mechanisms could be more effective than cash payments. However, this needs a strong institutional mechanism within the municipal government where such in-kind or project-based support could be mobilized through a multisectoral approach.

Keywords: Climate change; PES; Incentive; Public; Institutions

1. Introduction

With growing recognition of the Ecosystem Service (ES) approach, sustainable ecosystem financing mechanisms were discussed during the early 2000s, when Wunder provided the basic theoretical framework for the payment of ecosystem services [1]. The PES mechanism is an incentive or cash payment to adopt environmentally friendly practices that produce or restore ES. However, there are some disagreements that contest the success of these mechanisms [2]. The Payments for Ecosystem Services (PES) mechanism is designed in such a way that producers of ecosystem services are incentivized through the transfer of incentives or payments from those who consume ecosystem services [1,3]. The PES mechanism is defined by Wunder [1] as "a voluntary transaction where well-defined ecosystem services (or land uses likely to secure those services, i.e., water quality and quantity) are bought by a minimum of one service buyer from a minimum of one service provider, if and only if the service provider continuously secures service provision (conditionality)".

In recent years, the PES mechanism has been developed focusing on two major objectives: supplying ecosystem services and poverty reduction [4–6]. Many scholars also argued that the PES schemes contribute towards governance and ensure transparency, as Gaglio [7] reported in case of Italian protected areas where PES schemes provide opportunities for stakeholders in nature conservation. Admasu [8] reported that the PES schemes contributed largely to halt biodiversity loss and reverse ecological processes in the central highlands of Ethiopia. In China, Zhang [9] argued that the PES can contribute to behavior change on urban greenery and environment contributing sustainable urban development. In their global review of PES programs, Le [10] confirmed that the PES become a typical environmental policy tool contributing towards sustainability. However, PES outcome for sustainability of communities and ecosystem largely depends on a number of factors, such as contextual factors, governance, ownership and participation. In low-

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middle income countries, PES programs are expected to be cost-effective and contribute to the livelihoods of communities and are different from other approaches such as integrated conservation and development programs [3,11,12]. In addition, PES can be instrumental for sustainable ecosystem financing by incentivizing ecosystem service providers and supplementing the conservation initiatives taken by government entities [12]. However, there are challenges to achieving multiple outcomes through single policy initiatives, as also discussed by Tinbergen [13] in classic research on policy domains. Tinbergen's analysis argued that the motives to achieve both conservation and poverty reduction with PES may be unrealistic [14], given the fact that the relationship between environmental conservation and poverty alleviation is not necessarily linear [1].

In low-middle income economies, the implementation of PES schemes is comparatively new and recent, but there is considerable interest and increasing discussion in achieving a supply of ecosystem services and in rural development [15–17]. Unlike Wunder's classical PES concept [1] where ecosystem services consumers pay directly to ecosystem service providers in cash, Grima [18] argued that the mode of PES payment needs to contribute social and personal capacities, and therefore, in-kind or project-based payment could be more effective in Latin American countries. Supporting concept of in-kind or project-based payment, Deng [19] revealed that the sustainability of PES schemes is based on strengthening livelihood capitals in rural China where project-based support is found more effective to strengthen human and social capitals. Bhatta [20] and Rai [21] argued that PES schemes should be considered as incentive mechanisms and named as incentives for ecosystem services (IES), as low-income country like Nepal may have limited access to cash payments and consumers of ecosystem services may be willing to contribute in kind. Dhakal [22] also confirmed similar findings from Nepal arguing that in-kind or project-based support helps to ensure transparency and minimize the chances of frauds in collective funds.

While there are growing global concerns about the impact of climate change on ecosystems and their ability to produce ecosystem services, scholars and parties to the United Nations Framework Convention on Climate Change (UNFCC) have been arguing the need for local-level financing mechanisms to tackle the negative impact of climate change on ecosystems and populations [23]. At the same time, Nepal's climate and ecosystem-related policies and legal instruments also suggest generating local-level finances to invest in ecosystem restoration and climate change adaptation [16,24,25]. At this crosspoint, our research aims to understand public perceptions on payment mode for payment for ecosystem services to generate local-level financing for ecosystem management and climate action. We also aim to understand public perception whether they prefer cash or in-kind contribution within PES schemes in rural settings of Nepal.

2. Methods and Methodology

2.1. Municipal Research Area

We organized our study in two representative municipalities, Dasarath Chand from Sudur Paschim (Far west), and Dhankuta in Koshi (far east) provinces in Nepal (Figure 1). We selected these two municipalities because of multiple reasons, (a) Both municipalities are located in mid hills geographical region, (b) both municipal city center suffer from shortage of drinking water (c) concept of PES was attempted since 2016/2017 in both municipality taking drinking water as an identified ecosystem service and (d) these two municipalities represent different socio-cultural dimensions. Details on demographic and other relevant information is presented in Table 1.

Figure 1. Map of Research area (Source: Department of Survey, Nepal).

Table 1. Research area at a glance with demographic information.

Major Dimensions	Dhankuta Municipality	Dasarath Chand Municipality
Geographical area (Sq Km)	111.60	134.90
# of household	9460	7198
Total population (women population %)	35,983 (52.2%)	31,567 (53.7%)
Population % by age group	>19 (34.10%), 20–44 (39.28%), 45–69 (22.22%), <70 (4.40%)	>19 (38.61%), 20–44 (34.32%), 45–69 (21.35%), <70 (5.70%)
Literacy rate (woman literacy rate)	84.50% (78.90)	80.4% (70.1)
Sex ration	91.41 male per 100 women	86.21 male over 100 women
Economically active population	73.70%	67%
Key Economic activities	Agriculture (60.4%), small scale business (11.5%), manufacturing (2.8%), construction (3.4%)	Agriculture (66.9%), small scale business (9.2%), manufacturing (2.3%), construction (7.6%)
Ethnicity	Chhetri (20.6%), Rai (24.70), Newar (8.6%), Tamang (8.4%), Brahman(8%), Magar (7.8%), Limbu (4.4%), Dalit (6.4%)	Brahman (33%), Chhetri (30.1%), Dalit (26.9%), Thakuri (5.7%), Sanyasi (3.6%), Magar (0.2%), Others (0.2%)

Source: National Population and Housing census, 2021, National Statistics Office, Government of Nepal.

Water scarcity is emerging as a severe problem in Nepalese middle hills [26]. With increasing population in urban centers due to migration; small hilly towns are one of the victims of water scarcity. Water supply project in both municipalities was initiated with the support from Asian Development Bank (ADB) under Small Towns Water Supply and Sanitation Project [27] to meet the demand of 1270.73 m^3 per day in Dhankuta [28] and 492 m^3/day in Dasarath Chand municipality [21]. These projects are very appealing in terms water treatment, distribution system, and development and maintenance of infrastructure. However, lacks site specific plan for management and protection of water sources. In order to address the issues of environmental and water source degradation, municipal authorities in collaboration with external agencies initiated the concept of PES where water consumers agreed to pay NRS 20 per household per month to support upstream conservation activities in 2017. The collected PES funds were agreed to disburse to water source communities based on project proposal. In Dhankuta municipality, the PES concept was functional, whereas Dasarath Chand municipality could not take it further.

2.2. Key Informant Interviews (KIIs)

We organized 30 KIIs, fifteen in each municipality, to understand their perceptions on payment for ecosystem services schemes and the mood of payment, either in cash or kind, or both. An stakeholders mapping was prepared for each municipality which do have stake and interest on upstream and downstream watershed management. Based on the stakeholders' mapping, 15 key informants were selected based on their representation, direct stake, and ongoing activities supporting watershed management. Key informants include, elected mayor/deputy mayor of the municipality and members of relevant ward committees, forest and watershed authority, non-governmental and civil society organization, agriculture authority, representative of forest user groups, water supply and sanitation management committee.

2.3. Focus Group Discussions (FGDs)

Eight FGDs, four in each municipality, were carried out with different stakeholders. The stakeholders include: (a) municipal authorities; (b) government offices (Division Forest Office (DFO); (c) watershed management offices; (d) agriculture offices; (e) ecosystem service providers; and (f) consumers. Total participants on FGDs were 54, ranging from 6 to 10 in each FGD.

The focus group discussions were primarily focused on existing ecosystem management and governance practices, PES possible schemes, fund management, and payment modes. Focus group discussions were organized with both upstream communities (ecosystem service producers) from where water is supplied to downstream city centers (ecosystem service consumers).

2.4. Household Survey

A total of 203 household-level questionnaires were administrated, 101 in Dhankuta and 102 in Dasarath Chand municipality using Salvin's formula to determine sample size. Household questionnaires were randomly administered to both upstream and downstream communities. Besides demographic information, the questionnaire was focused on agriculture practices and dependency on natural resources, change in land use pattern and its impact on production, availability of water resources and change pattern, existing water tariff system. In addition, questionnaire also included respondent's understanding and willingness to participate in PES schemes, present management and governance practices, preferred payment mode under the PES schemes and possible support they preferred or expected (especially for ecosystem service producers).

2.5. Calculating Willingness to Pay (WTP) and Multiple Linear Regression (MLR)

In order to understand willingness to pay for water as an ecosystem service, respondents were asked their willingness pay in cash if the water is available throughout the day. The WTP of all respondent households was then totaled and divided by the total number of sampled households to calculate the average WTP of a household. The average value was multiplied by the total number of households within the study area to calculate the total WTP. In addition, an average and total WTP for each municipality was also calculated.

In order to understand the relationship between WTP and various socio-economic variables, a multiple linear regression (MLR) equation was developed. The socio-economic variables chosen in the present study include gender, age, years of education, family size, landholding, annual household income. The equation of the multiple linear regression model is expressed as;

$$Yi = \alpha + \sum \beta ij\ Xij \quad (1)$$

where,

Y = willingness to pay (WTP) for water as ecosystem service

α = constant

β = is coefficient of socio-economic variables

X—independent variables (socioeconomic variables)

The Equation (1) is extended as below:

$$WTP = \alpha + \beta 1\ GENDER + \beta 2\ EDUCATION + \beta 3\ FAMILYSIZE + \beta 4 LANDHOLDING + \beta 5\ HOUSEHOLDINCOME + \beta 6 AGE \quad (2)$$

3. Result

3.1. Sample Characteristics

Out of 203 respondents interviewed, 93 were female respondents. Female respondent in Dhankuta is much higher than the Dasarath Chand municipality which may be because of the workload of women, cultural limitation (in case of Dasarath Chand municipality). The average age of the respondent is about 43 years in Dhankuta, and 48 years in Dasarath Chand municipality. The average land holding is Dhankuta is 6.16 Ropani whereas 6.06 Ropani in Dasarath Chand municipality (Table 2).

Table 2. Sample characteristics (standard deviation in parentheses).

Variables	Municipality	
	Dhankuta	**Dasarath Chand**
Female respondents (%)	66	27
Age	43.17 (15.45)	48 (13.02)
Family size	6.96 (3.37)	5.184 (2.12)
Annual household income (000, Nepali Rupees) *	202 (8.643)	128.92 (6.946)
Land holding (Ropani) **	6.16 (4.045)	6.06 (8.78)
Years of Education	8.72 (0.492)	4.16 (0.468)

* 1 USD is 130 Nepali Rupees (2024) ** 1 hectare is 19.66 Ropani.

3.2. Public Perception on PES as Means to Generate Ecosystem Financing and Climate Action at the Municipal Level

Nepal's climate change policy 2021 aims to mobilize international and national climate finance for adaptation and mitigation measures. The climate policy also discussed on innovative solutions such as Payment for ecosystem services to generate local level financing [25]. The forestry sector policy (2019) also aims to initiate incentive based mechanism in forestry sector. In line with the forestry sector policy, article 44 of the Forest Act (2019) further spelled out PES provision to generate finances for conservation. Many scholars [16,21,29,30]) argued that purely market-based PES mechanism, as discussed in Wunder's classical model, may not be suitable or contextual to a country like Nepal. The scholars argued that the consumers of ecosystem services in low-income country like Nepal may lack cash but still have willing to contribute in kind. As a reason, it needs to broaden the scope within the incentive mechanism. There has been a long debate whether Nepal or Nepal like developing countries should adopt Wunder's [1] free market-based PES mechanism, which more often functions with the market. The common property regimes (CPR) as mostly discussed by Ostrom [31] is more relevant to design such financial instruments where communities are incentivized and given responsibilities to manage their resources [32] which can ensure sustainable supply of ecosystem services.

We asked both ecosystem service producers and consumers whether PES or PES-like mechanisms would be feasible to generate local level funds to manage ecosystems for sustainable supply of services that they are enjoying, considering water as a major ecosystem service in the research area. Out of 203 respondents, 40% found the concept itself is very new to them, whereas remaining 60% sample population is aware of the concept. Almost all respondents from ecosystem producers found that the mechanism is encouraging for them, whereas consumers in both municipalities do have mixed responses. In Dasarath Chand municipality, one third of respondents from the consumer population argued that this may cause additional financial burdens to poor households. In Dhankuta, more than 90% respondents from consumer population agree on financial mechanisms, however, have concerns that the financial resources generated will be invested on ecosystem management, and water source protection. Similar findings from Indonesia [33] and developing countries [34] also reflect the mixed responses of both consumers and producers of ecosystem services at the initial design of PES schemes when a clear institutional mechanism has not been established and operational.

While respondents mostly agree that the impact of climate change is severely impacting on their cultivation practices (Figure 2), as rainfall patterns are changing, there is a need to invest in existing water source protection and multiple use of water. There was a total of 54 participants in FGDs, and 30 key informants, with an average of 35% women. All key informants argued that a clear institutional and investment modality needs to be established for PES and funds generated from such schemes need to be invested in adapting climate change impacts with a clear implementation plan. Similarly, more than 85% of participants from FGDs suggested that the municipal government needs to play a facilitating role while ensuring municipal investment for the same.

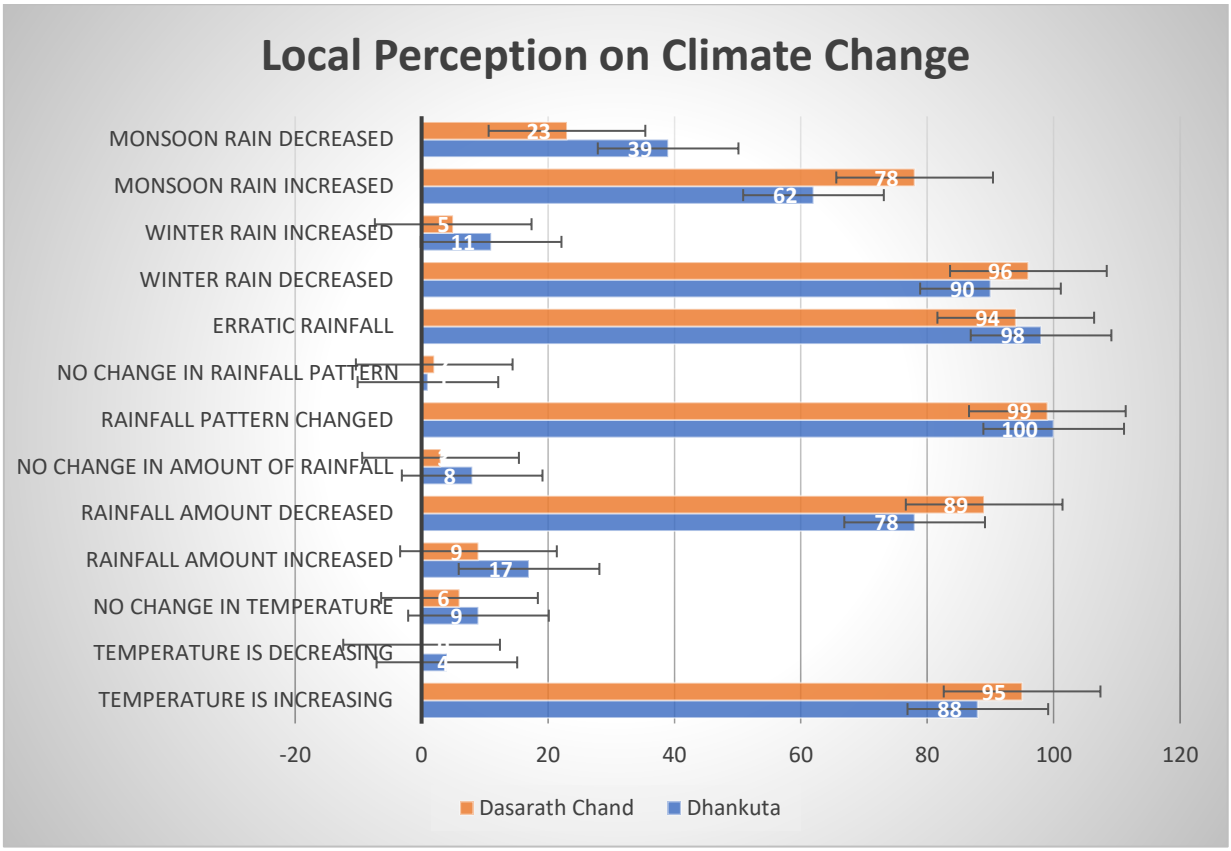

Figure 2. Local Perception on Climate Change.

3.3. Public Willingness to Pay for Ecosystem Services (Drinking Water)

Almost all respondents expressed their willingness to pay for ecosystem services, except one respondent in Dasarath Chand municipality. Mean annual willingness to pay for water as ecosystem services is NPR 473.55. The annual value of water as ecosystem service is NPR 7,916,364 (US$ 67,087.83). The mean WTP in Dhankuta municipality is NPR 472.09 whereas WTP of ecosystem service consumer in Dasarath Chand municipality is NPR 475.00 which is similar to that of Shardukhola watershed in Nepal [35]. Summary of the WTP is presented in Table 3.

Table 3. Households willingness to pay (WTP) for water as ecosystem service.

Value of Water as Ecosystem Services	Household Level WTP—Annual Average	Annual Total WTP	
	NPR	NPR	US$ *
Dhankuta municipality	467.45	4,422,077	37,475.23
Dasarath Chand municipality	479.71	3,481,255	29,502.17
Total average	473.55	7,903,332	66,977.39

* 1 USD is NPR 132 (2024).

The present study has assessed the household's WTP with respect to six socio-economic variables, (i) gender, (ii) education, (iii) family size, (iv) household income, (v) landholding and (vi) respondent's age (Table 4)

Table 4. Summary of socioeconomic variables assessed.

Variable (Unit)	N	Minimum	Maximum	Mean	Standard Deviation
Gender	203	0	1	0.45	0.499
Age (Year)	203	18	84	45.59	14.404
Education (number of school years)	203	0	16	6.54	5.518
Household size (Number)	203	1	21	6.05	2.903
Land holding (Ropani)	203	0	53	6.10	6.855
Annual Income (NPR 000)	203	50	400	164.77	86.478

The F-statistics for overall goodness of fit of the model is 0.0000248 ($p < 0.05$) suggest that the model is significant to assess the linear relation between dependent and independent variables. The R2 value is (0.1451) reflects that there is correlation with the independent variables assessed with WTP.

The results of the regression analysis reveal that out of six socio-economic variables, 'education', 'household income', 'family size' and 'gender' have significant effect on WTP (Table 5). Two variables, landholding and age were found insignificantly correlated with the WTP ($p > 0.05$)

Table 5. Results of Multilinear Regression Model.

	Coefficients	**Standard Error**	**t Stat**	***p*-Value**
Intercept	502.22 (61.29) *	61.2996	8.1929	3.24×10^{-14}
Age	−0.201 (0.90)	0.9007	−0.2234	0.8234
Education	−7.37 (2.68) *	2.6847	−2.7456	0.0066 ***
Family size	−10.257	4.3531	−2.3561	0.0194 **
Landholding	−0.7523	1.773	−0.4243	0.6718
Income	0.3067	0.1487	2.0616	0.0405 **
Gender	95.9972	26.6726	3.599	0.0004 ***

Note: *, ** and *** denote significant at 10, 5 and 1 percent level.

Our result revealed that women do have more willingness to pay for water as ecosystem service, which may be because of the role of women in rural household to collect water for their use. Similarly, the significant positive correlation of education indicates that educated persons do have high willingness to conserve water source and upstream watershed, which may be because of the higher exposure and awareness on ecosystem and watershed management. Households with higher number of members are willing to contribute more towards conservation of ecosystem to ensure sustainable supply of ecosystem service, such as water. There might be a number of reasons behind such as bigger family size may need more water for their household use, as a reason, their willingness to pay is higher than that of smaller household. Households having higher income do have more willingness to pay for water as ecosystem service than the households having lower income. It may be due to people having low income need to invest primarily in the subsistence living rather than contributing towards ecosystem management. Our findings are similar to that of the findings from Nepal [36,37].

3.4. Public Perception on Cash or In-Kind Contribution

Wunder's classical PES model is mostly a market-based approach where consumers of ecosystem services pay in cash for the supply of ecosystem services with a conditionality [1,38]. A fully market-based instrument may be difficult to practice, even with substantial investments in establishing institutions and governance mechanisms [39]. Many scholars argued that PES should be based on social welfare theory where benefits from the common property is distributed to large segment of population, with particular to socially disadvantaged and marginalized groups. As a reason, a purely market-based approach may not function in low-income countries like Nepal [16,21,30,40] Also, communities in poor or low-income countries lack cash but may still be willing to contribute in kind, such as labor. As a result, a context-specific PES approach, sometimes very specific to the site or location, needs to be discussed and implemented.

In any of the PES schemes, compensation in cash or/and in-kind is one of the key issues among others. Kaczan [41] found that in-kind contribution such as seed, fertilizer to upland communities in Tanzania significantly encourage farmers to participate in PES schemes. Similar findings from Porras [42] where they found in-kind payment (equipment, tax cut, fertilizer) over cash payment significant in Kenya. We asked producer communities of ecosystem whether they prefer cash or in-kind or project-based support under incentive mechanisms for ecosystem services. We found mixed responses in both municipalities. In Dasarath Chand municipality, around 35% of the respondents preferred cash payment, whereas 65% opted for either cash or project-based support. The preference for in-kind or project-based support in upstream Dhankuta municipality is more than 50%. The Figure 3 below reflects preferences from ecosystem producers' communities for project-based support. Mndeme [43] also discussed similar findings from Tanzania and from Nepal on community preferences for project-based support under the PES mechanism [21].

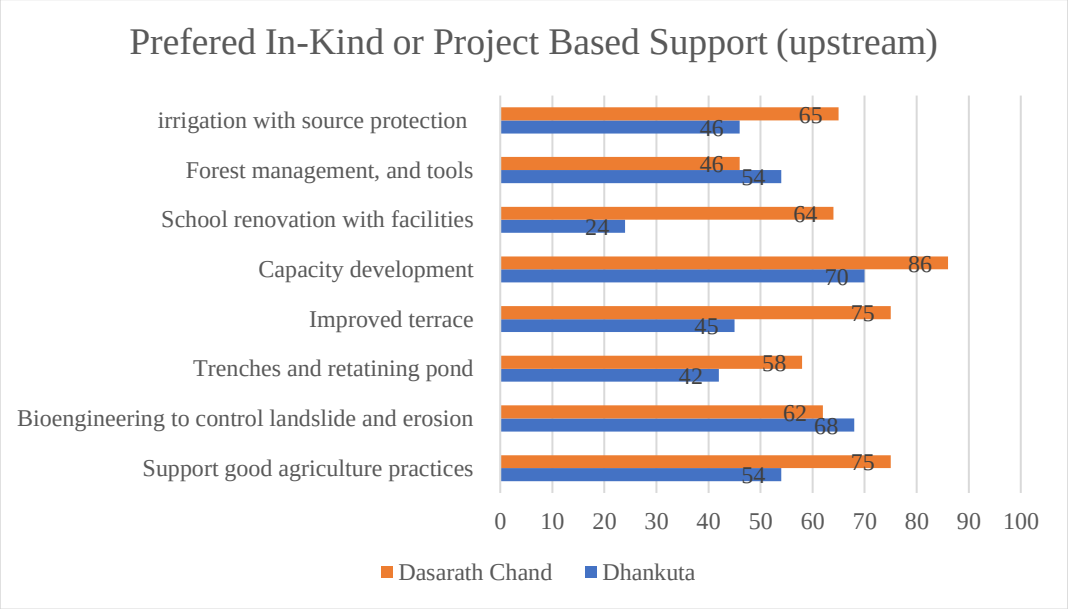

Figure 3. Community preference on project-based payment.

On in-kind or project-based payment, our study revealed that ecosystem service producers mostly expect in-kind payment to support agriculture production with affordable technology followed by irrigation, landslide control and capacity development. 75% respondent from Dasarath Chand municipality argued for in-kind payment to support good agriculture practices whereas 68% from Dhankuta municipality asked for bioengineering support to control erosion and landslide. Capacity development is found major concerns from both municipality which is obvious as farmers need capacity to diversify their income sources.

3.5. Perception on Relevant Public Policies (PES, Ecosystems, Climate) and Their Effectiveness

The Government of Nepal has formulated a number of policies and legislative instruments related to ecosystems, climate change, and incentive-based mechanisms for ecosystem services. More importantly, federal legislative instruments empower municipal governments to formulate their local-level policies to safeguard natural resources and initiate innovative solutions on local financing for ecosystem management and climate change [44]. The National Biodiversity Strategy and Action Plan (NBSAP), the National Adaptation Plan (NAP), the Forest Act and Regulation, the Local Government Operation Act, and Vision 2030 are major policies and legal instruments that discuss maximizing benefits from natural resources while generating local-level finance for ecosystem management and climate change adaptation options.

Despite a large number of policy and legal instruments and the devolution of power, their effectiveness in local action is limited [45]. Ranabhat [46] and Tankha [47] discussed policy coherence and interdependency on climate change and natural resource-related policies and their implementing institutions in Nepal, where they reported that the policy coherence among sectoral policies with climate policy is there but is not coordinated when it comes to action at the local level. Many scholars and studies [48–52] argued the policy and institutional gaps in Nepal to ensure local-level financing through payment mechanisms for ecosystem management and suggested an institutional mechanism for PES at the municipal level [20,30].

Article 44 of the Forest Act (2019) concretely discussed on PES schemes to generate conservation financing which is further elaborated on Forest Regulation (2022). Similarly, National Adaptation Plan (2021–2050) provisioned for PES in multiple sectors, including forest and water resources. The Local Government Operation Act (2017) empowers local government to generate local financing through PES like schemes, however, the Act does not explicitly discuss on PES schemes. Table 6 highlights existing policies, strategies, and legal instruments that are discussed for local-level financing and/or incentive-based mechanisms for ecosystem and climate actions.

Table 6. Existing Policies and Legal instruments on PES in Nepal.

	FSS/FP	NAP	NBSAP	LGOA	APP	WRS	FA/FR
Explicit on Local financing/PES or incentive mechanism	**X**	**X**				**X**	**X**
Implicit on Local financing/PES or incentive mechanism			**X**	**X**	**X**		

Note: **FSS/FP**: Forest Sector Strategy/Forest Policy; **NAP**: National Adaptation Plan; **NBSAP**: National Biodiversity Strategy and Action Plan; **LGOA:** Local Government Operation Act; **APP**: Agriculture Perspective Plan; **WRS**: Water Resource Strategy; **FA/FR**: Forest Act/Forest Regulation.

Focus group discussions in both municipalities reflect that there is a strong need to roll out national policies and legal instruments related to PES and/or incentive-based mechanisms to manage ecosystems and climate action at the municipal level, as the majority of stakeholders and communities are not very aware of such federal policies and international obligations. Less than 50% of the respondents are aware of such policies and have a very limited understanding of Nepal's commitments globally. Dhankuta municipal respondents are found to be more aware (54%) of such policies than Dasaratch Chand (42%). However, respondents from both municipalities argued that the effectiveness of such policies at the municipal or local level is very limited. As a result, even municipal governments have not formulated local policies or legal instruments related to incentive-based mechanisms. Respondents from FGDs also argued that the lack of inter-agency coordination, both vertical and horizontal, is one of the major reasons for limited actions at the municipal level.

3.6. Perception on Water Availability, Forest Ecosystem, Climate Change, and Interlinkages (the Nexus)

Forests are considered one of the most important elements of the ecosystem and provide a number of ecosystem services for the welfare of communities, including provisioning services such as water. The forest-water relationship is complex. Some scholars argue that forests increase soil infiltration and, thus, provide groundwater recharge [53] and forests influence climate through physical, biological, and chemical processes leading to the hydrological cycle [54]. Forests are an important source of carbon sink and sequestrate atmospheric carbon, contributing to reducing carbon depository and climate change phenomena [55]. The nexus among forests, water, and climate change is important to understand for a sustainable supply of ecosystem services. Therefore, nexus-based municipal planning helps mitigate the impacts of climate change while ensuring the flow of ecosystem services.

The majority of the respondents from both municipalities argued that the forest cover is decreasing, while about 30% responded with no change. The reason is that water availability is also decreasing. However, data shows that there has been an increase in forest cover from 2000 to 2022 in both municipalities (Figure 4 and Table 7). There is a probability that the forests near the city centers (Dhankuta town and Gothalapani town) may decrease, whereas forest cover may increase in some remote and uncacheable areas within the municipality.

About two-thirds of respondents responded to the decrease in water availability, whereas only less than 10% responded to a neutral change. During the focus group discussion, when asked the reason behind the decrease in water availability, many participants argued for decreased forest cover and broadleaved species, which is not supported by the land set data, where forest cover has been increasing in the last two decades. Also, respondents argued for increasing demand for water while changing health consciousness and behavior and increasing water demand in city centers with increased hotel and similar service centers.

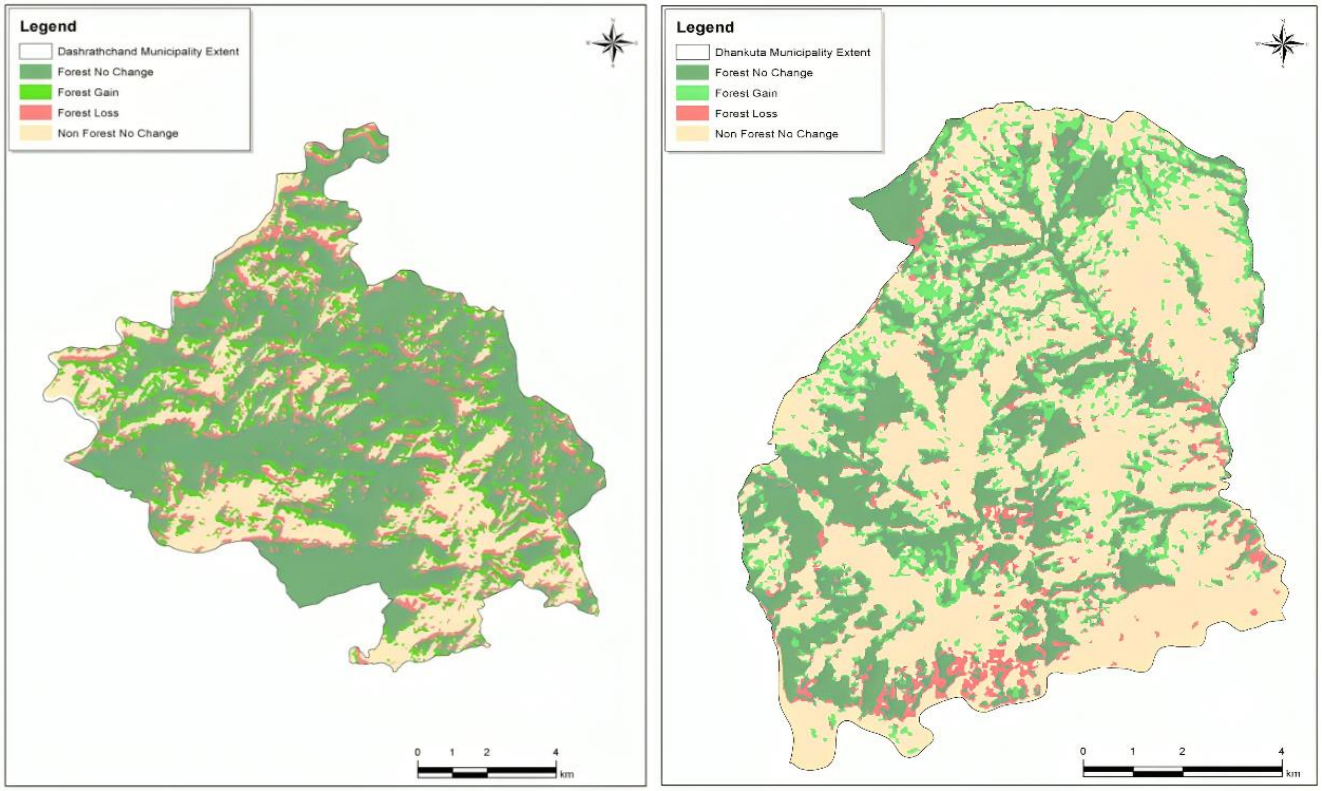

Figure 4. Forest Cover Change 2000 and 20022 of research area. Source: Classified images of ICIMOD 2000, 2022.

Table 7. Community perception on Forest Cover Change and water availability.

Variable	Frequency (Percent)		
	Decreasing	**No Change**	**Increasing**
Change in Forest Cover	123 (60.6)	63 (31.03)	17 (8.37)
Change in Water availability	142 (69.95)	33 (16.26)	28 (13.79)

4. Discussions

Although there is still limited and insufficient empirical evidence to support PES contributing to climate change adaptation or actions [11,56] , most recent research findings have tried to fill this gap. Taconi [57] reported cases from Asia, Africa, and Latin America where PES contributes to enhancing social and human capital and, therefore, contributes towards the adaptive capacity of communities. However, cash payments through PES to individual farmers (ecosystem producers) are not effective in ensuring hydrological services in Latin America [58]. Our findings confirm that local communities do have willingness to pay for ecosystem services in both municipalities and their preference is found more towards in-kind or project-based payment through PES schemes in kind or project-based support in low-income countries like Nepal is also suggested by earlier studies [21,30], arguing that the in-kind payment helps to ensure transparency and reduce the chances of corruption, which is likely with cash-based payment. Our findings also support the fact that ecosystem service consumers from poor households have a cash deficit, as a reason, their willing to contribute in kind, such as labor, is more justified and rationale.

Payment for ecosystem services can be instrumental in enhancing farmers' adaptive capacity to cope with climate and other stresses by providing finances and implementing interventions to increase soil productivity. However, increasing adaptive capacity depends on whether PES-made finances are utilized in the proper way, as Gaarder [59] and Gertler [60] argued that making cash payments may reduce spending on undesired items as money is less readily available. This argument further supports in-kind or project-based support within PES schemes and is in line with the respondent's willingness to accept it in the research area. A similar argument was supports in-kind or project-based payment that ensures proper use of generated funds from the PES schemes to collective social welfare [21,30].

The success of ecosystem management and payment schemes largely depends on adaptive governance and institutional arrangements at various tiers of government, in particular at the local level. There are a number of institutions working at the local level providing support to local communities, such as the municipal government, forest

department, soil and watershed management office, and agriculture office. However, our findings suggest that these institutions are working in silo, with very limited collaborative actions and cooperation. Therefore, both vertical and horizontal coordination is an issue at the level of implementation [16,61,62]. We found that the PES schemes are considered as possible local-level financing contributing to ecosystem management and climate change adaptation, there is a need for strong institutional arrangements at the municipal level with identified collaborative actions. Our research finding also revealed that local communities need both short-term and long-term strategies for ecosystem management to ensure sustainable supply of ecosystem services. PES schemes could be instrumental to generate local-level financing support community based long term and short-term strategies for climate action and ecosystem management. However, long term financing needs a proper institutional arrangement with agreed PES payment modality at the local level which can be well adopted within the municipal development plan.

5. Conclusions

Community perceptions and experiences reveal that the concept of Payment for ecosystem services can be instrumental to generate local level financing, and need for a proper institutional mechanism at the municipal level. We found that there is strong willingness to pay for ecosystem services in both municipalities and producers are more towards in-kind or project-based payment than cash payment. There is a strong argument that the in-kind or project-based payment is more effective than the cash payment which not only ensures equitable benefit sharing but also transparency on fund utilization.

We found that the local perception on implementation of policies at the local level is weak and uncoordinated. There are a number of agencies working in and with the municipal governments, their inter-agency coordination, both at vertical and horizontal is weak. Also, there is a need for a federal level umbrella policy on PES, as the present legal instrument under the Forest Act is perceived as sectoral policy while PES needs multi-sectoral approach. The Local Government Operation Act-2017 empowers and authorizes municipal governments to manage their common properties such as biodiversity, ecosystem and water resources while generating local level financing for sustainable management of these resources. Despite strong federal legislative instruments, there are no local level policies or strategies developed in Dasarath Chand and Dhankuta municipality. Our study suggests that the municipal government develops its own local level strategies or policies related to ecosystem management, and invests in operationalizing PES like schemes to generate local level financing.

The National Adaptation Plan discussed climate change impacting ecosystems and communities, however, its implementation at the local level is limited. The national adaptation plan is hardly rolled out at the municipal level, and also the fact that municipal governments do have their own priority, especially on infrastructure development. With limited resources, local governments are not in position to finance adaptation action. Therefore, PES-like schemes could be instruments to generate local financing which also can be invested on adaptation actions at the local level.

Our research was mostly focus on water as ecosystem service where we investigated if PES schemes can be feasible to generate funds at the municipal level. However, there are some challenges, such as monitoring of flow of ecosystem services, and payment to be made if ecosystem services are not available.

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Author Contributions

All authors equally contribute to the research and manuscript development. Conceptualization, L.D.B. and B.B.; methodology, L.D.B., M.K. and R.K.R.; Software. L.D.B. and M.K.; validation, B.B., N.R.D.; formal analysis, L.D.B.; investigation, L.D.B.; Data curation, L.D.B. and M.K.; writing—original draft preparation, L.D.B.; writing—review and editing, B.B., R.K.R.; supervision, B.B., N.R.D., R.K.R. All authors have read and agreed to the published version of the manuscript.

Ethics Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and standard operating procedure for non medical human and animal subject research approved by the Institutional Review Board of Agriculture and Forestry University, Nepal (approval received on 7 August 2022).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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Declaration of Competing Interest

The authors have no conflict of interest to disclose.

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