Enhancement of feasibility and opportunities of ecotourism development around Jagdishpur Reservoir, Nepal

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Abstract: The study on Jagdishpur Reservoir, Nepal's largest artificial lake and a key wetland, evaluates its potential as a sustainable ecotourism destination.Situated near the Lumbini World Heritage Site, the reservoir is rich in biodiversity, especially its avian population, with a Simpson diversity index of 0.73519, indicating high species diversity. In addition to bird watching, the area offers scenic lake views, cultural homestays, and proximity to significant historical and cultural sites, including Sagarhawa, Tilaurakot, and the Araurakot Asoka Pillar, enhancing its tourism appeal. Data collection included bird surveys, household and visitor questionnaires, interviews, and mapping tools. Both locals and visitors strongly support ecotourism development, seeing it as a means to improve livelihoods and foster community development. Bird watching emerged as the most preferred activity, followed by lake-related attractions and scenic beauty. Despite its potential, challenges such as inadequate tourism infrastructure, poor marketing, and limited guest management skills among locals pose barriers to growth. The study recommends capacity-building workshops, improved infrastructure, and collaboration with commercial stakeholders to enhance promotion and marketing. These efforts could transform Jagdishpur Reservoir into a sustainable ecotourism hub that benefits local communities and supports conservation initiatives.

Keywords: *Development, Diversity, Ecotourism, Jagdishpur, Perception, Reservoir*

1. Introduction

1.1 Background

Nepal is a landlocked country and rich in natural beauty. The country is bordering between two of the fastest-growing economies of the world- India in the east, south, and west and China in the north. Ecologically, Nepal is divided into three main regions Himalayan, Hill, and Terai. It is located between 26° 22" to 30° 27" north latitudes and 80 ° 4" to 88° 12" east longitudes covering an area of 1,47, 181 sq. km, accounting for 0.03 % of land areas of earth and 0.3% of Asia. The altitude ranges from 59m (Musaharniya) to 8848 meters (Mount Everest, the world's highest peak), and the climate varies from tundra to polar. The country has an average length of 885 Km from east to west and 193 Km breadth from south to north. The country's population is 29,192,480 (CBS 2021). Nepal is considered to be rich in biodiversity. Nepal is home to many wild varieties of plants and animals in addition to the scenic beauty created by various landscapes along the altitude. Nepal is rich not only in scenic beauty and diversity but also in culture. There are more than 142 ethnic groups in Nepal with more than 124 different types of languages (CBS 2021). There is unity in diversity in the country. There are different cultures, customs, festivals, and traditions which are the gift to the present generation from our ancestors. These festivals and

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cultures of different ethnic groups can be seen and celebrated year-round. The combination of natural beauty and socio-cultural diversities creates a promising environment for enticing tourists to visit Nepal. These two factors form an important base for tourism development. The country is famous for eco-touristic destinations in the world. The ecotourism concept emerged in the 1990s as an alternative to mainstream tourism incorporating rural and cultural tourism features. Ecotourism is environmentally responsible travel to natural places emphasizing ecologically sustainable activities, conservation measures, and local community participation (Anup, 2016). Ecotourism has been identified as a possible funding source for wetland conservation (Aryal 2019). It is a key component of the sustainable tourism business, emphasizing forest conservation, environmental preservation, poverty alleviation, and economic growth (Anup et al, 2015). It provides alternative livelihood options and can generate funding for biodiversity conservation, and it has gained popularity in underdeveloped nations worldwide, including Nepal (Chandel and Mishra 2016).

Ecotourism has become a popular way for people to travel and experience natural environments while supporting the conservation of those areas. It is one of the world's fastest-growing tourism markets, attracting significant attention from developing countries and economically challenged regions (TIES, 2016). Although eco-tourism is not a new concept in Nepal, people-centered management strategies for the sustainable use of natural resources and cultural assets are being promoted to direct benefits to impacted communities (Bhandari, 1997). Eco-tourism includes tourist activities, environmental conservation, and sustainable development having an economic valuation of the area (Baral et al. 2016).

Ecotourism has become crucial for the tourism industry in countries like Nepal, which is rich in biodiversity of unique geographical features, high altitudinal variation, and diverse climatic conditions. Ecotourism has the potential to be an economic boom in Nepal if adequate rural tourist planning and design are implemented, as many urban inhabitants now prefer to visit these eco-tourism locations to relax and recharge (Anup et al, 2021). Jagadishpur Lake could be a suitable location. The Jagdishpur Reservoir is a man-made reservoir located in the Kapilvastu district of Nepal (Pathak et al., 2020). It is a potential location for ecotourism development due to its diverse flora and fauna and scenic views.

However, before any ecotourism development can take place, it is important to assess the current state of the area and determine the potential impacts of tourism. Wetlands also provide ecological services, such as eco-tourism. At the global level, at least 35% of Ramsar Sites indicate some amount of tourism activity, which is fairly consistent across areas that provide recreational activities and economic benefits (RCS, 2006). As a result, using wetland resources can be a fantastic opportunity and a means to reduce poverty. Despite the enormous potential for tourism development in the Jagdishpur reservoir area, it has not been fully realized. Despite being adjacent to the Lumbini World Heritage Site, the place remains unknown to both national and international travelers. The primary purpose of the study is to assess the feasibility and possibilities of eco-tourism in and around Jagdishpur Reservoir.

The general objective of the study is to analyze the viability of ecotourism in and around the Jagdishpur Lake area. The specific objectives are: 1).Conduct a comprehensive assessment of the Jagdishpur Reservoir and its avifaunal diversity; 2). Assess the peoples' perception and opinions towards ecotourism development; 3).Comparison and ranking of different existing major attractions in the Reservoir; 4). Identify and enhance potential ecotourism activities and areas around the Reservoir.

1.2. Study Area

The study was carried out in the Jagdishpur Lake Kapilvastu District, which is located at 27°35'N 83°05'E Province No. 5, in Nepal's southern lowlands at a height of 197 meters (Figure 1). The Reservoir is the country's largest manmade lake, with an area of 225 hectares, and is located in Kapilvastu Municipality Wards 9 and 10, approximately 11 kilometers north of Taulihawa. The district's climate ranges from tropical to subtropical depending on the altitude. The average yearly temperature ranges from a high of 43°C in the summer to a low of 4.5°C in the winter. The Reservoir serves 17,390 houses with a population of 54,358 by providing irrigation, fish, food, and recreational activities (Man et al. 2018).On August 13, 2003, the reservoir was recognized as a Ramsar site and designated as a bird sanctuary in 2022.

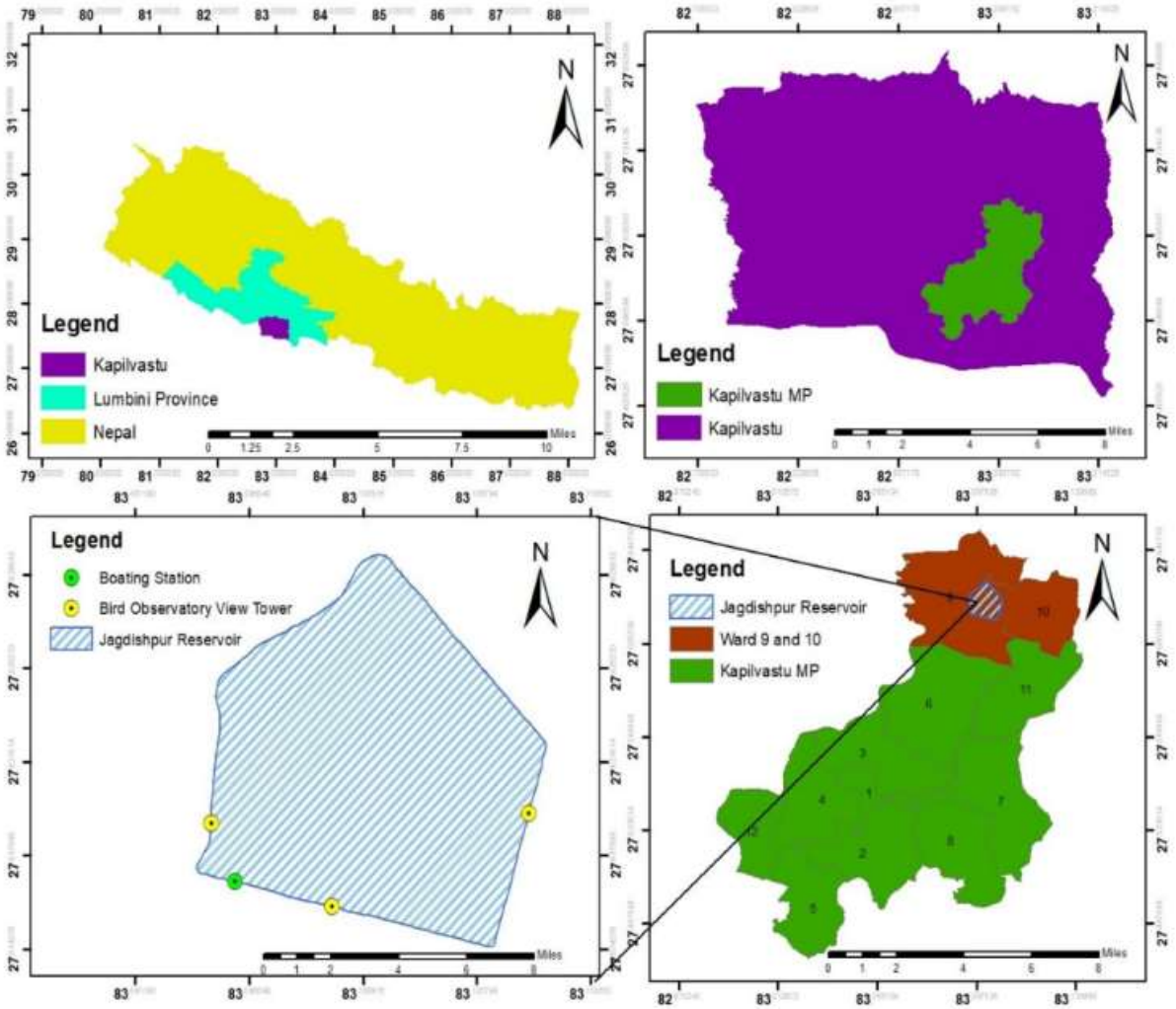

Figure 1. Location of the study area.

The man-made reservoir is the largest in the country, covering an area of 225 hectares, with a core zone of 157 hectares. It includes 60 hectares of marshland and 7 hectares of shrubland, which provide habitats for a range of vulnerable, endangered, and critically endangered species. According to (IUCN, 2015), it is home to 55 plant species, comprising 22 herbaceous plants, 18 shrubs, and 15 tree species. Additionally, the reservoir supports 43 types of fish, 52 herpetofauna species, 168 bird species, and 32 different mammal species.

2. Methodology of research

The reservoir is bordered by farmland and smaller lakes that act as buffer zones for bird migration. The site is a sanctuary for several rare and threatened species of conservation significance, such as the endangered Serpentine (*Rauvolfia serpentine*), the uncommon Pondweed (*Potamogeton lucens*), the threatened Lotus (*Nelumbo nucifera*), and the endangered Indian Sarus Crane (*Grus antigone*), which is noted as the tallest flying bird. The reservoir also serves the local community through various uses, including fishing, grazing, collecting fuelwood and fodder, domestic purposes, and providing irrigation water for 6,200 hectares of agricultural land around it (Kafle & Savillo, 2009).

2.1 Data collection method

2.1.1 Primary data collection

A. Bird survey

This method was used to know the abundance of bird species in the wetland. The survey was conducted at least twice a month from February to April 2023. Observations were done with the help of 10 *42 Bushnell binoculars, and other simple techniques were applied to know the overall abundance of bird species in the area not only during survey time but also during the winter to spring season. The survey was done clockwise or anticlockwise direction around the Reservoir in different surveys and observed birds mostly from the definite ten vantage locations.

B. Key informant interview

Key informant interviews with major stakeholders were done to develop further ideas for the study. Open-ended structured questionnaires were used in the interview. The key informant includes the Chairperson of the Jagdishpur Reservoir Management Multi-stakeholder Forum, the Chairperson of Jagdishpur Jalasaya Homestay, DFO, the concerned police officer, and teachers of the area to find out the other different potential sites around the Reservoir and also know about the plan and activities that can be conducted in the site to develop it as touristic site and its promotion.

C. Questionnaire survey

Two sets of questionnaires were created for the home and visitor surveys. To ensure clarity and reduce any misunderstandings among respondents, the questions were developed in English before being asked in Nepali. In March 2023, a semi-structured questionnaire was distributed to 10% of the anticipated 1,000 households i.e. 100 households within a two-kilometer radius of the reservoir. The Yamane formula was used to establish the proper sample size, which ensured population representation. Households were chosen using a simple random sampling procedure, and interviews were conducted to determine their perceptions of the wetland's ecotourism potential. In April 2023, 52 visitors were randomly questioned about ecotourism activities, available visitor amenities, and their satisfaction with ecotourism products and services. The sample size of the visitors was determined from the peak hour tourist flow during the month. Peak hour tourist flow was considered on Saturday, and 4 Saturdays of the month were considered as the baseline for the visitor flow. Out of the average tourist flow on Saturdays of the month (520), 10% sampling intensity was considered to represent the visitor's population.

D. Direct observation

Direct observations were done every once a week along with local respondents of the study area to assess the current state of the area and gather additional data about the area.

2.1.2 Secondary Data Collection

Secondary data were collected from government bodies, institutions, authorized NGO experts, official records, various published and unpublished articles, research, journal documents, and other available literature. Various websites providing information on ecotourism and related topics were also surfed frequently. Data were collected from institutional offices like Jagdishpur Reservoir Management Multistakeholder Forum, Divisional Forest office, Jagdishpur temporary police post, etc.

2.2. Data analysis method

Data was collected, organized with cross-checking, processed, tabulated, and analyzed both statistically and qualitatively. Data were coded and analyzed using Microsoft Excel and the Statistical Package for Social Science (SPSS). Arc GIS and Google Earth Pro were used to create a map of the study area.

Simpson's Diversity Index

Simpson's Diversity Index was used to calculate the avifaunal species diversity in the wetland.

Simpson's Diversity Index, (Simpson, 1949)

$D = 1 - \sum (pi^2)$,

Where D represents the Simpson's Diversity Index, Pi represents the proportion of species I, $\sum$ indicates the summation of all species.

People's Perception towards Jagdishpur Lake

Likert scale of level 3 was used to find out peoples' perceptions about ecotourism potentiality. Friedman rank test and Wilcoxon Signed Rank Test were deployed for the comparative analysis of major attractions of the Jagdishpur Reservoir. Fisher's exact test was used to analyze the perception of locals and visitors toward ecotourism and community development. The weighted mean was also used to determine the ranking of different ecotourism activities.

Weighted Mean,

$\sum_{i=1}^{n} wiXi / \sum_{i=1}^{n} wi$ (Zar, 1999)

Where, W = weight of ranked position, N = number of choice, X = response count for answer choice, I observed values.

The findings from the analysis were finally interpreted in the form of pie- charts, columns and tables.

3. Results and discussions

3.1 Avifaunal diversity and occurrence

A total of 56 bird species were recorded during the observation period. These species belonged to various families such as Anatidae, Podicipedidae, Rallidae, Gruidae, Ciconiidae, Threskiornithidae, Ardeidae, Phalacrocoracidae, Anhingidae, Charadriidae, Jacanidae, Scolopacidae, Laridae, and other. The occurrence status of each species was categorized as Common, Fairly Common, or Rare. The counts of individual species varied, ranging from 1 to 5,895 individuals observed. Details such as common and scientific name, status, proportion, and square of proportion are presented in (Table 1). The occurrence of proportion and squared of proportion for all the species were also calculated to interpret Simpson's Diversity Index. So, an analysis of avian species diversity and occurrence in the study area using the Simpson's Diversity Index was done.

Table 1 Status of wetland birds observed in Jagdishpur Reservoir during field survey (Note: *status)

No	Species	Scientific Name	Family	Occurrence*	Count	P	P^2
1	Lesser Whistling duck	*Dendrocygna javanica*	Anatidae	Common	4957	0.319889	0.10233
2	Fulvous Whistling Duck	*Dendrocygna bicolor*	Anatidae	Rare	1	6.453E05	4.2E09
3	Ruddy Shelduck	*Tadorna ferruginea*	Anatidae	F.Common	21	0.0013552	1.8E06
4	African Comb Duck	*Sarkidiornis melanotos*	Anatidae	Rare	11	0.0007099	1.5E07
5	Cotton Pygmy Goose	*Nettapus Coroman-delianus*	Anatidae	Rare	6	0.0003872	1.5E 07
6	Red-creasted Pochard	*Netta rufina*	Anatidae	Common	1962	0.1266133	0.01603
7	Common Pochard	*Aythya ferina*	Anatidae	Common	324	0.0209086	0.00044
8	Baer's Pochard	*Aythya baerl*	Anatidae	Rare	1	6.453E05	4.2E09
9	Ferruginous Duck	*Aythya nyroca*	Anatidae	F.Common	60	0.003872	1.5E05
10	Tufted Duck	*Aythya fuligola*	Anatidae	Common	154	0.009938	9.9E05
11	Greater Scaup	*Aythya marlia*	Anatidae	Rare	1	6.453E05	4.2E09
12	Garganey	*Anas querquedula*	Anatida	Rare	1188	0.0076149	5.8E05
13	Northen Shoveler	*Spatula clypeata*	Anatidae	Common	69	0.0044528	2E05
14	Gadwall	*Mareca strepera*	Anatidae	Common	270	0.0174239	0.0003
15	Eurasian Wigeon	*Mareca Penelope*	Anatidae	Common	112	0.0072277	5.2E05
16	Indian Spot-billed uck	*Anas poecilorhync ha*	Anatidae	F.Common	6	0.0003872	1.5E07
17	Chinese Spot-ed Duck	*Anas zonorhyncha*	Anatidae	Rare	1	6.453E05	4.2E09
18	Mallard	*Anas platyrhynchos*	Anatidae	F.Common	124	0.0080021	6.4E 05
19	Northen Pintail	*Anas acuta*	Anatidae	F.Common	28	0.0018069	3.3E06
20	Common Teal	*Anas crecca*	Anatidae	Common	124	0.0080021	6.4E05
21	Little Grebe	*Tachybatus ruficolis*	Podicipedidae	Common	199	0.012842	0.00016
22	Great crested Grebe	*Podiceps cristatus*	Podicipediadae	Common	28	0.0018069	3.3E06
23	Brown Crake	*Zapornia akool*	Rallidae	Rare	1	6.453E05	4.2E09
24	White breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	F. Common	4	0.0002581	6.7E08
25	Purple Swamphen	*Porphyrio porphyria*	Rallidae	F.Common	101	0.0065178	4.2E 05
26	Common Moorhen	*Gallinula chloropus*	Rallidae	Common	41	0.0026458	7E06
27	Common Coot	*Fulica atra*	Rallidae	Common	5895	0.3804208	0.14472
28	Sarus Crane	*Antigone antogone*	Gruidae	Common	13	0.0008389	7E07
29	Lesser Adjutant	*Leptoptilos javanicus*	Ciconiidae	Common	14	0.0009035	8.2E07
30	Asian Openbill	*Anastomus oscitans*	Ciconiidae	Common	60	0.003872	1.5E05
31	Asian Woollyneck	*Ciconia episcopus*	Ciconiidae	Rare	2	0.0001291	1.7E08
32	Black Strok	*Ciconia nigra*	Ciconiidae	Rare	3	0.0001936	3.7E08
33	Black headed Ibis	*Threskiomis elanocepha lus*	Threskiornithida	F.Common	5	0.0003227	1E07
34	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	Common	96	0.0061951	3.8E05
35	Yellow Bittern	*Ixobrychus sinesis*	Ardeidae	Rare	1	6.453E05	4.2E09
36	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Ardeidae	Rare	1	6.453E05	4.2E09
37	Black crowned Night-heron	*Nycticorax nycticorax*	Ardeidae	Rare	30	0.001936	3.7E06
38	Indian Pond heron	*Ardeola grayii*	Ardeidae	Common	25	0.006133	2.6E06
39	Cattle Egret	*Bubulcus ibis*	Ardeidae	Common	162	0.0104543	0.0001
40	Grey Heron	*Ardea cinerea*	Ardeidae	F.Common	4	0.0002581	6.7E08
41	Purple Heron	*Ardea purpurea*	Ardeidae	Common	12	0.0007744	6E07
42	Great White Egret	*Ardea alba*	Ardeidae	F.Common	2	0.0001291	1.7E08
43	Intermediate Egret	*Ardea intermedia*	Ardeidae	F.Common	10	0.0006453	4.2E07
44	Little Egret	*Egretta garzetta*	Ardeidae	Common	28	0.0018069	3.3E06
45	Little Cormorant	*Microcarbo niger*	Phalacro coracidae	Common	179	0.0115514	0.00013
46	Great Cormorant	*Phalacrocorax carbo*	Phalacro coracidae	Common	131	0.0084513	7.1E05
47	Oriental Darter	*Anhinga melanogaster*	Anhingidae	F.Common	2	0.0084538	1.7E08
48	Little Ringed Plover	*Charadrius dubius*	Charadriidae	Rare	1	6.453E-05	4.2E-09
49	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	Common	51	0.0032912	1.1E-05
50	Grey-headed apwing	*Vanellus cinereus*	Charadriidae	F.Common	28	0.0018069	3.3E06
51	White-tailed Lapwing	*Vanellus leucurus*	Charadriidae	Rare	2	0.001291	1.7E08
52	Pheasant tailed acana	*Hydrophasia nus chirurgus*	Jacanidae	Rare	8	0.0005163	2.7E07
53	Bronze inged Jacana	*Metopidius indicus*	Jacanidae	F. Common	2	0.0001291	1.7E08
54	Common Sandpiper	*Actitus hypoleucos*	Scolopacidae	Rare	2	0.0001291	1.7E08
55	Green Sandpiper	*Tringa ochropus*	Scolopacidae	Rare	1	6.45 3E05	4.2E09
56	Brown headed Gull	*Larus brunnicephal us*	Laridae	Rare	2	0.0001291	1.7E08
Total					**15496**	**1**	**0.26481**

The analysis revealed a cumulative count of 15,496 individuals representing 56 avian species across various families. Among the recorded species, the Common Coot (Fulica atra) is highly abundant (5,895 counts) followed by the Lesser Whistling-duck (Dendrocygna javanica) with 4,957 counts. Brown Crake (Zapornia akool), etc. were found very rarely with only single no of occurrence during the observation time.

Similarly, several species were categorized as rare with counts ranging from 1 to 13 individuals. The species like Fulvous Whistling-duck (Dendrocygna bicolor), Baer's Pochard (Aythya baerl), Greater Scaup (Aythya marlia), Chinese Spot-billed Duck (Anas zonorhyncha).

The Simpson's Diversity Index for the wetland avian community at Jagdishpur Reservoir was 0.73519, indicating a high level of diversity and equitable distribution of bird species. Table 1 shows that the research region is an ideal environment for a diverse range of bird species. The wide diversity of wetlands birds identified throughout the study could be attributed to the availability of a variety of feed and foraging opportunities. During the survey, different aquatic vegetation was discovered to cover around 45 percent of the total reservoir. Wetland birds thus use a diverse range of habitats and rely on a mosaic of microhabitats for survival. This ecosystem contributes to diversity by supporting various food sources including fish, crustaceans, invertebrates, water plants, plankton, and mainly water birds.

3.2 General information of respondents

The necessary data were collected from a total of 152 respondents, which includes 100 HHs survey and 52 respondents as visitors from the visitors' survey. In total, 60.53% of them were male, and 39.47%. Among the two samples, in visitors, 68.6% were male and 31.4% female, while in the local community, 57% were male and 43% female.

The structure of age groups of residents accounting 42.11%, within the 36-55 years old followed by 40.79% in the 18-35 age category, while 17.11% of respondents were in the oldest age group, i.e., above 55 years. Similarly, for the visitors, 32.4%, 48.7%, and 18.9% accounted for in the 36-55 years old, 18-35 age category, and above 55 years group respectively.

Comparatively, the most of visitors were involved in agriculture and services, i.e. 17.30%, and 50.06%, then local respondents i.e. 17%, and 40%, respectively. But other occupations like foreign employees and labor work are occupied more by local respondents (15%) than visitors (11.53%). Also, business is more held by the Local people i.e. 28% than the visitors i.e. 21.11%. Most of the local people are involved in businesses like hotels, lodges, guest houses, etc. (Figure 2)

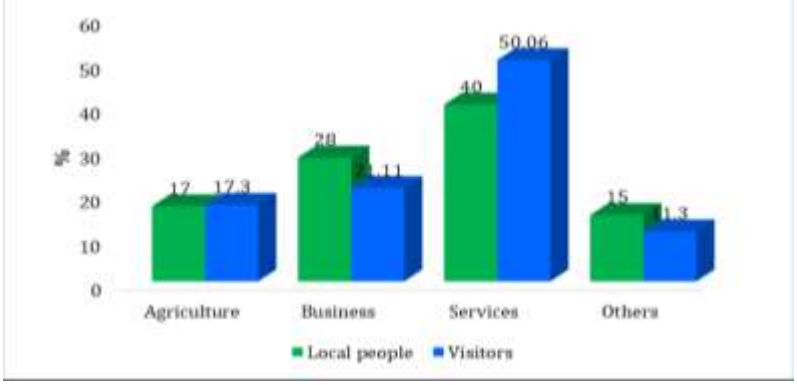

Figure 2. The professional structures of the two samples

Out of 152 total respondents, 52 were visitors. A visitors' survey was conducted to learn the information about their perceptions during to visit to the study area. Table 2 describes several

itimes wchich show that vistiors prefer to pay for ecosystem service, but in a lower percent to recommend the area to others.

Table 2. The vistors perception about paying and promotion

Items	Yes (%)	No (%)
Willing to pay for several ecosystem services conducted in the area	82.6	17.4
Willing to recommend others to visit the area	67.3	39.7

The survey was conducted to know the average level of satisfaction of visitors after visiting Jagdishpur Reservoir. As in Figure 3, among 52 visitors, 29 individuals (55.8%), were fully satisfied, 17 (32.7%) were just satisfied, and 6 individuals (11.5%) were dissatisfied.

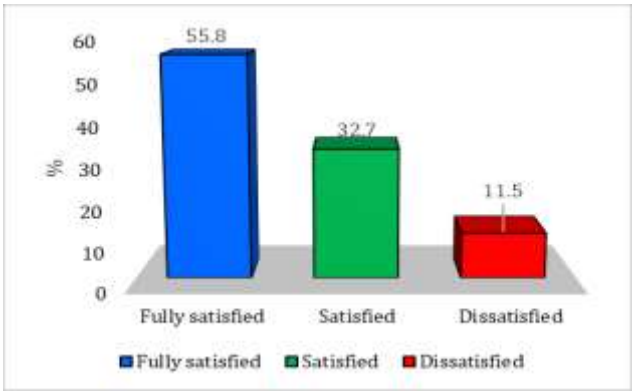

Figure 3. The visitor's satisfaction with Jagdishpur Reservoir.

Among the total respondents including locals and visitors, the economic benefit was received higher by the locals i.e. 39% than 19.23% of the visitors. Similarly, skill development and language development were benefited more by local people (19% and 11%) than visitors (11.53% and 7.69%), respectively. Education information and other benefits were received more by the visitors (46.15% and 15.38%) than by local people (18% and 13%), respectively as in Figure 4.

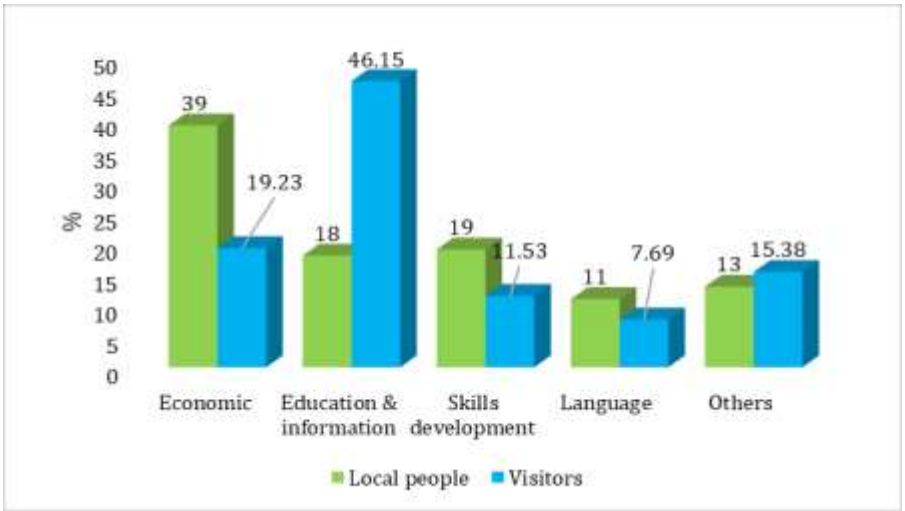

Figure 4. Perceptions about ecotourism's benefits

3.4. Comparative analysis of major attractions in Jagdishpur

A statistical analysis of the tourist attractions in the study area was conducted using the Friedman test and the Wilcoxon Signed Rank Test as in Table 2. The non-parametric Friedman test results indicated a significant difference among the four factors ($\chi 2$ = 46.022, DF = 3, p <0.001), suggesting variations in different tourist attractions of the study area. This means that

the tourists in the study area had different preferences for the four attractions. Among the four major attractions, Bird watching was ranked higher than the other factors. The mean ranks of Bird watching, Boating, Local culture and Homestay, and Natural beauty were 3.03, 2.53, 2.41, and 2.03, respectively. It suggests that the higher the mean rank, the higher will be the most preferred tourist attractions. The Wilcoxon Signed Rank Test further revealed specific pairwise comparisons. Bird watching was ranked higher than Boating with a significant difference (Z=-5.032, p<0.001). Local culture and Homestay were ranked higher than Natural beauty showing a significant difference (Z=-3.371, p=0.001). However, no significant difference was found between Local Culture and Homestay and Boating (Z = -1.344, p = 0.179).

Table 2. Comparative analysis of main attractions

Comparisons	Test statis-tics (Z)	p-value	Positive rank	Negative rank	Mean	Conclusion
Bird watching vs Boating	-5.032	0.000	120	32	69.91	Bird watching> Boating
Local Culture and Homestay	-1.344	0.179	105	47	62.04	No significant difference
Local culture and homestay vs Natural beauty	-3.371	0.001	107	45	69.57	Local culture and Homestay> Natural beauty
Note> P<0.05, a significant difference (Reject H0)						

3.5 Perceptions of respondents toward ecotourism and community development

Table 3 shows the results of Fisher's exact test to assess whether there is a significant difference in the responses of residents and visitors to four statements about ecotourism. The statements are:

- The area has the potential to promote ecotourism.
- Income from tourism will be used in community development.
- The hidden natural/cultural/religious features will be explored.
- Eco-tourism will provide the livelihood of the local people.

The results of Fisher's exact test showed that there was no a significant difference in the responses of residents and visitors to any of the four statements. This means that both groups have similar views on the potential of ecotourism for the area, the use of tourism income for community development, the exploration of hidden natural, cultural, and religious features, and the provision of livelihood opportunities for local people. The likelihood ratio test also produced similar results. The likelihood ratio for each statement was not significant, indicating that there was no significant difference in the responses of residents and visitors.

Table 3. Perceptions of Respondents towards various statements

Statements	Respon-dents	Responses			df	X_2	p-value	Likelihood ratio
		Agree	Neutral	Dissagree				
The area has the potential to promote ecotourism	Local	74	22	4	2	0.843	0.843	0.843
	Visitors	41	9	2				
Income from tourism will be used in com-munity development	Local	59	31	10	2	0.903	0.903	0.903
	Visitors	33	14	5				
The hidden natural /cultural/religious features will be explored	Local	85	15	0	2	0.628	0.628	0.628
	Visitors	46	6	0				
Eco-tourism will provide the livelihood of the local people	Local	72			2	0.108	0.116	0.119
	Visitors	45	6	1				

Overall, the results of Fisher's exact test and the likelihood ratio test suggest that there is no significant difference in the views of local residents and visitors on the potential of ecotourism for the area. This is an important finding, as it suggests that there is a consensus among stakeholders on the potential benefits of ecotourism for the area.

Statements:

1) The area has the potential to promote ecotourism.

Both residents and visitors exhibited a high level of agreement (74 and 41 responses, respectively) regarding the area's potential to promote ecotourism. The chi-square test statistic ($\chi2$=0.843, p=0.843) and likelihood ratio (0.843) indicated no significant difference in opinions between the two groups.

2) **Income from tourism will be used in community development.**

The statement focused on the utilization of tourism income for community development. Residents (59 Agree to responses) expressed a slightly stronger agreement compared to visitors (33 Agree to responses). However, Fisher's exact test results ($\chi2$=0.903, p = 0.933) and likelihood ratio (0.903) suggested no statistically significant difference in viewpoints between the two groups.

3) **The hidden natural/cultural/religious features will be explored**.

Both residents and visitors displayed a significant level of agreement (85 and 46 responses, respectively) concerning the exploration of hidden natural, cultural, and religious features.

The Fisher's exact test ($\chi2$= 0.628, p = 0.628) and likelihood ratio (0.628) indicated no significant difference in opinions between the two groups.

4) **Eco-tourism will provide the livelihood of the local people.**

The notion of ecotourism providing livelihood opportunities for local people received substantial agreement from both residents (72 Agree to responses) and visitors (45 Agree to responses). The Fisher's exact test results ($\chi2$ = 0.108, p = 0.116) and likelihood ratio (0.119) demonstrated no statistically significant difference in viewpoints between the two groups.

3.6 Visitors' perceptions of the feasibility of different ecotourism products

A total of 52 visitors were asked to rank 5 possible eco-tourism activities in and around the Reservoir from 1 to 5, giving weight or rank of 5 to the most feasible or first choice activity and 1 to the least important activity according to the view of the people.

Results shows that the majority of individuals consider bird-watching to be the preferred eco-tourism activity in the study area, while others favor boating or appreciating the lake and scenic beauty. However, conclusions cannot be drawn solely based on visual interpretation of the bar diagram (Table 4). Therefore, a weighted mean analysis is required for a more accurate assessment.

Table 4. Weighted mean of ranking of different eco-tourism activities

Weight	Preference	Bird watching	Lake & scenic beauty	Boating	Nature walk	Culture
5	1st choice	38	9	6	5	2
4	2nd choice	8	30	18	12	8
3	3rd choice	3	6	21	25	12
2	4th choice	2	5	6	7	14
1	5th choice	1	2	1	3	16
Weighted Mean		4.538	3.75	3.423	3.173	2.346
Rank		I	II	III	IV	V

From the analysis of the weighted mean of the ranking of different feasible ecotourism activities in and around the Reservoir, it was found that bird-watching had the highest weighted mean, i.e. 4.538(first choice), followed by Lake and scenic beauty as second choice activities with a weighted mean of 3.75. Similarly, Boating, Nature walking, and Culture were third, fourth, and fifth choice activities having 3.423, 3.173, and 2.345 weighted means respectively. These results suggest that bird watching is the most popular ecotourism activity in the reservoir area. This is likely since the reservoir is home to a variety of bird species, including some that are rare or endangered. The other activities are also popular, but not as popular as bird watching.

The results of the survey can be used to help develop ecotourism products in the reservoir area. For example, the results suggest that there is a demand for bird-watching tours and lake cruises. The results can also be used to educate visitors about the different ecotourism activities that are available in the area.

3.7 Potentiality of ecotourism around the Reservoir

The potential for ecotourism development in any location is determined by several physical, cultural, and religious factors. The components are as follows:

Accessibility and Location: The area should be easily accessible by tourists. It should also be located in a place that is attractive to tourists.

Scenery: The area should have beautiful scenery that will appeal to tourists. This could include mountains, forests, lakes, or rivers.

Culture: The area should have a unique culture that will interest tourists. This could include traditional architecture, festivals, or customs.

Climate: The area should have a pleasant climate that will make it enjoyable for tourists to visit.

Settlement features: The area should have a variety of settlement features that will interest tourists. This could include villages, towns, or cities. The fundamental attractions of tourism in the Reservoir are: religious and historical monuments, cultural uniqueness, natural sceneries, a calm environment, diverse flora, and fauna, etc. Some areas of ecotourism potentiality around Jagdishpur which are identified through the key informant interview and HHs surveys (Figure 5).

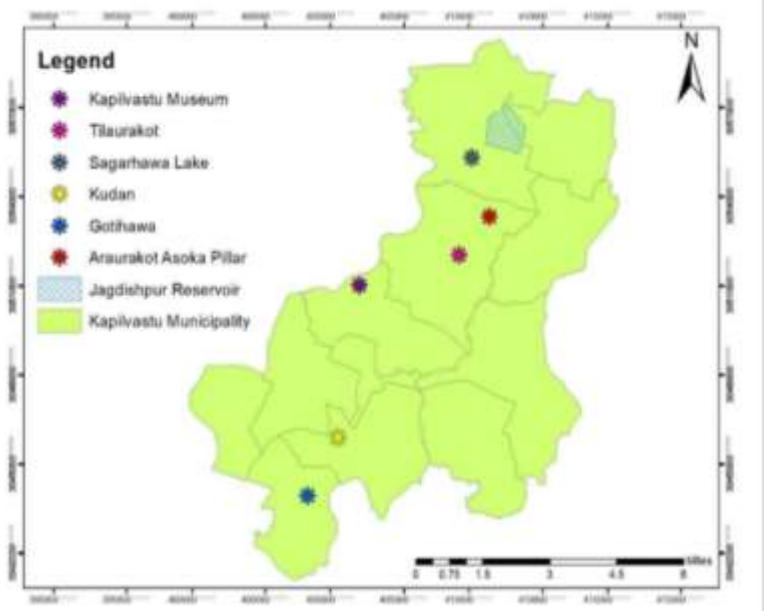

Figure 5. The map of potential eco-tourism sites around Jagdishpur.

A. Sagarhawa

Sagarhawa, located about 0.8 km south of Jagadishpur, is the site of King Virudhaka's murder of the Sakyas. Sagarhawa was previously a forest with a lake named Lambusagar. The present-day Sagarhawa is distinguished by a long and lovely lake surrounded by a breathtaking environment (Figure 6). Sagarhawa has enormous potential for the development of pilgrimage, spirituality, bird observation, and research/educational visits. The adjacent Sagarhawa village is ideal for village tours.

Figure 6. Historical Lake Sagarhawa(*Source: Photo clicked during field visit)*

Figure 7. Niglihawa Ancient Asoka Pillar. *(Source: Photo clicked during field visit)*

B. Araurakot Asoka Pillar

A rectangular walled region known as Araurakot, located approximately 5.6 kilometers from Jagdishpur, is thought to be the birthplace of Kanakmuni Buddha. It is known as the Niglihawa or Nigliva pillar. It is a Nepalese archeological site that has the remains of an Asoka pillar. Currently, this spot is best suited for spiritual strolling and open meditation (Figure 7).

C. Gotihawa

Gotihawa is located approximately 5 kilometers southwest of Taulihawa and 17.1 kilometers from Jagadishpur. Gotihawa is a famous pilgrimage destination for Buddhists from all over the world. A stupa has been built to commemorate this holy spot, which was sanctified by the birth of the Buddha. Emperor Asoka constructed an Asoka pillar here around 249 BCE. However, the upper portion of the Pillar is missing. Gotihawa, which is connected to Tilaurakot by an irrigation canal road and to Kudan by a graveled road, has equal potential for bird watching on fields and canals, as well as village tours (Figure 8).

Figure 8. The Gotihawa Pillar of Asoka *(Source: Photo clicked during field visit)*

Figure 9. Ancient Stupa at Kudan *(Source: Photo clicked during field visit)*

D. Kudan

The remains of the Nyigrodharama, now known as Kudan, are located around six kilometers south of Tilaurakot and 14.1 kilometers from the lake. This is thought to be the location where Buddha first met his father, King Suddhodhana, after attaining enlightenment. Kudan offers a very serene environment with a succession of spectacular stupas, a gorgeous mango garden, and a little pond. It is also good for bird watching (Figure 9).

E. Kapilvastu Museum

It is located 8.3 kilometers from the Jagdishpur Reservoir. The region of ancient Kapilavastu contains about 136 archeological sites. The Kapilavastu Museum houses archaeological finds from Tilaurākoṭ and other sites. The Nepalese government's Department of Archaeology operates this museum. Established in 1962, this museum is located on the right side of the Banganga River, near the western side of Tilaurakoṭ mound (Figure 10).

Figure 10. A Gate of Kapilvastu Museum *(Source: Photo clicked during field visit)*

Figure 11. The map of the ancient Kapilvastu, Tilaurakot *(Source: Photo clicked during field visit)*

F. Tilaurakot

Figure 11 shows Tilaurakot, 29 kilometers west of Lumbini, 3 kilometers northwest of Taulihawa, and 8 kilometers from the lake. It is the historic capital city of Kapilvastu, the Sakya kingdom where Prince Siddhartha spent his early years. Important archaeological and religious monuments have been discovered in Tilaurakot.

Table 5. Potentiality of different sites and their distance from Jagdishpur

Eco-tourism sites	Distance from Jagdishpur	Potentiality
Sagarhawa	0.8 km	Pilgrimage, spiritual, bird watching, and research study
Araurakot Asoka Pillar	5.6 km	Spiritual walking and open meditation
Gotihawa	17.1 km	Farmland, canal birds, and village tour
Kudan	14.1 km	Bird watching, peaceful environment with series of stupas
Kapilvastu Museum	8.3 km	Collection of archeological findings of ancient Kapilvastu
Tilaurakot	8 km	Archeological and religious.Monuments remains

3.8. Future plans and activities of ecotourism in the area

Several ecotourism activities and attractions can be developed around the Reservoir area, enhancing its tourism potential. This information was gathered through interviews with key informants, including community leaders, members of the Jagdishpur Reservoir Management Multistakeholder Forum, and local tourism stakeholders, who identified various opportunities to promote sustainable tourism in the region.

Cycling: The Lake has a perimeter of approximately 5 km, making it an ideal spot for cycling enthusiasts. Tourists can enjoy scenic views while exploring the area by bicycle.

Jeep Safari: The 18 km area around the wetland includes seven historical ecotourism sites, such as Tilaurakot, Gotihawa, and Niglihawa. A jeep safari can be a great way to explore these sites and promote tourism, especially to historical and Buddha-related destinations. Homestay owners have expressed interest in offering this service to tourists.

Wildlife Tourism: The reservoir area is a habitat for diverse wildlife species, such as deer, monkeys, and crocodiles. Visitors can partake in safaris to observe these animals in their natural environment.

Tharu Museum: Plans are underway by the Jagdishpur Reservoir Management Multistakeholder Forum, Jagdishpur Jalasaya Homestay, and Niglihawa Municipality to establish a Tharu Museum. The museum aims to preserve and promote the traditional knowledge, skills, and heritage of the Tharu community.

Picnic Spot: There is a designated picnic area near Jagdishpur Lake where visitors can relax, enjoy recreational activities, and participate in bird-watching.

World's Tallest Buddha Statue: The Kapilvastu Municipality, in collaboration with the Jagdishpur Reservoir Management Multi-stakeholder Forum and other local authorities, plans to build the world's tallest Buddha statue in Kewanpur, which is located around 2 km from the reservoir. This project is expected to attract religious and cultural tourism.

3.9 Challenges of ecotourism in the study area

Despite the high potential for tourism development in the study area, tourism has been poorly developed. Key issues and challenges related to tourism promotion in the area given by the key informants and respondents include:

-Despite having a stronger tourism product base, Reservoir, and the surrounding area have virtually fewer accommodation services and facilities.

-Tourism infrastructure, such as road facilities, is poor.

Likewise, limited infrastructure is being developed, particularly related to Bird watching, picnics, and recreation facilities.

-There is no visitor center to provide information to tourists.

- There is a low level of awareness, knowledge, and understanding about the tourism business, including the capacity of stakeholders.

- Likewise, there are limited skilled human resources for tourism development and tourism enterprises, especially related to nature guiding, Bird watching, and other recreational activities.

-Very few tour operators have included and packaged the Kapilvastu and Jagadishpur areas as a part of the Greater Lumbini Area. There is no specialized tour package for village tours and recreational visits have been developed and offered by any tour operators in this area.

Conclusion

Jagdishpur Reservoir has tremendous potential for sustainable ecotourism, which aligns with the research objectives of assessing avifaunal diversity, public perception, and development

opportunities. The reservoir has 56 bird species and a Simpson Diversity Index of 0.73519, making bird watching the most popular pastime, followed by cultural and scenic attractions. Key places such as Sagarhawa and Tilaurakot add to its appeal. Residents and visitors agree about the area's tourism potential and community development advantages. However, problems such as poor infrastructure, restricted lodging, and a shortage of competent workers stymie progress. Addressing these issues through targeted investments, capacity building, and tailored tour packages has the potential to transform the area into a sustainable ecotourism destination that balances biodiversity conservation, better local livelihoods, and regional tourism development.

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