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Valuation of ecosystem services provided by Jal Binayak community forest, Nepal

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Abstract
A lot of income-generating activities occur when there is an incentive that springs up massive contributions to the entire society. Therefore, due to rapid urbanization and a large population, the income trend may fluctuate, but the income trend has not yet been studied. The ecosystem service and generation of income from community forest is increasing research issues in urban areas. Thus, this study was objectively conducted to identify and rank the forest ecosystem services, assess the trends of income and expenditure as well as map the spatial distribution of ecosystem services provided by Jal Binayak community forest. The primary and secondary data were collected from the study site. Observation was done from 5th November to 13th November, 2020 to collect the data including GPS coordinates of available ecosystem service and discuss with users. Total 5 Key informant's survey was conducted. Similarly, the record of income and its source and expenditure were collected from the year 2006 to 2019. The ecosystem services provided by the community forest was calculated using Likert scale. The collected data were analyzed using economic analysis tools like Net Present Value, Benefit Cost ratio and profitability index. Moreover, the coordinates were used to prepare the map of ecosystem services. Manjushree Park, Barahi cave Jal Binayak temple, aesthetical beauty, water resources are the major ecosystem services in the community forest. The result showed that eco-tourism was the highest source of income in community forest. Through the analysis showed that the income was increasing annually, as Jal Binayak community forest's initial investment was only US$ 956.1 in 2006 which reached to US$ 217764.55 in 2019 with a present value of expected benefit being $301677.63. The co-efficient of variance were the highest of other income with 2.24 which was followed by interest with 2.71. The least value of coefficient variance was fee from film shooting with 0.41. The expenditure trend was also increasing from 2005 to 2019 with US$ 105.43 to US$ 17688.76. The highest value of coefficient of variance was found of infrastructure development with 1.35. The cost benefit ratio was 315.36, NPV was 208238.23 and profit index was 218.68. The point map showed that location of Bagmati River, Ganesh temple, Manjushree cave and park. Thus, investment in ecosystem service improvement in community source is practical concept in city.

Keywords: Ecosystem services, economic valuation of ES, Mapping of ES, Jal Binayak community forest

1. Introduction
Human demands for ecosystem services are growing rapidly. At the same time, humans are altering the capability of ecosystems to continue to provide many of these services [1]. We human beings are directly or indirectly benefited from forest, products like woods, fodder, water, foods which are one of the most valued ecosystem services. But even if humanity is becoming ever more urban, we are still as like before, dependent on nature. 'Ecosystem services' is a philosophy that globalizes and prioritizes the material and non-material benefits Ecosystem benefits human gains from ecosystem [2].

According to Millennium ecosystem assessment (MEA, 2005) "Ecosystem services (ES) are the benefits people obtain from ecosystems and these are classified into four types: provisioning services (for services such as food and water); regulating services (floods, drought, land degradation, disease); supporting services (soil formation, pollination, nutrient cycling) and cultural services (recreational, spiritual, aesthetic benefits)." The value of ES can be divided into use values and non-use values. The use values are subdivided into direct use values, indirect use values and option values. Whereas direct use values are more easily recognized by local people, other value types are less well understood by non-experts [3]. Ecosystem provides human beings with a broad variety of products and services varying from fairly basic, such as reliable clean water flow to dynamic, for example carbon sequestration.

Eventually, for basic needs such as clean air, safe water and food security, human life relies on ecosystem services (ES). Ecosystem services is thus the provision of natural resources and healthy ecological systems which produce goods and services of environmental and economic values [4]. The MEA, 2005 indicated that 60 to 70 per cent of environmental resources are declining faster than they can regenerate because the forest offers ES products, so there is a different range of beneficiaries of such resources. Although recognized by people, these unique features of most of the services are uncounted, unpriced and therefore remain outside the market domain [4]. Therefore, many other developing countries, like Nepal, manage much of their forestry and land conservation through a community-based strategy, such as Community Forest User Groups (CFUGs), a mechanism intended to open up for active citizen participation, administration, coordination and mobilization. Community Forestry is one of the most successful participatory forest management practices in Nepal which began in 1970 after the government of Nepal had recognized the role of the citizens in sustainable development. Community forests are national forests which are handed over to local user groups for protection, management and use under the Forest Act, 1993. Community-based forestry (CBF) has evolved through the co-evolution of human cultures, societal principles and biophysical processes and is guided by social interests, taking into account what community needs from its forests [5]. CF has been seen as an effective national strategy for improving rural health and conservation of the environment in Nepal, where local communities conserve and maintain forest resources to improve land cover and conditions [6]. Aboriginal citizens or groups according to RRI (2014) Owns or controls 511 million hectares (15.5%) of the world's forests as community-managed forests, of which the vast majority (97%) are living in low and middle-income countries. CBF's been practiced in Nepal for almost 40 years and is becoming a pioneer with 2.05 million hectares of forest maintained by multi-benefit community groups [7].

2. Materials and methods

2.1 Study Area: Chobhar or Chovar, Chobar is a village in Kathmandu District in the Bagmati Zone of central Nepal and part of Kirtipur Municipality. At the time of the 1991 Nepal census, it had a population of 5,627 and had 1,109 households in it. Chobhar is known for the nearby Chobhar Gorge where there are the Chobhar caves. There is also a temple, Jal Binayak Temple and Adinatha Lokeshwar, that is sacred to both Buddhists and Hindus. There is beautiful herbs and suburbs along with limestone adding its more beauty in the town. One of the biggest income generation of this village is through the supply of water and the tourist site Manjushree Park. The area is geographically placed at 27° 40′ 0″ N, 85° 17′ 0″ E.

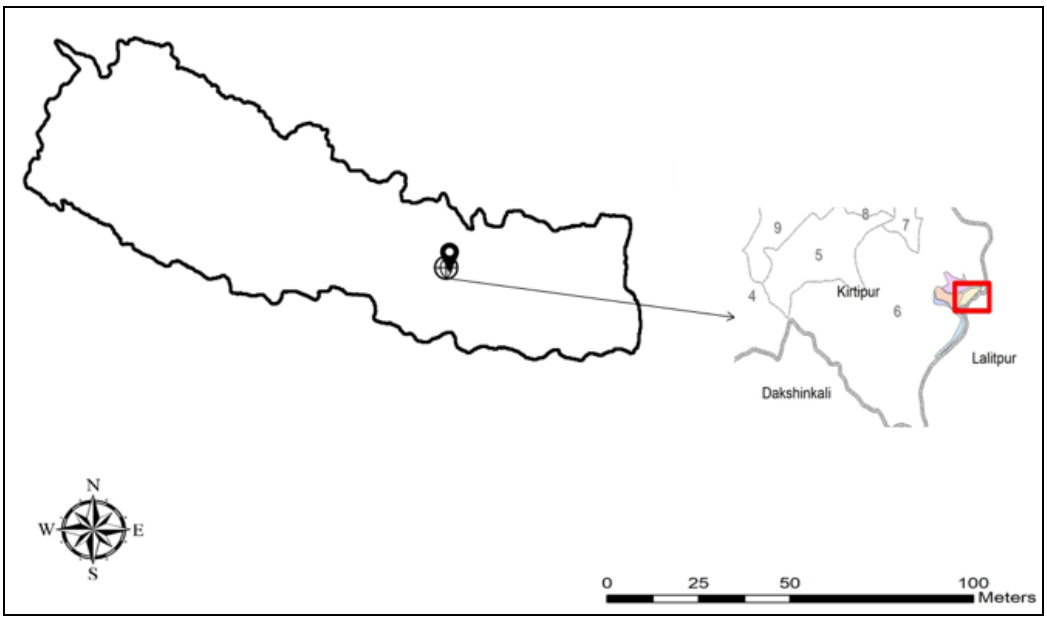

Fig 1: Map of different study area of Jal Binayak community forest

2.2 Climatic condition: The Kirtipur lies on 1343m above sea level the climate here is mild, and generally warm and temperate. In winter, there is much less rainfall in Kirtipur than in summer. The climate here is classified as Cwa by the Köppen-Geiger system. The average annual temperature in Kirtipur is 17.7 °C | 63.8 °F. In a year, the rainfall is 1479 mm | 58.2 inch. Precipitation is the lowest in November, with an average of 7 mm | 0.3 inch. The most precipitation falls in July with an average of 378 mm | 14.9 inch. At an average temperature of 23.2 °C | 73.8 °F, July is the hottest month of the year. January has the lowest average temperature of the year. It is 9.8 °C | 49.6 °F. Between the driest and wettest months, the difference in precipitation is 371 mm | 15 inches. During the year, the average temperatures vary by 13.4 °C | 56.1 °F.

2.3 Data collection

The research was carried out in Jal Binayak community forest and focused on both qualitative and quantitative measures for the research.

Primary data collection

A. Observation: In order to know the general state of the study area, observation was done by communicating with the respondent through participatory study and furthermore establishing a link. Therefore, preliminary field visit was undertaken to determine the location and know the flow of visitors and be familiar with the CFUGs and local people.

After getting familiar with the environment, the data collection was done for about a week from 5th November to 13th November.
Firstly, interaction with the CFUGs was done and questionnaires were performed with the core committee members. GIS points were collected throughout the community forest with the assistance of committee members for mapping purposes. As the community forest had inaugurated parks such as Manjushree park questionnaire with the visitors were also done. Through this we could also detect people's participation and their involvement with the community forest.

B. Key informant interview (KII): Total 15 Key informants survey was conducted to generate and substantiate in-depth information about the status of community forest. Open ended questions were given to each chosen interviewer which gave us more concrete information regarding the standing of CF.

Secondary data collection: Secondary data was collected from different journal papers, articles, books, websites, and published and unpublished thesis reports. Also, different data were collected from the audit report showing the expenditure and income source and quantity for 15 years (2006 to 2019).

2.4 Data Analysis
The information collected from both primary and secondary sources were analyzed by using Microsoft Excel, GIS, for both qualitative and quantitative analysis. Microsoft Excel was used to monitor the community forest's income and expenditure trends. Likewise, Google Earth and Arc GIS were used to map the area. And as for the economic evaluation net present value (NPV), benefit cost ratio (B/C ratio) and profitability index (PI) were calculated

A. Net Present Value
Net present value is computed by finding the difference between the present worth of benefit stream less the present worth of cost stream. Or it is simply the present worth of the cash flow stream since it is a discounted cash flow measure of project worth along with internal rate of return.

NPV = Present worth of Benefit Stream – Present Worth of Cost Stream.

Mathematically, it can be shown as

$$\text{NPV} = \sum_{t=0}^{n} (\text{Bn} - \text{Cn})/(1 + \text{i})^n$$

Where, Bn = benefits in each year of the project.
Cn = Costs in each year of the project.
n = number of years in a project
i = interest (discount) rate
Bn – Cn = Cash flow in n^{th} year of the project

The project is profitable or feasible if the calculated NVP is positive when discounted at the opportunity cost of capital.
If the NPV is positive, then the present value of the revenues exceeds the present value of the costs and the investment can be considered financially acceptable. Likewise, if the NPV is negative, the present value of the costs exceeds the present value of the revenues and the investment is considered financially unacceptable.
The formula is usually used to assess the investment feasibility by predicting the future cost and benefit of the project. Discounting using present Interest rate of Future cost and benefit is the main approach to convert the future cost to the present. The difference in Present value of cost and Present value of benefit is Net present value.
But in our case the past investment is converted into Present value using compounding, in compounding the actual interest rate (12%) paid by farmer has been used.
Now the formula for the case becomes:

PNR= $\sum_n^0 B(1+I)^n$

PNC= $\sum_n^0 C(1+I)^n$

NPV= PNR-PNC

Where, NPV: Net Present Value, PNR: Present Net Revenue & PNC: Present Net Cost

B. Benefit Cost Ratio: It is the ratio of present worth of benefit stream to present worth of cost stream i.e., Sum of the present worth of benefit.
B/C Ratio = Ratio Present Value of Revenue to Present Value of Cost
Mathematically, it can be shown as B/C Ratio = PNR/ PNC
The investment is said to be profitable when the BCR is one or greater than 1. This method is widely used in economic analysis and not in private investment analysis.

C. Profitability index (PI): The profitability index (PI), alternatively referred to as value investment ratio (VIR) or profit investment ratio (PIR), describes an index that represents the relationship between the costs and benefits of a proposed project. It is calculated as the ratio between the present value of future expected cash flows and the initial amount invested in the project. A higher PI means that a project will be considered more attractive. The formula for the PI is as follows:

$$\text{Profitability index} = \frac{\text{present value of future cash flow}}{\text{Initial investment}}$$

Therefore: If the PI is greater than 1, the project generates value and the company may want to proceed with the project. If the PI is less than 1, the project destroys value and the company should not proceed with the project. If the PI is equal to 1, the project breaks even and the company is indifferent between proceeding or not proceeding with the project. The higher the profitability index, the more attractive the investment.

3. Results and discussion
3.1 List of ecosystem services and their ranking
The table comprises various types of ecosystem services offered by the Jal Binayak CF, which indicate their ranks according to locality perceptions. According to the following results (Table 1), cultural services have the upmost priority in comparison with other services. Likewise, ecotourism has the highest rank followed by Spiritual and religious, Aesthetic, Cultural heritage, and Recreation values.

Table 1: Ranking of Ecosystem Services at Jal Binayak community forest

Types of Ecosystem services	services	Liker scale rank (0-7)	Remarks
Provisioning services	Food	1	
	shelter	1	
	Fresh water	3	
	Firewood	4	
	Fibber	2	
	Biochemicals	4	
	Genetic resources	3	
Regulating services	Climate regulation	5	
	Disease regulation	2	
	Water regulation	2	
	Water purification	3	
Cultural services	Spiritual and religious	6	
	Ecotourism	7	
	Recreation	5	
	Educational	4	
	Aesthetic	5	
	Inspirational	3	
	Sense of peace	3	
	Cultural heritage	5	
Supporting services	Soil formation	4	
	Nutrient cycling	3	
	Primary production	3	

3.2.1 Trends of income generated by Jal Binayak community forest

The table: 2 illustrates several sources of income and their variance over the 15-year timeframe. Since the majority of these resources are non-material resources that people receive from ecosystems, they often mean that these bases fall under cultural services. The data show that the net surplus has improved with the year, despite depreciation in the year 2015, with a gross annual revenue stream of $53114.43 as the entire country was suffering from a natural catastrophe. The community forest steadily recovered over the years and now has the highest revenue of $217764.55 in the year 2019.

Among these sources financial support has the highest source of income which was $195551.03 whereas, the membership fee provides the least which was $973.42. Components such as parking fee, picnic fee, cave entrance fee, shooting fee were more stable and reliable source of income for sustainability. The bar graph below shows the overall presentation of the income gained over the timeframe.

Table 2: Source of Income from different source in Jal Binayak Community Forest

	Source of income (U.S. $)												
Years	Parking fee	Driving lesson fee	Shooting fee	Park entrance fee	Picnic fee	Cave entrance fee	Financial support	Membership fee	Stall rent income through stall	Micellaneous	Return of interest	Other incomes	Total of each year
2005	68.7	38.64	218.98	0	0	0	358.65	135.65	0	134.80	0	1.19	956.61
2006	1240.5	112.5	1251.19	988.67	173.59	470.59	4511.13	100.86	0	9126.35	0	161.43	18136.81
2007	1210.51	229.71	1368.83	1984.47	634.91	753.72	2971.02	145.81	0	11469.65	0	239.15	21007.78
2008	1596.32	306.14	1743.76	4138.11	1600.59	963.51	18397.26	75.27	0	29822.03	0	132.35	58775.34
2009	1493.48	289.63	1739.38	5679.38	3793.38	863.35	1973.37	89.79	0	17572.14	0	180.82	33674.72
2010	2036.24	319.44	2079.76	6792.55	3382.33	588.38	0	10.91		17803.63	1836.3	757.7	35607.26
2011	2021.21	507.92	1640.55	7939.07	4479.45	1052.47	0	35.28	206.01	19243.82	997.51	86.84	38210.13
2012	1342.17	554.2	1888.71	1556.02	7155.98	855.28	0	12.02	704.54	22270.99	1096.4	234.46	37670.76
2013	1828.99	644.88	168.13	13571.6	8757.02	1340.95	169.68	233.01	544.34	29680.62	650.78	494.2	58084.18
2014	1072.56	617.41	1929.5	13539	9736.37	1197.02	403.35	134.82	5932.24	33993.69	205.54	112.99	68874.53
2015	1276.86	716.56	1726.68	1279.28	9262.67	1165.27	1278.75	0	1279.26	34877.83	0	280.27	53143.43
2016	951.18	841.53	1600.02	15514.2	9095.44	727.32	14558.4	0	1300.29	64519.85	0	376.81	109485.07
2017	12326.85	621.27	1699.87	4551.37	5620.36	892.19	41968.31	0	1852.42	59033.55	0	399.55	128965.74
2018	55.82	71.7	985.75	4898.97	6544.58	988.79	43913.18	0	4911.41	65021.67	75.33	2576.1	130043.30
2019	0	626.85	1296.64	7990.2	4321.92	481.99	65047.93	0	5408.17	124156.50	0	8434.35	217764.55
Total	28521.39	6498.38	21337.75	90422.94	74558.59	12340.83	195551.03	973.42	22138.68	538727.12	4861.87	14468.21	

3.2.2 Standard deviation and coefficient of variation of the sources

Coefficient of variation: The table 3 showed that driving lesson fee, shooting fee, park entrance fee, Picnic fee, cave entrance fee is more suitable as their COV are 0.58, 0.40, 0.82, 0.69, 0.41 respectively. On the other hand, sources such as membership fee, donation and income through stalls have high COV like 1.12, 1.58, 1.34 respectively. And thus, proves that these sources have high amount of fluctuation which is not suitable for long term investment. Whereas sources related with the recreational services has high sustainability and is flexible for the community forest. This, such services must be given upmost prioritization and protection for the stability and conservation of such services.

Table 3: Descriptive analysis of income from different source

Source	Average	Standard deviation (S.D)	Coefficient of variation (COV)
Parking fee	4353.14	2958.94	1.56
Driving lesson fee	900.00	253.43	0.58
Shooting fee	2885.87	574.41	0.40
Park entrance fee	13689.56	4922.08	0.82
Picnic fee	11952.68	3408.03	0.69
Cave entrance fee	1762.74	340.11	0.41
Donation support	33046.39	20627.70	1.58
Membership fee	124.35	72.88	1.12
Stall rent income through stall	3985.24	2168.78	1.37
Miscellaneous	86631.99	31386.10	0.87
Return of interest	648.37	564.72	1.74
Others/income	2541.85	2158.48	2.24

3.2.3 Share of income from different source

The table 4 illustrates the variation of different sources and their share in the income generation. Through this data it can be denoted that throughout the years donation has a variety of contribution over the years. And each source has significant contribution for the source of income in Jal Binayak community forest.

Table 4: Share of income ($) from different source

Years	Source of income in percentage (U.S. $)											
	Parking fee	Driving lesson fee	Shooting fee	Park entrance fee	Picnic fee	Cave entrance fee	Donation	Membership fee	Stall rent income through stall	Miscellaneous	Rate return of interest	Others/ income
2005	7.18	4.04	22.89	0.00	0.00	0.00	37.49	14.18	0.00	14.09	0.00	0.12
2006	6.84	0.62	6.90	5.45	0.96	2.59	24.87	0.56	0.00	50.32	0.00	0.89
2007	5.76	1.09	6.52	9.45	3.02	3.59	14.14	0.69	0.00	54.60	0.00	1.14
2008	2.72	0.52	2.97	7.04	2.72	1.64	31.30	0.13	0.00	50.74	0.00	0.23
2009	4.44	0.86	5.17	16.87	11.26	2.56	5.86	0.27	0.00	52.18	0.00	0.54
2010	5.72	0.90	5.84	19.08	9.50	1.65	0.00	0.03	0.00	50.00	5.16	2.13
2011	5.29	1.33	4.29	20.78	11.72	2.75	0.00	0.09	0.54	50.36	2.61	0.23
2012	3.56	1.47	5.01	4.13	19.00	2.27	0.00	0.03	1.87	59.12	2.91	0.62
2013	3.15	1.11	0.29	23.37	15.08	2.31	0.29	0.40	0.94	51.10	1.12	0.85
2014	1.56	0.90	2.80	19.66	14.14	1.74	0.59	0.20	8.61	49.36	0.30	0.16
2015	2.40	1.35	3.25	2.41	17.43	2.19	2.41	0.00	2.41	65.63	0.00	0.53
2016	0.87	0.77	1.46	14.17	8.31	0.66	13.30	0.00	1.19	58.93	0.00	0.34
2017	9.56	0.48	1.32	3.53	4.36	0.69	32.54	0.00	1.44	45.77	0.00	0.31
2018	0.04	0.06	0.76	3.77	5.03	0.76	33.77	0.00	3.78	50.00	0.06	1.98
2019	0.00	0.29	0.60	3.67	1.98	0.22	29.87	0.00	2.48	57.01	0.00	3.87

3.3.1 Trends of expenditure from Jal Binayak community forest

The following table: 5 demonstrates the expenditure of Jal Binayak community forest and their trends throughout the time span of 15 years. Activities such as tree plantation, environmental protection directly contributes in the maintenance of ecosystem services. Over the year there is constant flow of income and correspondently with development of infrastructure and sustainability of ecosystem services. The bar graph below shoes that year 2008 has the highest outflow of expenditure with the total sum of $45471.51. Where, the majority of the funds were spent on infrastructure growth and the creation of new areas for improved tourism management and attraction of domestic as well as international tourist. Since then, there was a gradual and constant flow of expense though there was a high rate of fall in the year 2015 which is $14700 as this year had a lot of disturbance due to natural calamity. After this there was a constant outflow of expenditure throughout the years.

Table 5: Expenditure of Jal Binayak community forest

Years	Expenditure (U.S. $)											
	Salary	Depreciation	Electric and communication expenses	Environmental expenses	General commite meeting	Hospitality expenses	Inrastructure development expenses	Office equipment	Expenses related with cave	Others	Micellaneous	Total
2005	9.10	0.00	0.00	0.00	41.90	0.00	0.00	0.00	0.00	52.72	1.72	105.43
2006	870.56	135.95	318.04	146.73	72.80	45.59	50.69	2684.74	139.69	6076.94	169.71	10711.44
2007	1201.04	544.56	585.71	730.72	577.40	0.00	0.00	60.70	137.88	11136.50	90.38	15064.89
2008	2332.03	265.12	889.87	730.72	580.36	217.07	15185.76	106.62	228.91	24864.82	74.24	45475.51
2009	3421.93	216.48	1009.46	6478.35	467.86	208.58	536.86	99.65	139.46	1263.08	189.57	14031.28
2010	4805.51	369.04	1284.80	845.44	30.99	170.51	318.01	0.00	114.26	9565.58	347.68	17851.83
2011	4414.94	356.32	1720.38	0.00	1450.83	209.71	714.90	538.30	207.56	18070.08	147.88	27830.89
2012	5785.10	331.48	184.75	72.75	184.75	334.35	592.55	866.50	95.10	14725.34	416.38	23589.04
2013	6816.75	754.66	2624.93	335.45	2624.93	332.07	817.06	260.53	78.01	18191.65	511.78	33347.80
2014	5239.31	754.66	1948.64	1912.89	2624.93	332.07	817.06	260.53	78.01	19012.83	511.78	33492.70
2015	6878.58	278.19	113.70	3485.21	958.05	168.30	434.35	214.07	57.32	1184.95	927.65	14700.38
2016	3136.20	297.32	272.86	2148.10	0.00	212.03	505.99	913.11	2405.71	11347.83	522.95	21762.10
2017	3228.26	359.92	275.36	809.20	88.50	399.55	494.67	1032.58	809.20	12356.47	374.46	20228.17
2018	3397.02	314.71	275.36	809.20	759.72	399.55	507.88	693.81	65.52	13223.42	602.95	21049.14
2019	3434.80	598.47	394.75	1913.04	807.09	81.79	858.70	883.90	60.11	8505.07	151.03	17688.76
Total	54971.12	5576.89	11898.61	20417.80	11270.10	3111.17	21834.48	8615.04	4616.74	4616.74	5040.15	

3.3.2 Standard deviation and coefficient of variation of the expenditure

The following data gives an overview on the deviation of the variables also their variability through coefficient of variation. This table: 6 also states that salary and depreciation are most constant variable as their COV is 0.29 whereas expenses related with cave and other expenditures has highest COV of 1.02 which denotes that they are mostly fluctuating and not stable throughout the years.

Table 6: Standard deviation and COV

Expenditure	Average	Standard deviation (S.D)	Coefficient of variation (COV)
Salary	6871.39	1979.46	0.29
Depreciation	697.11	203.85	0.29
Electric and communication expenses	1487.33	754.70	0.51
Environmental expenses	2552.22	1663.09	0.65
General committee meeting	1408.76	836.79	0.59
Hospitality expenses	388.90	129.63	0.33
Infrastructure development expenses	2729.31	3679.66	1.35
Office equipment	1076.88	666.82	0.62
Expenses related with cave	577.09	589.93	1.02
Miscellaneous	630.02	242.96	0.39
Others	577.09	589.93	1.02

3.3 Net present value, benefit cost ratio, Profitability index of community forest

In the following table: 7 Net present value was calculated, where NPV is used to analyse the feasibility of any project. The NPV of Jal Binayak community forest is $ 208238.23 and is positive, indicating that the project is likely to benefit in the future. Similarly, the project's current valuation is optimistic and growing over time, indicating that it has helped to increase the value of ecosystem services provided by the Jal Binayak community forest, either directly or indirectly.

Likewise, in a cost-benefit analysis, a benefit-cost ratio (BCR) is a ratio used to summarize the cumulative relationship between the relative costs and benefits of a planned project. The investment is supposed to provide a favorable net present value to the organization and its creditors since the B/C ratio is 315.36, which is greater than 1 since the project delivers a positive net present value (NPV) and has an internal rate of return (IRR) above the discount rate, this suggests that the NPV of the project's cash flows outweighs the NPV of the costs as a result, this project should be taken into consideration, with a higher emphasis placed on protecting and conserving ecosystem services.

Similarly, the profitability index (PI), alternatively referred to as value investment ratio (VIR) or profit investment ratio (PIR), describes an index that represents the relationship between the costs and benefits of a proposed project. Jal Binayak community forest has a profitability index of 218.68, which is greater than 1 and signifies a wise

investment. A project with a higher PI would be seen as more appealing. Since this formula splits the estimated capital inflow by the projected capital outflow to calculate a project's feasibility, it provides a good picture of a better project.

Table 7: NPV, B/C ratio and PI of community forest

year	Cash flow	present value of benefit
2005	(956.61)	
2006	7425.37	6875.34
2007	5942.89	5095.07
2008	13299.83	10557.83
2009	19643.44	14438.51
2010	17755.44	12084.05
2011	10379.24	6540.68
2012	14081.72	8216.55
2013	24736.38	13364.30
2014	35381.83	17699.72
2015	38443.05	17806.57
2016	87722.97	37622.88
2017	108737.57	43181.19
2018	108994.16	40076.93
2019	200075.79	68118.01
PV of Expected Benefit		301677.63
PV of Expected Cost		956.61
B/C Ratio		315.36
NPV	208238.23	
PI	218.68	

3.4 Mapping of Jal Binayak community forest

Jal Binayak community forest has seven different land mark with the total area of 22.372 hectare. Although it covers a small area it has successfully delivered ecosystem services throughout the society. The total area is sub divided into six different blocks which are named as ‘block 1 kamitar’, ‘block 2 Manjushree’, ‘block 3 Barahi’, ‘block 4 Bagaichha’, ‘block 5 Thulochaurpakha’, ‘block 6 Bagar’, ‘block 7 Golchaur’. As seen from this mapping most of the services provided by this community forest lies on cultural aspect of ecosystem services. Chovar is also regarded as our country's religious center, with attractions such as Jal Binayak temple, Manjushree cave, Barahi cave, new cave, Bagh cave, and Manjushree Park. We could also see the plantation sector, which was created by CFUG members. This map depicts many infrastructure construction activities such as the creation of a children's park, hut field, umbrella area, and finally Manjushree Park. As a result, Jal Binayak community forest is blessed with cultural services by a higher rate than other ecosystem services (Figure 2 to 7).

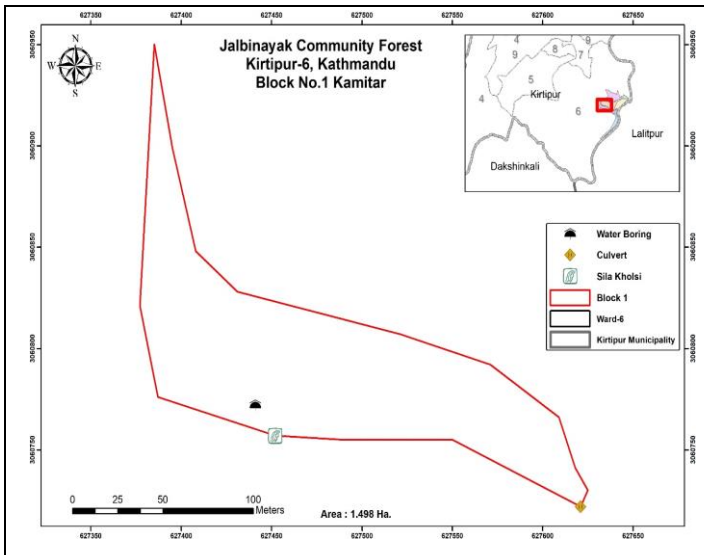

Fig 2: Block 1 Kamitar

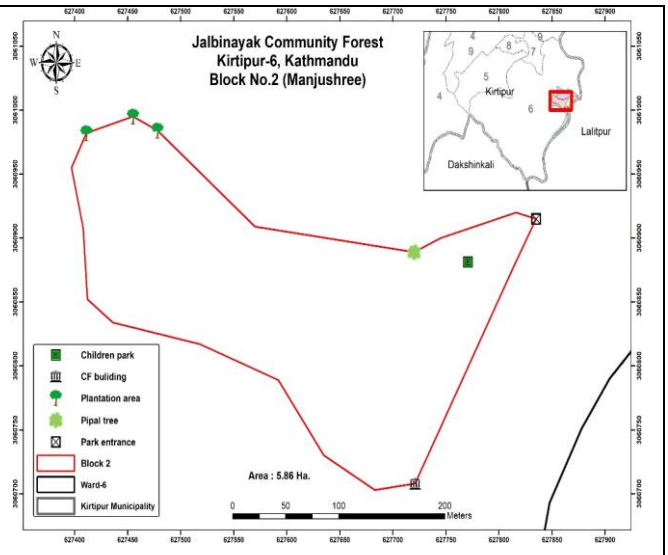

Fig 3: Block 2 Manjushree park

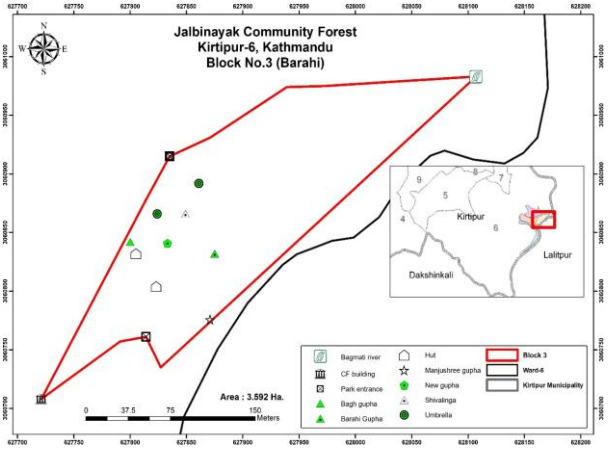

Fig 4: Block 3 Barahi

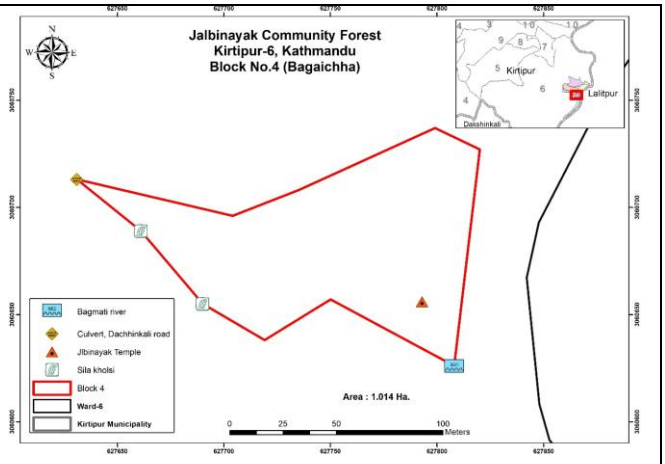

Fig 5: Block 4 Bagaichha

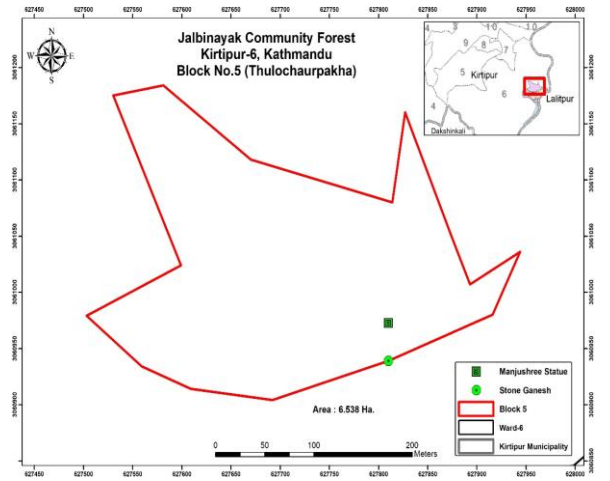

Fig 6: Block 5 Thulochaurpakha

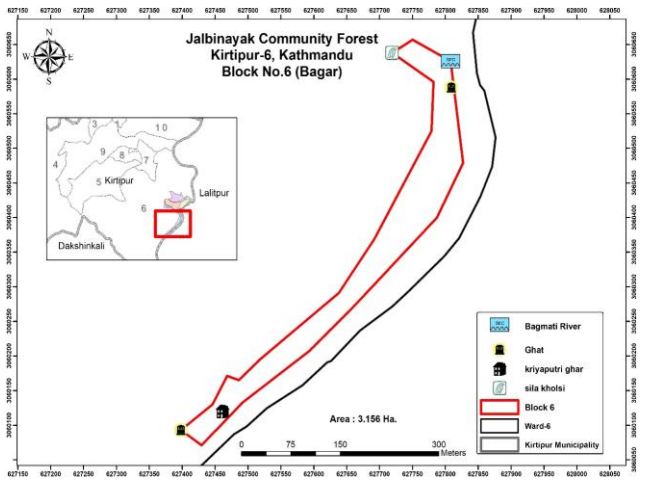

Fig 7: Block 6 Golchaur

4. Discussion

Ecosystem services are one of those words that are easy to recognize but difficult to describe and understand when asked for. Without a doubt nearly 80% of those who responded to the survey said they were familiar with the term "ecosystem services." Since Jal Binayak CF was surrounded by many cultural hubs such as Manjushree cave, Barahi cave, and Jal Binayak temple, cultural services were mostly notable. And the hierarchy of services included cultural services, regulating services, supporting services, and finally provisioning services. Jal Binayak community forest is mainly focused on ecotourism which explain the stability and concrete development of income and expenditure throughout the years.

Even though Jal Binayak CF covers a limited region, it has never failed to provide services to the community, with activities such as offering employment, reforestation, uplifting social values, and upholding historical and cultural values being their top priorities. Services such as tourism, climate regulation, aesthetic value, water purification, soil formation, inspirational were ranked highly by the community people, which proved that this community forest has mainly been providing benefits through cultural services and regulating services. Also from the study done by Paudyal, Baral, & Keenan, 2018 indicated that the social values concept is a promising tool for eliciting people's preferences in the ES assessment and analysis of trade-offs and synergies in developing countries where community involvement is the dominant approach of forest management [16].

Tourism has always been a one of the important aspects of revenue flow in our country Nepal, likewise Jal Binayak CF is one of those trivial contribution. Opportunities for tourism and recreation are often viewed as part of cultural services. Cultural services are inextricably linked to one another and are often linked to provisioning and controlling services. Cultural services are also among the most essential values that people equate with Nature, so understanding them is vital. Jal Binayak community forest started since 2006 with an investment of $956.61 where it was able to increase the income source by $301677.33 and had sum of $217764.55 by the end of 2019. As we can see the enormous benefit from the investment in community forest, we can state that it not only benefits the environment but as well as also helps to enhance the livelihood and uplift human well-being. It has not only increased the monitory value but has also invested on enhancing the social status, construction of infrastructures, providing social security and also provide aids for the needy and deserved people. As well as in china, the total economic value of forest ecosystem services in Xingshan County is estimated to be 582.96 million RMB per year, being a part of actual ecosystem services. These services provide an indirect economic value of 528.73 million RMB per year (RMB: Chinese Currency, 8.3 RMB=US$1) based on their estimation [15].

The trend analysis of income and expenditure shows that Jal Binayak community forest has been consistently investing in the betterment of the environment, as well as protecting

and improving the services offered by nature itself. As the standard deviation of these sources such as picnic fee, entrance fee, shooting fee are standard and expected it shows that it is correspondently stable with the mean and average. Thus, CFUGs must focus on investing on these services for the sustainability and resilience of community forest. On the other hand, sources such as donation, support, membership, return of interest fee has higher standard deviation which states that it has high fluctuation and is volatile for the future use. Likewise, coefficient of variation shows the consistency of variability so, lesser the COV better is the variability and vice versa for which reason investing on infrastructure development of the better management of park, picnic spots, parking area, better shooting spot will help to attract the tourist. As a result, it is braver to invest in the aesthetic aspect for stability, as it is becoming popular as a tourist destination. According to the research done by KC, Kandel, & Adhikari, 2013 also examined the value of ecosystem services Baghmara Buffer Zone Community Forest and projected average willingness to pay by all users for recreational and aesthetic services was NRs. 33,347 (about US$ 460) per year. For domestic tourists, income was only factor that affected their willingness to pay, but for international tourists along with income, gender, travel group and education were major determinants of willingness to pay. The average projected willingness to pay by all tourists was US$ 3,806,468 per year [17, 18].

Net present value (NPV), Benefit cost ratio (B/C ratio) and profitability index are economic analysis tools that checks the profitability and its benefit for the future cash flow it suggests weather the project is eligible or not. Since the NPV is $ 208238.23 and this suggests that the NPV of the project's cash flows outweighs the NPV of the costs as a result, this project should be taken into consideration, with a higher emphasis placed on protecting and conserving ecosystem services. As the project delivers a positive net present value (NPV) have an internal rate of return (IRR) above the discount rate, this suggests that the NPV of the project's cash flows outweighs the NPV of the costs as a result, this project should be taken into consideration, with a higher emphasis placed on protecting and conserving ecosystem services. Jal Binayak community forest has a profitability index of 218.68, which is greater than 1 and signifies a wise investment. A project with a higher PI would be seen as more appealing. Since this formula splits the estimated capital inflow by the projected capital outflow to calculate a project's feasibility, it provides a good picture of a better project.

Lastly mapping showed that there are different ecosystem services available inside the Jal Binayak community forest premises which covers a total area of 22.372 hectare and is divided into seven sub group. Through the information gathered from the director of CGUG the soil texture of kritipur area is not fertile for which reason they conductus programs like tree plantation, regular maintenance program and many such environmentally friendly activities. This has not only helped to enhance the environment but has also provided job opportunities to local people.

5. Conclusion and recommendation

Many ecosystem services were detected in the Jal Binayak community forest, with all four major services present and contributing to the ecological balance. When ranking those services, tourism is found to be the most beneficial to both the environment and the local community. The CFUGs prioritized cultural services highly as the area is blessed with historical and cultural beliefs and values. Simultaneously regulating services, supporting services and provisioning services were equally monitored and maintained by the members of CFUGs. The eco-tourism was one of the highest services provided by the community forest.

There were several ecosystem services in the community forest like park, cave temple etc. The income was increasing annually, from establishment 2006 to 2019. The co-efficient of variance was the from donation from other income so this needs to maintain tactfully. The least value of coefficient variance was fee from film shooting was indication of potential scope of the community forest. The expenditure trend was also increasing from 2005 to 2019. The highest value of coefficient of variance was found of infrastructure development, it needs to manage wisely. The high value of benefit cost ratio, NPV and profit index showed a community forest nearby city is pertinent source of income. Thus, investment in ecosystem service improvement in community source is practical concept in city.

Thus, we encourage Jal Binayak community forest to invest more on sources related with eco-tourism and simultaneously preserve the environment fulfilling the utility of local people and visitors. This research would help to have further study on the payment of ecosystem services delivered by community forest. It is recommended that Jal Binayak community forest should also focus on the enhancement of provisioning services, regulating services and supporting services.

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