Estimating the Socio-Economic Values of Forest Ecosystem Services Using the Stated Preference Method in Dir Kohistan (Pakistan)

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Abstract

The research study was conducted in the Dir Forest Division of the KP Forest Department. The primary purpose was to estimate the socioeconomic values of ecosystem services of forests. For this study, 120 respondents were selected in 10 villages of the Dir Forest division through random sampling techniques. The study showed that firewood is the primary fuel source, and the local communities procured huge amounts of firewood from plantations and farmlands through local purchases. The economic value of forest ecosystem regulation, support, and cultural services must be addressed at the public level. As a result, the overall worth of the forestry industry in the globe in general, and Pakistan in particular, could be considered much higher. This study aimed to determine the relevance of various types of ecosystem services and their relationship to the socioeconomic status of individuals in the Dir Forest division. It focuses on estimating the economic value of a subset of services relevant to local communities, such as provisioning services (fuel wood) and cultural services (tourism), using the stated preference method (Contingent Valuation) and recommending a feasible payment for ecosystem services (PES) mechanism. According to data from the Economic valuation of fuel wood services, Dir Forest Division obtains a total of US$ 04 million- $ USD worth of fuel wood services per year. To determine the tourism trend and its economic worth, data was collected from hotel owners, 120 tourists, and key informants in the study area using a pretested questionnaire for seven years, from 2015 to 2021.

Keywords: Ecosystem Services, Recreation, Fuelwood, Socioeconomic Value.

Introduction

Forests are widely acknowledged as the major source of ecosystem services. Several national classifications consider variables such as food, timber, fuel production, water conservation and management, nutrient retention, carbon sequestration, biodiversity protection, climate control, ecotourism, and spiritual and traditional values. As a result of environmental changes, forest

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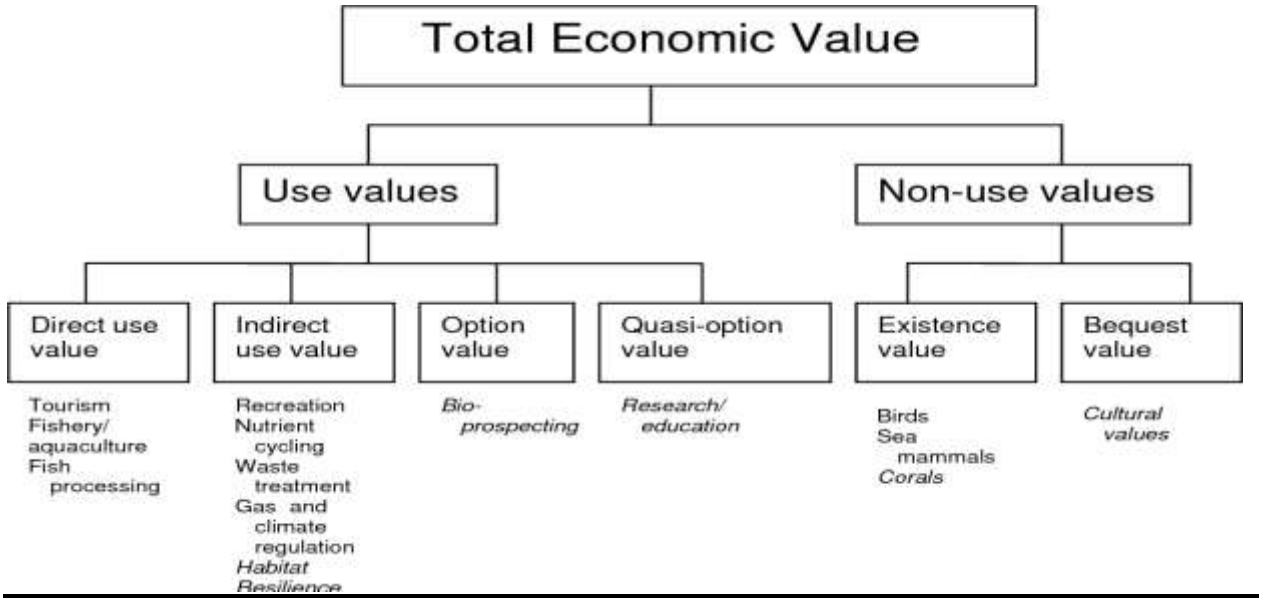
resources have grown more significant as a carbon sink (Havlk et al., 2015). On the other side, forest ecosystems provide us with intangible goods such as scientific, cultural, religious, and legacy assets to pass on to future generations. A deeper understanding of the role of forests in creating national assets and enhancing human living standards is crucial in an era where the use of free public goods (natural resources) is under growing pressure (Potschin 2017). Natural ecosystems provide various benefits to humans and are a source of reliance for life on Earth. The four leading categories of ecosystem services are provisioning services (timber, fuel wood, non-timber forest products (NTFPs), fodder), regulating services (climate, water, carbon regulation, pollution control, erosion control, pollination, and so on), supporting services (habitat, biodiversity, nutrient cycling), and cultural services (recreation, ecotourism) (Capistrano et al., 2005).These services can be summarized in the following figure:

Figure 1: Ecosystem Services



Forests encompass roughly a third of the earth's surface. The world's total forest area is 4.06 billion hectares (ha), or 31% of the total land area. Even though woods are not distributed evenly across the world's inhabitants or geographically, 0.52 hectares per person 1 is comparable. Tropical forests comprise the bulk of the world's forests (45 per cent), with boreal, temperate, and subtropical forests following closely after. The Russian Federation, Brazil, Canada, the United States of America, and China are the only five nations contributing more than half (54%) of the world's forests (FAO, 2020). The world's forests cover 30% of the planet's surface area and provide a range of cultural advantages. Maintaining forests appropriately reduces climate change and improves people's lives (Schaap, 2018). Pakistan is a forest-poor country, with only 4.8 million hectares (5.1%) of its land covered with trees (Lubna, 2001). This translates to 0.021 hectares per person, compared to the global average of 1 hectare per person (Shahbaz, 2007). One of the world's oldest and second-largest Juniper forests may be found in Pakistan. In Pakistan's northern undulating plains, they are mainly evergreen pine woods that grow between 1500 and 9000 meters above sea level. Slope pine forests, clean ragged or foot slope forests, watered manors, the Indus River delta, and mangrove forests are all unique to Pakistan (Qazi, 1994). The northern part of the

country is dominated by evergreen woods (42 per cent in Khyber Pakhtunkhwa, 16.6 per cent in Gilgit Baltistan, and 7.7 per cent in Azad Kashmir). Brushy and pine woods may be found on the upper slopes of the mountains in Swat, Dir, Mansehra, and Chiral, while high and sub-snowcapped meadows can be seen on the ridges. Brushy and coniferous woods are primarily found in Khyber Pakhtunkhwa and span throughout the Hindukush, Himalayas, and Karakorum ranges, with brushy and coniferous forests beginning from the upper Himalayas (Khan, 2009). The valuation of ecosystem services is a relatively new invention that is gaining traction and garnering the attention of experts in both developed and developing countries. This concept is known as payment for ecosystem services, and it aims to encourage and improve these services by drawing policymakers' attention to them (Turner et al., 2003).In the study region of Dir Kohistan, research on the socioeconomic values of forest ecosystem services had yet to be done. The study's goals were to analyse the importance of forest ecosystem services in Dir Forest Division as seen by local inhabitants, as well as to estimate the socioeconomic values of selected forest ecosystem services in Dir Forest Division, such as provisioning (fuel wood) and cultural services (recreational).

Materials and Methods

Study Area Description

The research area encompasses 54935 hectares of designated woods between 35° N and 71° 22' E in the northern section of District Upper Dir, the Panjkora River's north watershed. The tract encompasses the Upper Dir District's administrative Dir Kohistan Sub Division. The tract is bordered on the north and west by Chitral, on the east by Swat Kohistan, and the south by Dir/Painda Khel. The entire area of the Dir Kohistan valley is 189241 ha, of which 88912 ha (according to the GIS data) is covered by all types of forests, while the designated forest (Coniferous Forests) area covered/addressed under this plan is 54935 ha. The region is bordered on the north and northwest by the Hindu Raj, on the east by Torwal and Gabral Kalam, on the south by Dodbah Sar Ghar, and the west by Batarai Ghar. The Panjkora River, which rises where the Gabral and Hindu Raj ranges meet, runs through the area. After flowing for roughly 128 kilometres in a south-westerly direction through the Panjkora basin, the river enters Lowari nullah near Dodbah before joining the Swat River at Kulangi in the Malakand Agency.

Methodology

The primary goal of this study is to assess the economic value of the fuel wood and recreational activities offered by Dir Forest Division trees. The contingent valuation technique (Carson & Czajkowski 2014) is utilised in research to estimate the socioeconomic value of various ecological services. In order to determine Recreation's socioeconomic worth, a questionnaire was employed to collect information from visitors. The survey inquiries about the total amount of money tourists are willing to spend and the usual duration of stay in the area. The value of ecological services was calculated using total tourist expenditures and visitors' willingness to pay for ecotourism services. Statistics on tourism and Payment for ecosystem services (PES) were obtained from restaurants and guests. At the same time, records on regular visits were acquired using a pre-tested questionnaire from potential respondents in the locality. A total of 10 famous and well-known hotels in the research region were visited for the ecotourism data collection. One hundred twenty visitors and key informants were interviewed at a sample intensity of 2.5 per cent. The technique and method employed in this study were face-to-face interviews with visitors utilising random sampling. Data for visitor inventory was acquired from Tourism Corporation KP, tourists, and hotel management as critical informants for seven years (2015-2021). Ten villages were chosen at

random from a total of 1542 settlements. Then, 12 respondents/households were randomly chosen from each community. Assume that the average number of families in the village is 50 and the sampling intensity is roughly 2.5 per cent. The data was analyzed, and simple statistical techniques such as averages and percentages were utilised to evaluate and explain the data and draw conclusions. A list of sample villages with respondents can be seen in Table 1.

Table 1: List of sample villages

S. No	Name of Village	No. of Respondents	Name of Sub divisions/ Range
1	Khadgal	12	Patrak
2	Jandrai	12	
3	Badgoie	12	
4	Kumrat	12	Patrak
5	Kalkot	12	
6	Bada	12	
7	Serai	12	Patrak
8	Junkai	12	
9	Darag	12	
10	Patori	12	Patrak

Results

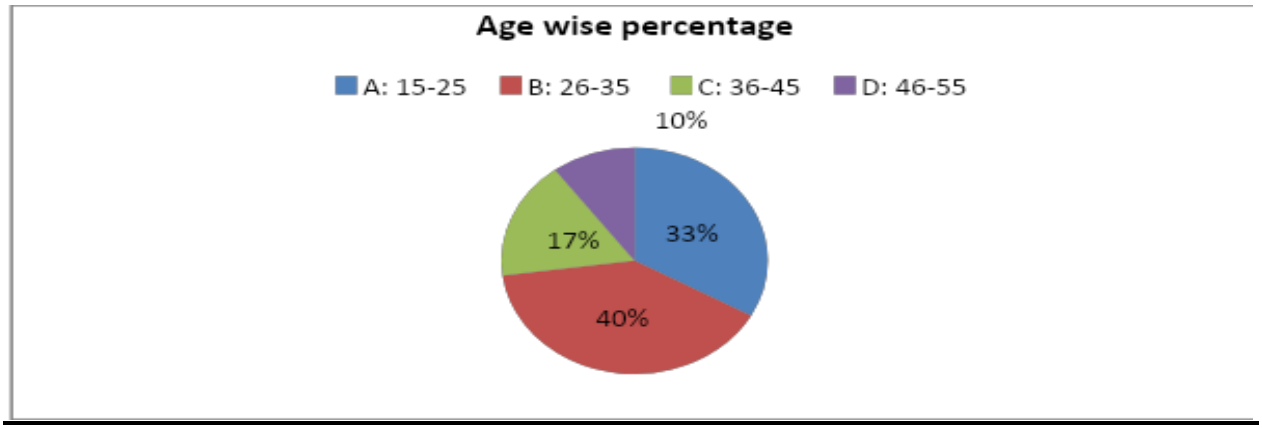
The data were collected and following results were obtained in given study area.

Socio-Demographic Profile

Age

A total of 120 participants were questioned, with 39 of them being between the ages of 15 and 25. (33 percent). 47 people (40 percent) were between the ages of 26 and 35. While 20 (17%) and 14 (10%) of the responders were between the ages of 36 and 55, correspondingly.

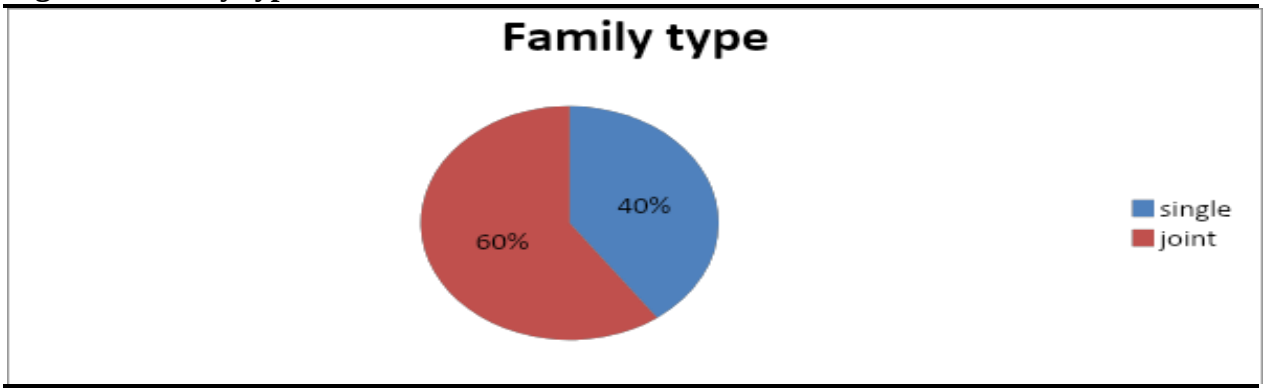
Figure 2: Age distribution of respondents



Family type

According to the findings, the majority of respondents (60%) live in joint families, while 40% live in single families. Figure 3 depicts the situation.

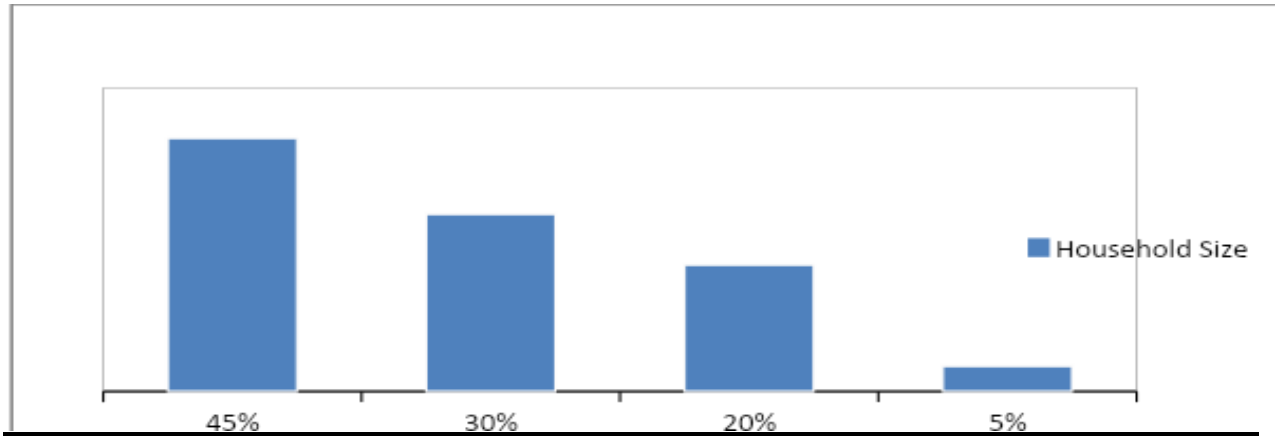
Figure 3: Family type



Size of the family

According to the statistics, households with fewer than 10 family members account for 30% of all households, while households with more than 20 family members account for 5%, while households with 10 to 15 and 16 to 20 people account for 45 percent and 20 percent, respectively, as shown in figure 4.

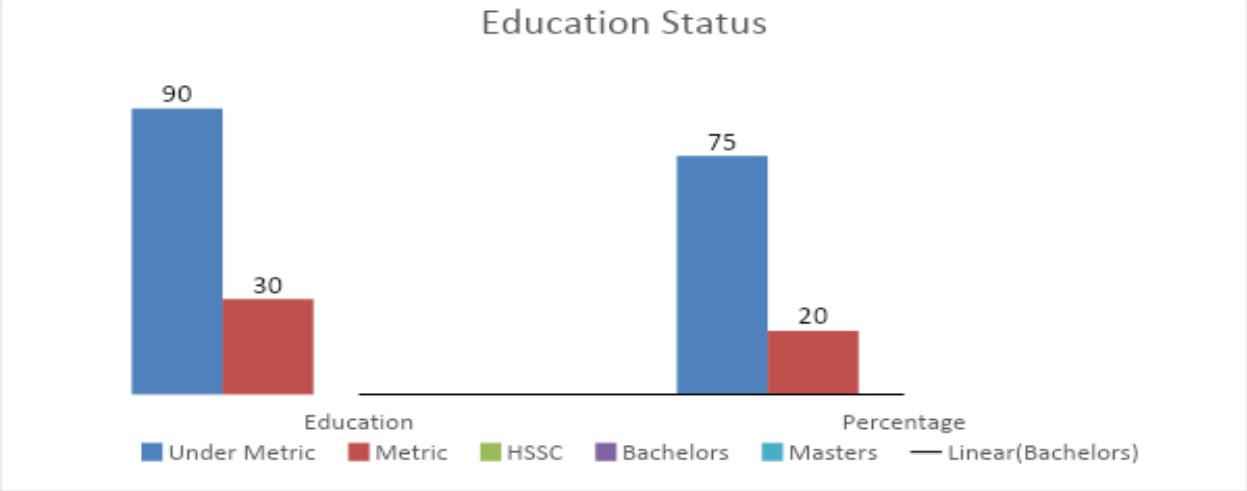
Figure 4: Household size



Educational qualifications

A total of 120 people were questioned and data was obtained from them, with 90 of them (75%) being illiterate or under matric, 30 having some education up to matric (25%) and the remainder having no one. Figure 5 shows the respondents' educational levels and percentages.

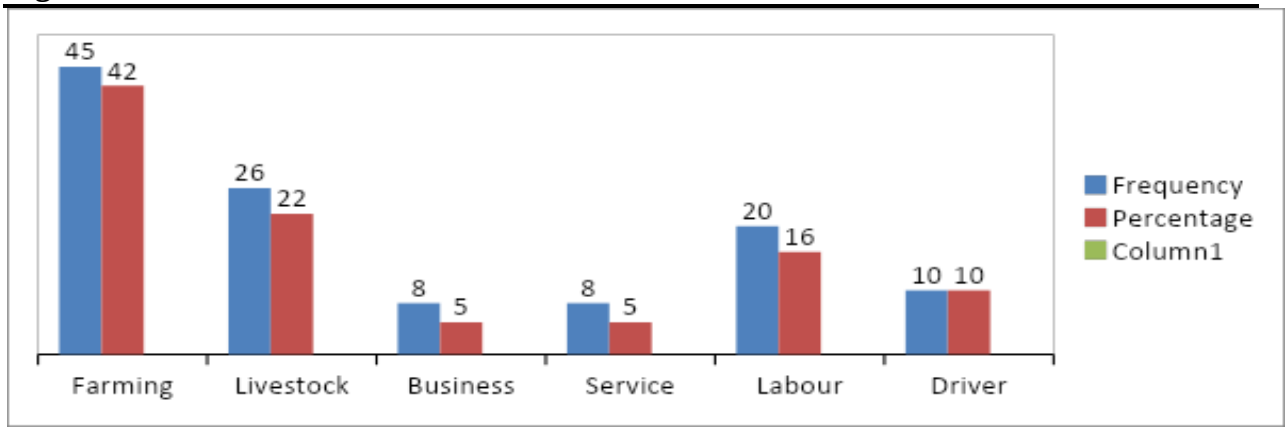
Figure 5: Education level in Kumrat



Households' main sources of income

A total of 120 people were questioned. Farming is the primary source of income for 45 of the respondents (37 percent). The major source of income for 26 respondents (21%) was livestock, whereas the main sources of income for 08, 08, 20, and 13 respondents, respectively, were business, service, labor, and driving.

Figure 6: Main income of household



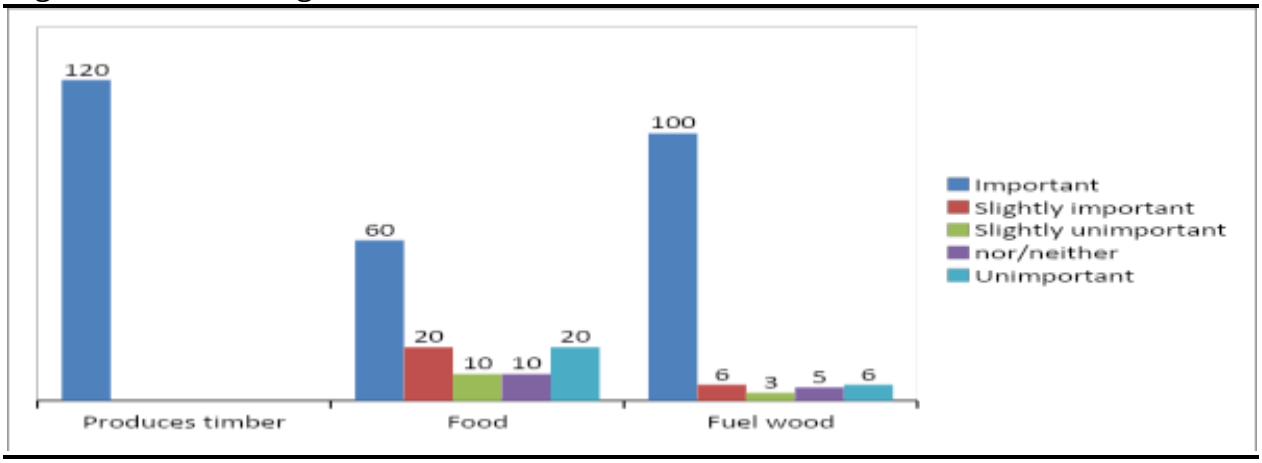
Assessment of importance of ecosystem services as perceived by community

The perception of the local community of the study area about the importance of fifteen ecosystem services, including four provisioning services, four regulating services, four supporting services, and cultural services, is recorded using a questionnaire designed using the Likert Five point scale method, out of the twenty-one ecosystem services classified by MEA (2004). Simple statistics are used to examine the data from the respondents, which are as follows:

Provisioning services

A total of 120 people agreed that timber is an important service. Of the 120 foods recognized as key services by 60 respondents, somewhat important, neither/nor, slightly unimportant, and insignificant were chosen by 20, 10, 10, and 20 respondents, respectively.

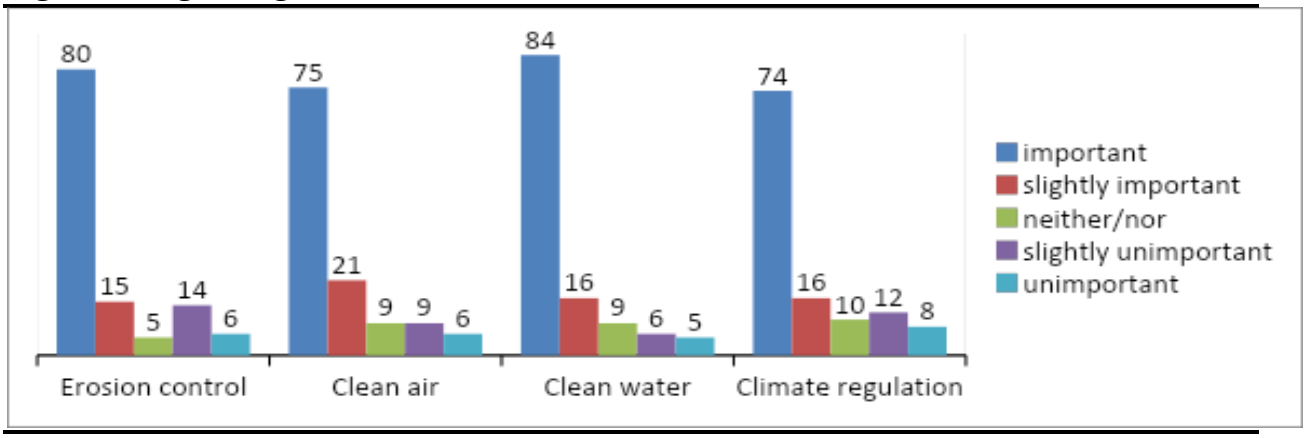
Figure 7: Provisioning services



Regulating services

According to Figure 8, on average, 80 respondents thought that regulating services was important. 15 people think it's vital to be slightly significant. The conduct of 05 responders is neutral. 14 people believe that slightly important is important, whereas 06 people believe that regulating services is insignificant.

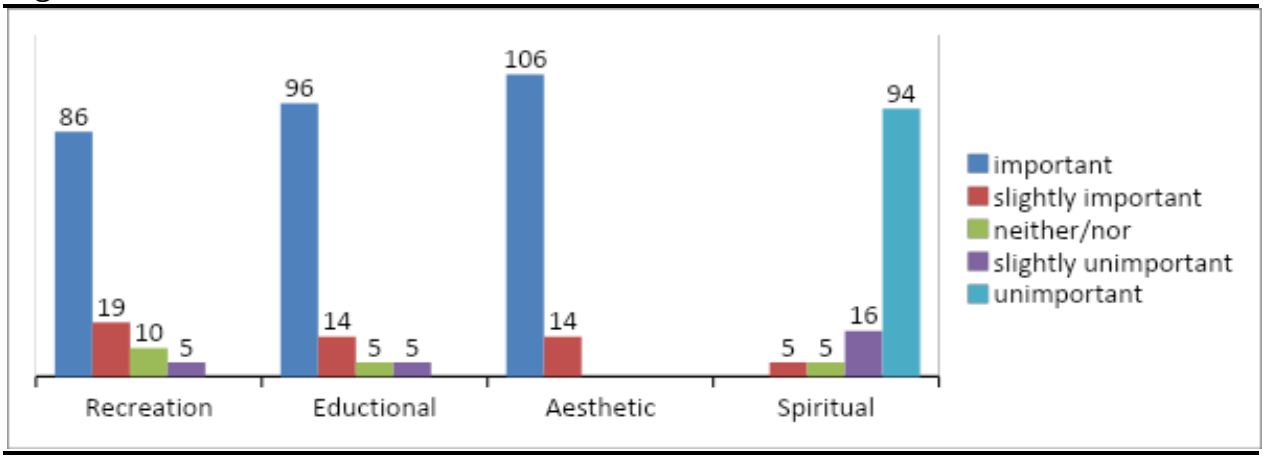
Figure 8: Regulating services



Cultural services

The Dir Forest Division has an exceptional scenery, visual splendor, and significant proportions of geology, topography, ecosystems, and animals of worldwide and national significance. The natural resources in the region offer a lot of promise for eco-tourism development; nevertheless, a lack of infrastructure has hampered the enhancement and advancement of eco-tourism in the area. 86 respondents selected recreation as an important cultural service,19 chosen slightly important,10,05 and none selected as neutral, slightly unimportant and unimportant respectively as shown in figure 9.

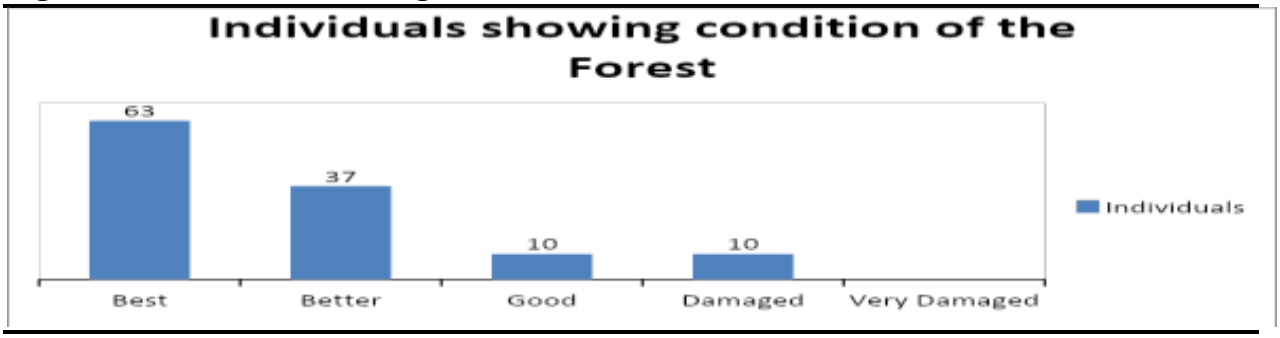
Figure 9: Cultural services



People's perceptions towards forest-related concerns

Stakeholders are pushed to work toward better and more effective forest management as a result of the respondents' favorable replies to questions regarding their relationship with ecosystem services and their reliance on forest ecosystem services. To the detailed respondent's impression, the following were added:

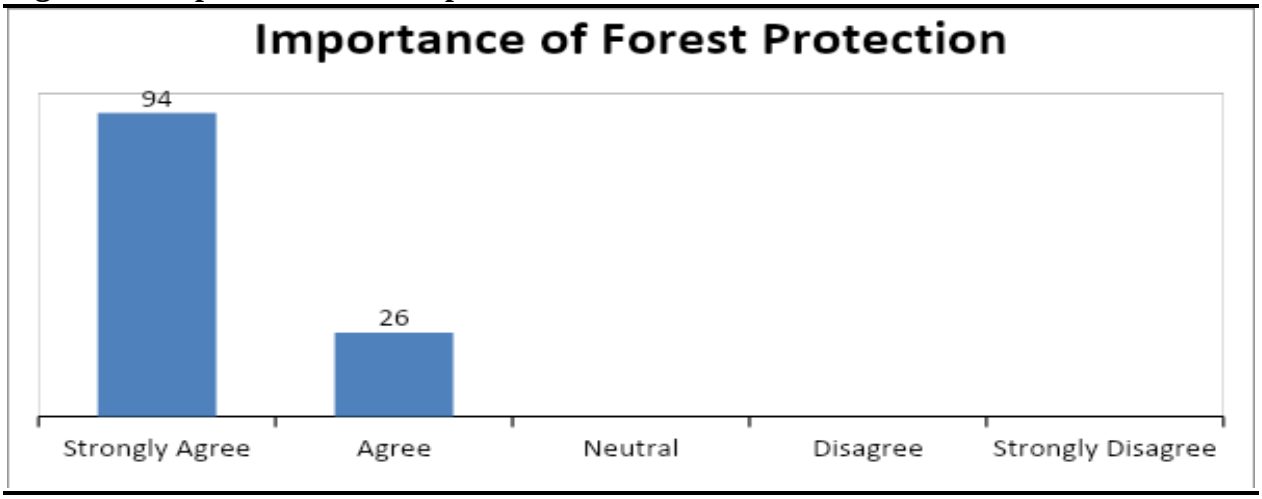
Figure 10: Individuals showing condition of the forest



Forest protection issues are important

According to the survey questions, 94 out of 120 respondents strongly agreed that forest conservation is important, while 26 strongly disagreed, as indicated in figure 11.

Figure 11: Importance of forest protection



The protection of the forest is important for the livelihood of your family

According to the results of the study, 83 out of 120 respondents strongly agreed that forests are crucial for their livelihood, whereas 17 and 20 agreed and were indifferent, respectively, as shown in figure 12.

Figure 12: Importance of forest for livelihood

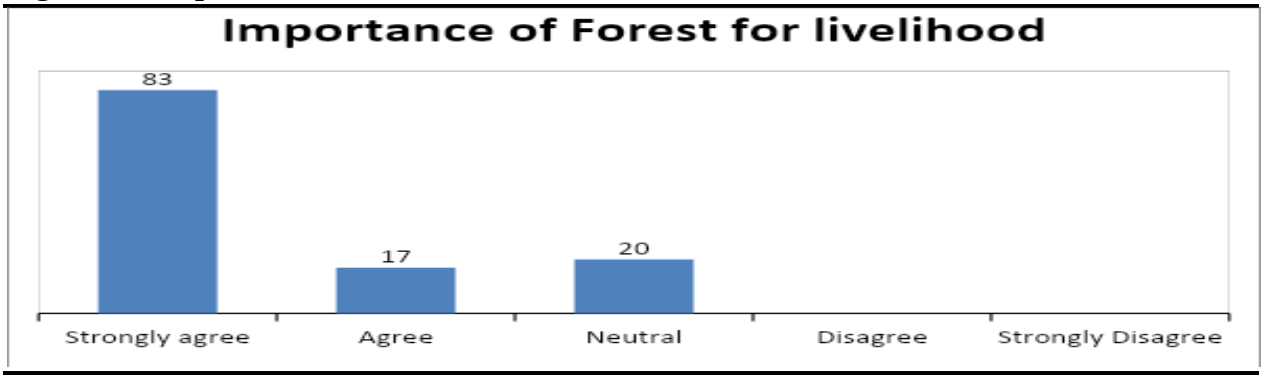


Figure 13: Current management of forest in interest of local communities

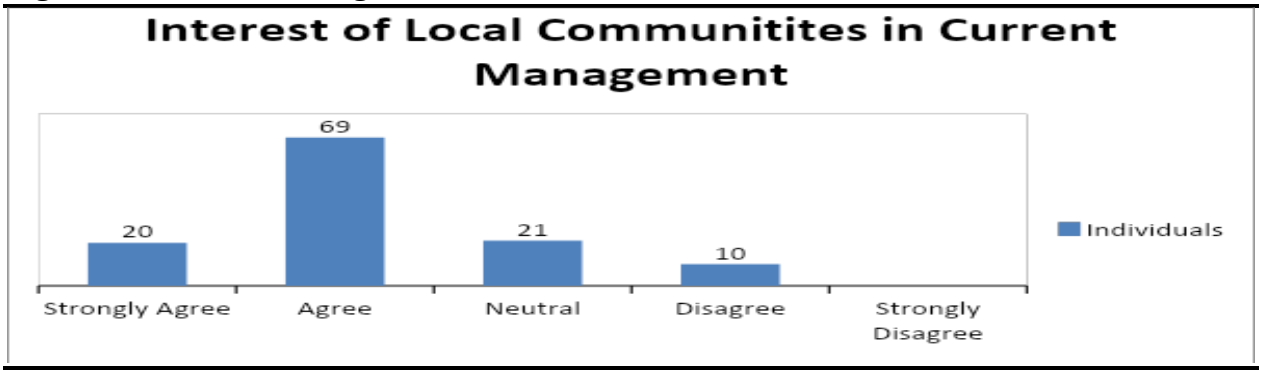
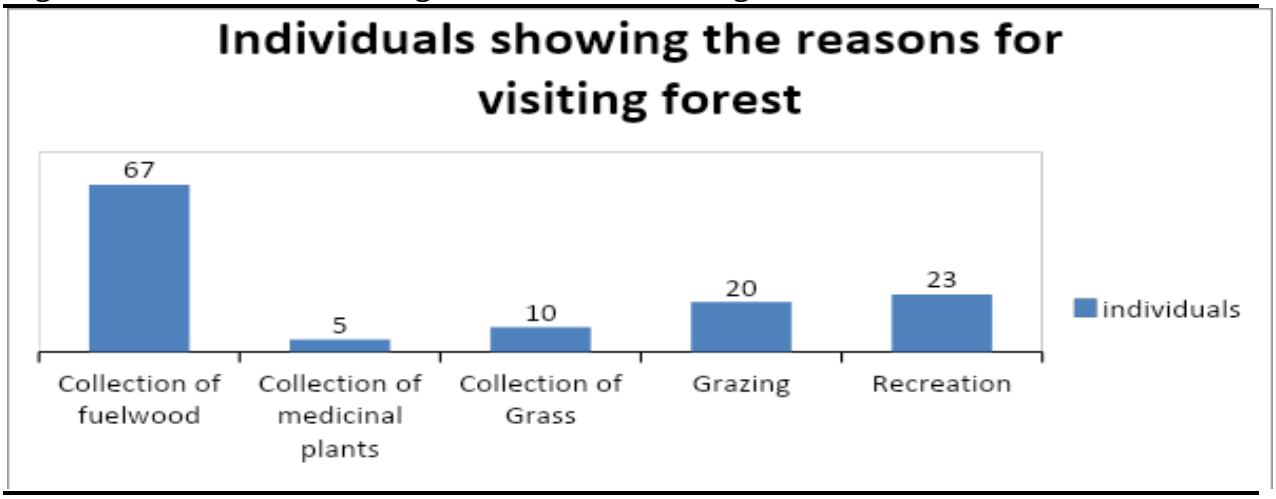


Figure 14: Individuals showing the reasons for visiting forest



Valuation of fuel wood

According to a questionnaire study done in Kumrat, the average household size is 08. In the summer, the average monthly fuel wood use per family is 180kg. During the winter, the typical family consumes 1800 kg of fuel wood every six months. During the summer, the typical family consumes 1080 kg of fuel wood each six months. The average annual fuel wood use is 2880kg.If the cost of burning wood per household for a year is calculated to be Rs. 28800 (Rs 10 per kg). When the amount of fuel wood is converted from PKR to USD, it equals 164.6$. The overall annual cost of fuel wood for the entire household is 712.5 million dollars (24741x total households). When we translate the average annual cost of fuel wood from PKR to USD, we get 40.7 million dollars.

Table 2: Valuation of fuel wood

Average Household Size	8
Total Households in Study Area	24741
Average fuel wood per month per households in winters (kg)	10x30 = 300/-
Average fuel wood per month per households in Summer (kg)	6x30 = 180/-
Average fuel wood per 6 months per households in winters (kg)	300x6= 1800/-
Average fuel wood per 6 month per households in Summer (kg)	180x6 = 1080/-
Average fuel wood per year per household (kg)	1800+1080=2880/-
Cost of Fuel wood per year per Household (PKR)	2880x10=28800/-
Cost of Fuel wood per year per Household (USD)	28800 /175= 164.6$
Cost of Fuel wood per year per total Households (PKR)	28800 x 24741 =712million Rs
Cost of Fuel wood per year per total Households (USD)	40.7m $

Recreation valuation

The data was gathered at random from ten hotels in Thal, Kumrat, and Jahaz Banda. For the years 2015, 2016, 2017, 2018, 2019, 2020, and 2021, data was obtained from hotel management. Following the visit of Pakistan's former Prime Minister, Mr. Nawaz Sharif, in 2015, a large number of visitors was reported. In 2015, the Valley was exclusively visited by locals from Malakand Valley.

Following the arrival of current Prime Minister Imran Khan in 2017, there was a massive surge of visitors. In 2018-2019, between 15000 and 20000 tourists were registered on average. However, the tourist influx was severely hampered from 2019 to 2020 because to the corona epidemic. According to current data, the Kumrat valley saw an average of 280 tourists each day in 2021. According to the hotel operators, the Kumrat valley attracts an average of 50,000 people every season (April to September). During their stay to Kumrat Valley, a single family typically spends between 30,000 and 40,000 dollars. A single family spends an average of $142 during their vacation to the valley. We assume a single-family size of five people to estimate the overall economic evaluation of eco-tourism for the year 2021. The overall cost of tourism in Kumrat for the year 2021 is estimated to be 1.42 million dollars. From the given and estimated valuation of forest resources and ecosystem services we can add up its value more worth by conserving the natural resources. This can add up to the national GDP of Pakistan if we properly analyze the existing resources of forest ecosystems and also by properly highlighting the scenic beauty of northern valleys to the other countries. Recreation in terms of ecotourism plays an important role in enhancement of economic growth of the nation. Tourist influx can be to the northern valleys and other recreational spots can be maximized if policy makers make sure the proper action plans. Nature has blessed us with numerous scenic spots in every province of our country. This can make a huge difference in economic growth of our national GDP.

Table 3: Number of tourists visited the valley in the previous 07 years

No of tourists visited in 2015	1500
No of tourists visited in 2016	5000
No of tourists visited in 2017	8000
No of tourists visited in 2018	10000
No of tourist visited in 2019	5000
No of tourists visited in 2020	7000
No of tourists visited in 2021	50,000
Average size of family members	05
Average cost in PKR per family	25000
Average cost in $ per family	$ 143
Total families in 2021	10,000
Total costs of all families in 2021(PKR)	10000 x 25000 = 250 million $
Total costs of all families in 2021($)	$ 1.42 million

Discussion

The overall cost of tourism in Kumrat for the year 2021 is estimated to be 1.42 million dollars. The non-monetary services from forest ecosystems can be much improved by adequately utilizing the existing resources. We can add more value by conserving natural resources from the given and assessed valuation of forest resources and ecosystem services. This can add to Pakistan's national GDP if we properly analyze forest ecosystem resources and adequately highlight the northern valleys' scenic beauty to other countries. Developed countries like Japan, the USA, and India are taking much more interest by attracting foreigners to their countries using social media and other platforms. The economic value of forest ecosystem services, especially in Pakistan, must be enhanced as the government has a lot of scenic beauty.

A study on the worth of the world's ecosystem services and natural capital was released by Costanza et al. in 1997. Based on existing studies and a few novel estimates, They evaluated the economic worth of 17 ecosystem services for 16 biomes. The yearly cost of the whole biosphere (mainly outside the market) is estimated to be between US$16 and US$54 trillion, on average. We calculated the entire cost of fuel wood per year for all families, which is 712.5 million dollars based on our study (24741x total households). The average yearly cost of fuel wood was then translated from PKR to USD, resulting in a total of $40.7 million. We only calculated the economic value of one ecosystem service, fuel wood, but they determined the monetary value of 17 ecosystems and 16 biomes.

Research on assessing the total economic worth of restoring ecosystem services in a degraded river basin: outcomes of a contingent valuation survey in the United States was published by Loomis et al. in 2000. Households would pay an average of $21 per month or $252 per year for more ecosystem services, according to the findings of roughly 100 in-person interviews. When we did our research, we calculated that the total cost of tourism in Kumrat in 2021 will be 1.42 million dollars. The disparities are attributable to the Kumrat Valley's inadequate infrastructure and lack of services.

Economic Assessment for Cultural and Passive Ecosystem Services Using a Quoted Preference was studied in Kenya by Eregae et al. (2021). According to the data, 97 per cent of the population is prepared to pay for the ESs in the issue. Individual maximum WTP varied from $1 to $57.1 in cultural terms, $1 to $95.2 in bequest terms, and $1 to 76.2 in bequest terms. (Conservation of biodiversity) The aggregate maximum WTP was 7.4 0.34 USD, including 11.1 0.68 USD for cultural and biodiversity services. When we focused our investigation on cultural services, we discovered that a single-family visiting the valley spends an average of $142 daily. Then, we estimated the total economic evaluation of eco-tourism for 2021. In 2021, we estimated that the total cost of tourism in Kumrat will be 1.42 million dollars. The disparity is because the residents of our research region were unwilling to pay for an existent natural ecosystem function, namely recreation. Second, the residents in our research location needed more facilities and resources. Because the residents in our research region are impoverished and lack basic amenities such as fuel gas, and fewer tourists visit the area, they need more opportunities to pay for environmental services. However, economic revenue can be increased if the government improves road infrastructure and provides basic amenities.

Nahuelhal et al. studied the ecological services provided by Chilean temperate rainforests. Based on prior studies and research findings, they identified unique ecosystem services and presented estimates of their economic value. The net present stumpage values for secondary forests were US$ 3742 ha1 and US$ 3093 ha1 for sustainable forest management (SFM) and unsustainable harvesting, respectively. SFM provided US$ 4546 ha1 in benefits for old-age forests, whereas unsustainable harvesting provided US$ 5718 ha1. Yearly recreational benefits were US$ 1.6 ha1 and US$ 6.3 ha1 for the study region's two most important national parks. When we compare the results of our research to theirs, we can see that they have estimated the most valuable and essential service of the forest ecosystem, namely Timber. In contrast, the government has banned the harvesting of green trees here. They have also estimated the economic value of ecotourism, whereas we have calculated the monetary values of fuel, wood and recreation.

In Beijing, research was conducted on assessing ecological services (Xie et al., 2010). They measured the magnitudes and economic worth of forest ecosystem services in Beijing. In their analysis, the yearly value of forest ecosystem services was estimated to be 19 339.71106 Yuan (RMB). Fruit, Timber, and recreational activities are all available in this area (which encompass

tourism income from forest parks and aesthetic landscapes). We conducted our research to estimate the two primary functions: fuel wood and recreation. The disparity in the anticipated economic worth is because the local populations of the Kumrat Valley are not permitted to develop agricultural products near forest lands. We need essential amenities, such as well-paved roads, which are vital in attracting tourists. We also need reliable internet access, which means that visitors seldom remain for long.

Conclusion

The study was carried out to estimate two essential services: fuel wood and recreation. The discrepancy in the anticipated economic worth is because the local populations of the Kumrat Valley are not permitted to develop agricultural products near forest lands. The research region needs critical amenities, such as well-paved roads, to attract tourists. There was also a lack of reliable internet access, which meant visitors couldn't remain long. The local population relied heavily on the forest for fuel, wood, forage, grazing, trash, and other necessities, and most of the respondents derive their money from the forest because they are mostly illiterate and hence only work in their town. As a result, it is suggested that multifunctional and fast-growing trees be planted to help sustain local livelihoods. Regarding Ecosystem Services, it is recommended that forest communities, civic society, and other stakeholders be involved in raising knowledge of ecosystem services. Because the owners have a legitimate stake in the forest's proceedings, they must be compensated through payment for ecosystem services (PES) to accomplish more significant resource conservation.

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