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Human–Environment Relations and Livelihood Transformations: A Sociological Exploration of Wetland Impact around Raghagan Dam in District Bajaur

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ABSTRACT

Wetland ecosystems have historically played a vital role in sustaining human civilizations and continue to underpin various forms of socio-economic activity. This study explores the socioeconomic dependence of local communities on the Raghagan Dam wetland ecosystem, located in District Bajaur. Employing a quantitative research design, data were collected through a structured interview schedule from a randomly selected representative sample of 316 household heads 79 from each cardinal direction surrounding the dam. The findings reveal a strong and consistent reliance of local residents on the wetland ecosystem for both domestic and commercial activities. The wetland serves as a critical resource for agriculture, livestock rearing, fishing, and other livelihood practices. The study further underscores the multifunctional value of wetlands in rural economies and recommends promoting crop diversification as a strategy to enhance household income and strengthen community resilience. These insights contribute to the broader sociological understanding of human–environment interactions in ecologically sensitive regions..

INTRODUCTION

Water is critical for life and functions as the foundation of human continuance. Earth is the only known planet where life flourishes due to the presence of water. Ancient, homosapiens settled near waterbodies, leading to the rise of human civilization. Wetland ecosystems support almost all commercial activities and have been extremely connected with past human civilizations. Additionally, wetlands are vital for economic growth, as most economic activities depend on water bodies. Thus, human survival and progress are inherently tied to the preservation and sustainable use of wetland ecosystems.

During past 2 centuries, almost 64% of wetlands in the world have been demolished and most of the ecosystems are in danger. Recent Studies (International Water Management Institute, 2014.) show that Africa's wetlands are 125 to 131 Mha, and Asia's wetlands are 204 to 286 Mha, and South America's wetlands are 179 Mha (Sitienei et al., 2012). Scientists claim that 6% of total land area of the earth has been constituted with wetlands.

There are huge benefits of wetlands; they are necessary for human life and its well- being. they have positive impact on environmental health. The wild plants are used in medicine, various fruits and nuts, wood and organic fibres are products of these wetlands.

The environmental processes also occur due to these, as they purify air, water and soil through filtration and detoxification. Many scientific phenomena and cycles like biochemical, nutritional, and chemical cycles happen due to them (Adesina, 2005). They also control natural disasters like floods and storms avoiding soil erosion; and also maintain the flow of water. Consequently, it manages the macroclimate change. They also preserve precious kinds of flora and fauna. The biomass provided by these wetlands is helpful for cross-fertilisation and disperse of seeds for the revival of ecosystem (Masera et al. 2000).

As Cultural values also emerge from surroundings and wetland ecosystems have distinct cultural and societal customs and values. Waterbodies are source of aesthetic pleasure, leisure and spiritual activities, tourism and entertainment and contribute to scientific and educational progress as well (Food and Rural Affairs, 2005). Globally wetland have huge contributions to human civilization (Mitsch,1994).The Ramsar Convention, implemented in Ramsar, Iran, in year 1971 is the only worldwide agreement dedicated to conserving and sustainably Using the wetlands. Pakistan is among the 160 countries that recognize Ramsar treaty (Khan et al 2014). It puts emphasis on the "wise use" of waterbodies to benefit humanity while maintaining their environmental integrity (Ramsar, 2017). Pakistan agrees with Ramsar convention and actively participates in its meetings and aligns with its laws, There are 19 Ramsar sites in Pakistan which are ecologically significant wetlands in country (Ramsar Sites Information Service, 2024, Morardet & Koukou, 2005; Ramsar Convention Secretariat, 2021). These wetland sites in Pakistan also face difficulties and challenges and Despite efforts, public awareness of wetlands' crucial role remains limited (Van Koppen, 2004).

The definition of wetlands according to Ramsar Convention is "Areas of marsh, fen, peatland or water, whether original or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt. Including areas of marine water, the depth of which at low tide does not exceed six meters" (Finlayson, Bellioa, & Lowry, 2005). Wetland is "Marsh, fen, peat land, and water areas, whether natural or man-made, long-term or transient. With water that is either still or moving, fresh, brackish, or salt, including low tide is no greater than six meters. (Ramsar, 2017).

Although there are environmental concerns about the constructions of Dams They play an essential role in economic development by regulating water flow for flood control, generating hydroelectric power, and supporting irrigation (Arthington, 2010). They provide clean and

renewable energy, reducing dependence on fossil fuels, and offer water for agriculture, which strengthens food security and rural livelihoods. Furthermore, dams boost recreational activities and tourism, contributing to local economies and quality of life, while also ensuring clean drinking water and water supply management during dry periods (World Commission on Dams, 2000; International Hydropower Association, 2019; Shiklomanov, 1993; Lindholm, 2007; UNESCO, 2018; Graf, 2005).

Wetlands are essential ecosystems that provide goods like food, water, and building materials, while hosting wildlife species and supporting biodiversity. Global efforts like the Ramsar Convention aim to protect these critical habitats, yet degradation persists due to insufficient awareness. In Pakistan, wetlands in Punjab and Sindh support migratory birds and sustain local economies, with communities depending on fishing, agriculture, and water-based resources. The Central Indus Wetland Complex is vital for activities like fishing, which is tied to cultural traditions and livelihoods, despite differences in regulatory approaches across regions (Lehner et al., 2004; Mulei et al., 2014; Magut, 2014; Sitienei et al., 2012; Pradhan et al., 2018; Worldwide Fund for Nature Pakistan, 2014; Nazir et al., 2016).

Pakistan's fisheries sector, encompassing freshwater and marine resources, contributes modestly to the economy (0.4% of GDP) but supports millions through direct and indirect employment. Despite its potential, the sector faces challenges like human rights violations and unsafe labor conditions, necessitating better regulatory frameworks. Investments in this sector could enhance its link to the broader economy and boost productivity. Recent statistics highlight contributions of 360,000 tons of marine fisheries and up to 151,000 tons of freshwater fisheries annually, underscoring its untapped economic significance (World Bank, 2015; ILO, 2016; Jardine & Sanchirico, 2015; Tarar et al., 2019).

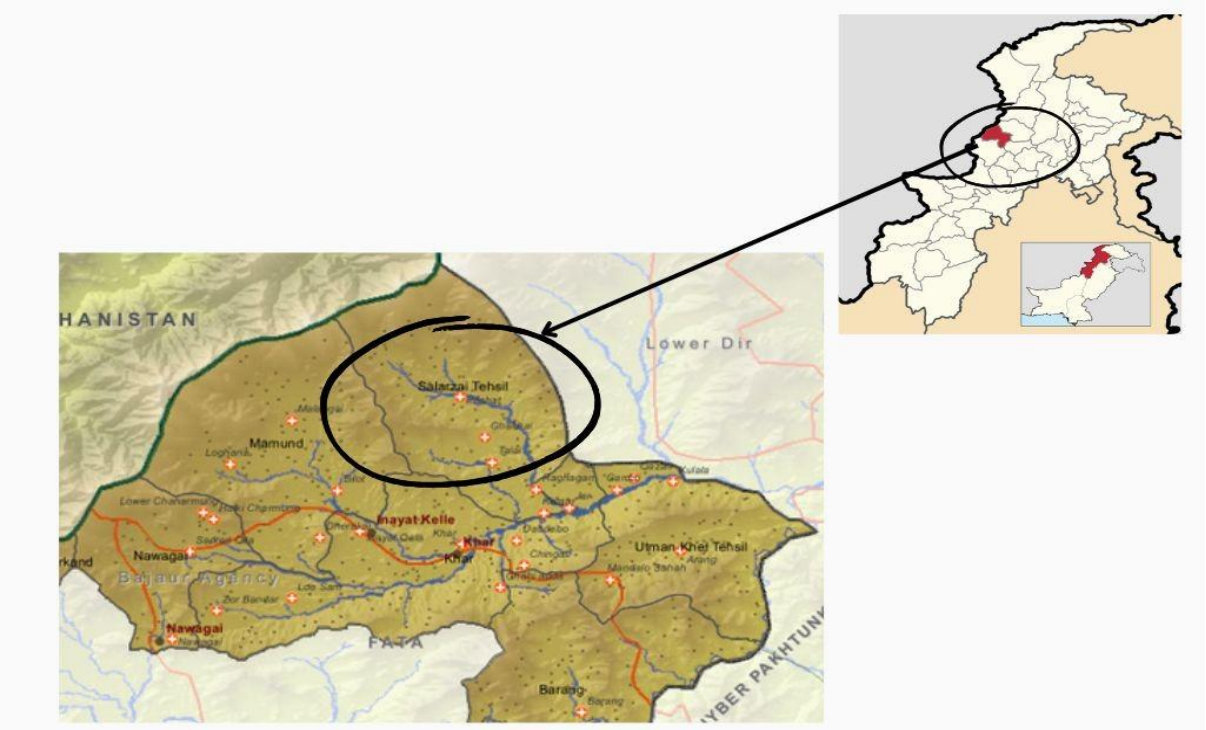

FIGURE 1: MAP OF RAGHAGAN DAM

The main objective of this research was to explore the socioeconomic dependence of local community on Raghagan dam. Raghagan Dam is newly constructed dam and yet there are no previous studies related to its socio-economic importance.

RESEARCH METHODOLOGY

Quantitative research methods were used to explore the socioeconomic dependence of local communities on Raghagan dam located in Bajaur. Raghagan Dam is located on the Babukara Khwarr, a left bank tributary of Bajaur Khwarr that flows into the Panjkorra River, the Raghagan Dam is situated in the Salarzai area of Bajaur District. Nearby villages include Raghagan, Chargurrai, Mullah Kaly, and Qazi Dheri. The dam is approximately 13 kilometers east of Khaar town in Bajaur District.

SAMPLE

There are around 1500 households located in the vicinity of dam. All these households constituted the unit of analysis of the current study. Out of these 1500 households 316 households were selected using Taro Yamane Formula. As the households are located in all directions east, west, south and north around the dam, 79 households were selected from each side of dam. Data from 79 households was obtained from each direction of the dam.

INSTRUMENT

An interview schedule was designed with 63 questions in English which was later translated into Pashto (Mother tongue of Author 1) and administered with local population in Pashto language. interview schedule was used as the tool for data collection. Rich and extensive data related to socioeconomic dependence was collected from the respondents by conducting the interviews.

PROCEDURE

To select the households systematic random sampling was used and every 5^{th} house was selected on each side of Raghagan dam. In each direction data from 79 household heads was obtained selecting every 5^{th} household by starting randomly at the first house located closest to the waterbody. Data was obtained only from the household heads. Due to cultural constraints and lack of access to women population, data was only obtained from males. In almost all household elderly males are the household heads. Data from females was not obtained due to these reasons.

ANALYSIS AND ETHICAL CONSIDERATIONS

Extensive data gathered through interview schedule was added to SPSS. First variables were clearly defined as some of the variables were hidden within the data collection process. Extra questions were also added into variables that came into researcher's knowledge at the time of data collection. Data analysis was conducted using SPSS software. Univariariate and bivariate analysis were performed to check the dependence of local community on wetland ecosystem. Before concluding this section, it is worth mentioning that all ethical values of the research were upheld during the process of research. Anonymity and informed consent were ensured during data collection as well as during entering the data. As the interview schedule was translated into local language and researcher tried to remove the language barrier, still at some instances researcher faced difficulty due to difference in local dialects and names of different things they use and obtain from waterbody.

RESULTS

TABLE 1: DISTRIBUTION OF THE RESPONDENTS BY TIMBER USE AND ITS RESOURCE

Categories	Status	*f*	*%*
Timber in Household	Yes	267	84.50%
	No	49	15.50%
Timber in Livestock Shed	Yes	261	82.60%
	No	55	17.40%

Source of Wood	Natural vegetation	93	29.40%
	Purchase	112	35.40%
	Both	111	35.10%
Used in Last 12 Months	Yes	211	66.80%
	No	105	33.20%
Fences Used	Yes	227	71.80%
	No	89	28.20%
Purpose of Fencing	Household Protection	90	28.50%
	Corps Protection	92	29.10%
	Animals Protections	85	26.90%
	Boundary demarcation	49	15.50%
Type of Fences	Natural Vegetation	97	30.70%
	Protection wires	112	35.40%
	Both	107	33.90%
Use of fuel	wood fuel	204	64.60
	Dung	49	15.50
	Kerosene	21	06.60
	LPG	28	08.90
	Electricity	14	04.40

Table 1 shows the distribution of the respondents by timber use which is obtained from the jungle near the waterbody or purchased from the market that is obtained by shopkeepers from the jungle whose vegetation is dependent upon wetland. This table thoroughly considers the use of wood among the respondents, describing and evaluating its uses in households, livestock sheds, and fencing. This table also examines how this wood is obtained and other associated practices. The findings clearly indicate that timber plays vital role in the respondents' everyday life, with 84.5% of respondents using timber in their households. Only 15.5% of the respondents admitted that they do not use the wood in any form. Similarly, a noteworthy 82.6% apply wood in their livestock sheds. In response to usage of timber for livestock sheds only 17.4% respondents said that they do not use the timber for livestock purposes. These findings suggests that timber is important source for building and maintenance of both residential and agricultural settings. As far as sources of this timber were concerned 29.4% of the respondents claimed that they obtain timber from jungle or natural vegetation and 35% purchase it from market. likewise, 35.1% also rely on a combination of both natural foliage and market timber. None of the respondents reported using alternative sources, such as Plastic or recycled materials, which highlights their confidence on traditional timber supplies. Over the past one year, 66.8% of respondents stated using timber for variety of purposes. Only 33.2% of the respondents did not use timber in last one year. Timber plays a major role in construction, repair and farming needs. The study also highlights fencing practices and shows that 71.8% of respondents use fence. while 28.2% do not use any kind of fence to protect the household or surrounding areas. The main reasons behind fencing include crop protection (29.1%), household protection (28.5%), animal protection (26.9%), and boundary demarcation (15.5%). These several purposes indicate the importance of fencing in guarding assets and distinguishing one household or farmland from other. When asked about the material of the fence, there are three types of fences that are used. Around 35.4% of the respondents use protection wire 30.7% of the respondents utilize wood obtained from the jungle and 33.9% of the respondents use both the natural material from the jungle and the protection wires. These results show that respondents are heavily dependent on the jungle for usage of

timber in households and for farmsteads. Timber and fencing materials are obtained from jungle as well as from the market it is used in manufacturing and maintenance of households and the animal sheds.

This table also shows the distribution of the respondents by fuel used in the household. Wood as fuel is used by most of the respondents, which constitutes 64.6% of all residence. Dung as fuel is used by 15.5% of the respondents and kerosene oil is used by 6.6% of the respondents. LPG, which stands for liquefied petroleum gas, is used by 8.9% of the respondents and electricity is the least common fuel source with only 4.4% of the households relying on it. Overall, this table shows that wood obtained from the jungles or bought from the market is the main source of fuel in the area. As the purpose of this article is to assess the socioeconomic dependence of local communities on resources generated by water body, reliance on fuel as wood shows significant dependence of the residents. However, too much reliance on burning wood as fuel is harmful for the environment (Heltberg, 2004).

TABLE 2: ***DISTRIBUTION OF THE RESPONDENTS BY DIFFERENT ITEMS OBTAINED FROM THE JUNGLE***

Categories	Status	*f*	*%*
Medicinal Plants	Yes	193	61.10%
	No	123	38.90%
Medicinal Plants used for	Own Medication	93	29.40%
	livestock medication	127	40.20%
	Both	96	30.4%
Medicinal Plants	Natural vegetation	132	41.80%
	Purchase	97	30.70%
	Both	87	27.50%
Results of Medicinal Plants	Yes	232	73.40%
	No	84	26.60%
Miswak	Yes	228	72.20%
	No	88	27.80%
Resource of Miswak	Natural vegetation	86	27.20%
	Purchase	159	50.30%
	Both	71	22.50%

This table 3 highlights the use of jungle wood by the respondents and their families for various day to day affairs. In response to this significant majority of the respondents said that they use wooden farming tools, with 71.2% using wooden handles and hand hoes, 66.8% using wooden rakes, and 66.5% using wooden pegs. Wooden shovels are used by 57.6%, wooden ploughs by 49.1%, and wooden blades by 39.9%. Yokes have a usage rate of 37.7%. Wooden planks and donkey carts are used by 60.1% and 59.8%, respectively, while 46.5% use wooden coachboxes. These different tools used by the respondents indicate a huge dependence of their lives on waterbody.

TABLE 3: ***DISTRIBUTION OF THE RESPONDENTS BY DIFFERENT THINGS OBTAINED FROM THE NATURAL VEGETATION***

Categories	Status	*f*	*%*
Wooden Pen	Yes	117	37.00%
	No	199	63.00%
Sticks	Yes	221	69.90%
	No	95	30.10%

Charpoy	Yes	237	75.00%
	No	79	25.00%
Wooden Stool	Yes	186	58.90%
	No	130	41.10%
Basket	Yes	224	70.90%
	No	92	29.10%
Broom	Yes	176	55.70%
	No	140	44.30%
Wooden Ladder	Yes	199	63.00%
	No	117	37.00%
Wooden Mesher	Yes	208	65.80%
	No	108	34.20%
Wooden Churner	Yes	204	64.60%
	No	112	35.40%
Wooden Stand	Yes	215	68.00%
	No	101	32.00%
Wooden Roof Drain	Yes	119	37.70%
	No	197	62.30%
Table Chair	Yes	234	74.10%
	No	82	25.90%

Table 4 shows the the distribution of the respondents by type of the domestic products obtained from the natural vegetation. Stable highlights the domestic products obtained from jungle by 316 respondents. The most common item is the charpoy, used by 237 individuals (75.0%). Table chairs are used by 234 respondents (74.1%), baskets by 224 (70.9%), sticks by 221 (69.9%), and wooden stands by 215 (68.0%). Wooden meshers and churners are used by 208 (65.8%) and 204 (64.6%) respondents, respectively. Wooden ladders are used by 199 individuals (63.0%), wooden pens by 117 (37.0%), and wooden stools by 186 (58.9%). Brooms are produced by 176 respondents (55.7%), while wooden roof drains have a lower usage rate, with only 119 respondents (37.7%).

TABLE 5: ***DISTRIBUTION OF THE RESPONDENTS BY COMMERCIAL SCALE USAGE OF DIFFERENT PRODUCTS OBTAINED FROM JUNGLE***

Categories	**Status**	***f***	***%***
Food Forage	Yes	186	58.90%
	No	130	41.10%
Fuelwoods	Yes	195	61.70%
	No	121	38.30%
Timber	Yes	193	61.10%
	No	123	38.90%
Hedges	Yes	203	64.20%
	No	113	35.80%
Medicinal Plants	Yes	183	57.90%
	No	133	42.10%
Wild Fruits	Yes	187	59.20%
	No	129	40.80%

Dairy Products	Yes	179	56.60%
	No	137	43.40%
Poultry Eggs	Yes	204	64.60%
	No	112	35.40%
Honey	Yes	202	63.90%
	No	114	36.10%
Farm Implements	Yes	198	62.70%
	No	118	37.30%
Domestic Products	Yes	189	59.80%
	No	127	40.20%
Miswak	Yes	190	60.10%
	No	126	39.90%
Wildlife	Yes	199	63.00%
	No	117	37.00%

Table 5 shows the distribution of the respondents by commercial scale usage of different items obtained from natural vegetation. Data from the table shows the various business-related uses of natural flora by respondents. The most common use, reported by 64.6%, is the utilization of eggs derived from natural flora. This is closely followed by the use of hedges, indicated by (64.2%), and honey production, reported by (63.9%). Significant dependence is also observed on fuelwood and timber, with (61.7%) and (61.1%), respectively, Similarly, (62.7%) reported the use of natural flora for creating farm implements, while (59.8%) use it for producing domestic products. Other prominent usages include wild fruits, utilized by (59.2%), and medicinal plants, reported by (57.9%) individuals. Food forage is sourced by (58.9%), while (56.6%) make use of natural flora for dairy products. The use of miswak is noted by (60.1%) of the respondents.

DISCUSSION

The results and findings of the data clearly indicate that local communities living in the surrounding areas of Raghagan dam are dependent heavily on resources of the waterbody. They rely on water for agricultural purposes. Some people also use water for domestic use as well. There are two main areas of dependence that were identified in this article. One is related to household usage and Farming uses of wetland and jungles surrounding that wetland and second is usage of wetland and its resources for commercial or business purposes.

For household usage a significant majority of the respondents accepted the use of water for domestic, livestock and agricultural purposes. A significant number of the respondents also obtained timber, wood, fence and other materials from jungle in surroundings of Raghagan Dam. They also obtained wood for different purposes such as charpoy making, furniture making and Miswaak. In households a significant majority of the respondents also use the jungle wood as source of fuel. So, in this regard that waterbody has huge impact on domestic lives of residents along the panjkora river. Saeed et al 2020 reported Similar finding related to importance of jungles near the wetland in Indus delta in Sindh and Punjab (Akbar, et al., 2020).

On the business or commercial dimension of the area it can be found that there are three main benefits of the Dam. One, Dam is a tourist site. Tourists visit dam regularly in summer and on special occasions which provides different kinds of businesses to the locals. Secondly, indigenous people of that area sell the products either directly obtained from the dam such as fish and also the products obtained from jungle surrounding the Dam area. These products include

timber, flowers, fruits, honey and many other products. Third, Dam has influenced overall economic activity of the area. One such area that can be identified is transportation which is progressing rapidly. Importance of aquatic flora has been established in earlier research conducted in Charsadda as well (Gul, et al 2017).

From results of the study, it can be established that not only this Dam but whole Kabul River system including its tributaries play a vital role in socioeconomic lives of people living on its banks. Geographical and geo logical landscape of that area as well as social landscape of the area are largely shaped by this wetland ecosystems. Nafees 2010 also reported Similar finding related to Kabul River system have (Nafees, 2010)

CONCLUSION

This study was first study of its kind that focused on Raghagan Dam located on Panjkora tributary of Kabul River system. The basic aim of this study was to explore the socio-economic dependence of local communities on the wetland ecosystem. This research widely establishes that all the socio-economic activities of residents of nearby villages are directly or indirectly influenced by the Dam and its surrounding natural vegetation. In both domestic and commercial spheres dam is playing many important roles for the residents of the area.

RECOMMENDATIONS

There are only three recommendations related to sustainability of the current dam project. One there should be proper mechanism of cleanliness in the area. There is need to establish rules to maintain the cleanliness of the dam. Second, there is need to promote alternative sources of energy to protect the environmental degradation. Third, it is pertinent for economic growth that people should be encouraged towards alternative crops. There are certain crops which can be grown in the area which can yield high level of incomes for the farmers. There is need to educate farmers and giving them trust that if anything bad happens, Government will stand with you. If this happens, crops with high income returns can be grown.

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