Economic Appraisal of Water-Ecosystem in Jammu and Kashmir

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Abstract

An ecosystem is a community held together by complex interactions between the biotic and abiotic factors in a given area, ecosystem can be as large as a desert or as small as tide pool. An aquatic ecosystem can be either fresh water or marine water ecosystem. The inhabitants of any type of ecosystem will be adapted to survival in the particular set of conditions presented by that ecosystem. Jammu and Kashmir is rich in aquatic ecosystem. The region is housed with many water bodies be it fresh water or marshy land. Kashmir region is world famous due its water bodies be it Dal lake, Wulur lake Mansbal lake, Kokarnag, Verinag, Jhelum river etc. Dal lake and Jhelum river are the nerve tributaries in the valley and different communities are dependent on these waterbodies for their livelihood. It is in this backdrop a comparative study was taken under consideration to highlight the economic potential of these two water bodies in the Kashmir region. For estimation of results different methods and methodologies were put up for achieving logical and realistic results. The results revealed that economic value associated with these water bodies is worth crores of dollars. Different communities in the valley are associated with these water bodies for their livelihood. Furthermore, the results reveal that over the years, pollution and encroachment has reduced the length of both the water bodies which has delimited the recreational value of these water bodies. Though every stakeholder is willing to pay for the restoration of these water bodies. Thus to conclude a sound policy is required to save the water bodies for the future generations of the valley and to restore the glory of these water bodies.

Keywords: Ecosystem, livelihood, recreational value, economic value, evaluation, restoration.

Introduction

Natural resources are capital endowments that determine a nation's wealth and its status in the world economic system. A natural resource is characterized by amounts of biodiversity and geo-diversity existing in various ecosystems. Considering the necessity of these resources, the major concern is to operate an economy within the ecological constraints of earth's natural resources. Among various resources, water is of immense importance owing to its uses in agriculture, industry, household, recreation and environmental activities besides its significant role in addressing the priority Millennium Development Goals (MDGs) of reducing hunger and poverty by providing food directly through its natural state and

indirectly through nourishing our landscapes. Water bodies are sensitive barometers of human activities, on their surrounding the watersheds, as any unsustainable use of ecosystems is readily visible in concerned water bodies (UNEP, 2009). Experts insist that dumping of biological waste, irrational exploitation of biodiversity and increased eutrophication etc., lead to the disturbances in the physical, chemical and biological properties of water bodies which in turn result in degraded ecosystems and loss of biodiversity. (Alegria et al. 2006; Tuan et al., 2009; Dong-Oh Cho, 2007; Gregory et al., 2002; UNEP, 2006). This deterioration of natural resources is a potential threat to the existence of mankind and is largely attributable to humans themselves. Among the various form of water resources, rivers and lakes are dynamic with high degree of physical and biological complexity. Being the centre point of human settlement for ages, such water bodies are perhaps the most affected ecosystem on the planet (Malmqvist, 2002). Even today, they continue to be heavily exploited for meeting societal needs stemming from urbanization, industry, and emergence of tertiary sectors. The most reported anthropogenic activities leading to water ecosystem degradation are deforestation, changing land-use dynamics (from desired to undesired ecology), industrial pollutants/pesticides/wastes, water withdrawals, climate change/temperature increase, extinction of exotic species, and overharvesting/overfishing. (Bunn et al., 1999; Falkenmark et al., 2007) (Rapport and Whitford, 1999; Malmqvist, 2002) (Rapport and Whitford, 1999; Chambers et al., 2006) (Wang and Cheng, 2000; CA, 2007) (Malmqvist, 2002, Jung et al., 2010) (Rapport and Whitford, 1999) (Thoms and Cullen, 1998, Hauer and Lorang, 2004). In an effort to sustain the water ecosystem, the world community is struggling hard to arrest deteriorating ecosystems and its services for our future generations. Thus valuation of the goods and services provided by the ecosystem, along with the estimation of the economic value of both use and non-use values would clear links between ecology, environment and economies. The scenario of water ecosystems, however, differ widely across different regions/locations. Himalayan region in the J&K occupy 62 per cent of the total Himalayan glaciers which besides providing fresh glacial water to meet the needs of the downstream population, supports adventure tourism, winter sports, recreation, generation of hydro-power, irrigation of agricultural fields and livelihood security to most of the people living in the upper reaches of the state that remain cut off from rest of the state/country during harsh winters. Water, either in glacial form or in springs/rivers and lakes reflects the nature's ultimate beauty in Kashmir. Dal Lake and Jhelum River being twin lifelines of Kashmir valley, represent valuable environmental resource with consequent high preservation, conservation and utilization value. (Marothia 2004). River Jhelum originates from Verinag

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spring which is housed within the Pir Panjal range of inner Himalayas. Several freshwater streams starting from the Pir Panjal Mountains meet with Arpal, Bringi and Sanderen streams to form river Jhelum at Khanabal (Anantnag). The river is joined by about 21 major tributaries on either side of its entire route of 239 kilometres from Verinag to Uri, and flows further 753 km's beyond Uri into Pakistan. The river flow is sluggish in nature and its width varies across its length, from 150 ft. at Khanabal (Anantnag) to 692 ft. at Asham (Baramullah). Jhelum contributes significantly to the state's agricultural economy by irrigating about 83 thousand hectares of land. Besides providing the services of extending safe and fresh drinking water, generating hydroelectricity, it also provides livelihood opportunities through sand extraction, transportation and fishing to number of families residing alongside of the river. Dal Lake, a Himalayan urban lake is located in the Srinagar city of Jammu and Kashmir (J&K) at an altitude 1,584 masl. with a mean latitude of 3407 N / and of 74052 E/ longitude. By the year 1980's, the area of lake reduced to 25km^2 from 75km^2.Yet again, owing to drastic geographical change this lake now stretches barely over a surface area of 11.4 km^2 (Yousuf and Mehdi 2008). The shore line of the lake, about 15.5 km long, is encompassed by a boulevard lined with Mughal era gardens, parks, houseboats and hotels. At the periphery of the lake there are floating gardens, known as 'Rad' in local Kashmiri language. The Dal Lake is also an important source for commercial operations like fishing and water plant harvesting. Floating gardens of the Dal Lake, according to Lawrence (1979), resemble the 'Chinampas' of old Mexico, divided by causeways into four basins; Gagribal, Lokut Dal, Bod Dal and Nagin (also considered as an independent lake). Lokut-dal and Bod-dal each have an island in the centre, known as Rup Lank (or Char Chinari) and Sona Lank, respectively. The houseboat site is a prime tourist attraction, especially for foreign and outside valley tourists. A barge known as Doonga and Shikara services that each houseboat carries are used to provide to and fro water transport services to the tourists. Both, River Jhelum and Dal lake provides a range of direct and indirect services with substantial economic values. Cities and towns have been established on the banks of these water bodies over centuries to avail goods and services including sanitation, transportation, water for drinking, agriculture, livestock, and fishing. However, for the past one and a half century, the added services from these wetlands including hydropower generation, sand extraction, water transport, water sports and irrigation for the crop lands, etc. have invited attention of more stakeholders to take advantage of this rich natural resource and its services. Independent of these direct uses, both the water bodies have 'existence' or 'passive use' values commonly referred to as non-use values. This is the value placed by any individual on a particular

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environmental asset simply because it exists and gives him/her satisfaction, and a desire to bequeath this asset for future generation. Persons deriving non-use value, not only express their concern towards clean environment but are also willing to pay for its conservation (Renzetti, 2010). The tributaries and wetlands of Jhelum and Dal have been the focus of environmental and ecological research in Kashmir, the economic aspects of their use and non-use services have, however, hardly been estimated. Studies highlighting long term trends in the physical and chemical properties of water and biodiversity of the river are, either scarce or absent. The meagre and scattered evidence available, reveal a significant human led interventions in the water quality parameters biodiversity and hydrological regimes of these Water bodies. (Yousuf et al., 2006; Anon., 2000) (Anon., 2007). In this regard, this paper conducts a comprehensive evaluation of the services/goods provided by these two water bodies to justify an integrated ecosystem approach for their preservation on a sustainable basis. It also attempts to estimate the total economic value of these wetlands by calculating their use and non-use values along with assessing the tourist behaviour, chemical health and the returns that accrue to stakeholders in and around these rich resources.

Dal Lake and associated problems

The Dal Lake is civilization old among the most beautiful Nation heritages. The lake is having multi-faceted eco-system and its magnificence is inviting the attention of tourists all around the world. The lake is situated in the summer capital of Kashmir (Srinagar). The lake is having a great tourism and recreational potential. Not only this, the lake is having a great commercial operation like in terms of fishing and water plant treatment. Within the premises of lake a number of activities are taking place throughout the year. The floating gardens, inside the Dal lake are known as “Rad” in Kashmiri, blossom with lotus flowers during July and August. The wet land part of the Dal is divided by causeways into four basins; Gagribal, Lokut Dal, Bod Dal and Nigeen (although Nigeen is also considered as independent lake). Lokut-dal and Bod-dal each have an island in the center, known as Rup Lank (or Char Chinari) and Sona Lank respectively as shown in fig..... . Over the last 30 years the Dal lake is facing many problems like encroachment, slitation, waste disposal, deposition of pollutants and depleting water quality to hold on to its existence. The problems began primarily in the 1980s, when encroachments started coming up around the lake area. Similarly, the growing tourist influx, hotels, houseboats in big numbers have also added to the existing problems associated with Dal. Waste from these commercial units is disposed in to the lake. During the recent years, with the growing number of hotels, new sewage lines

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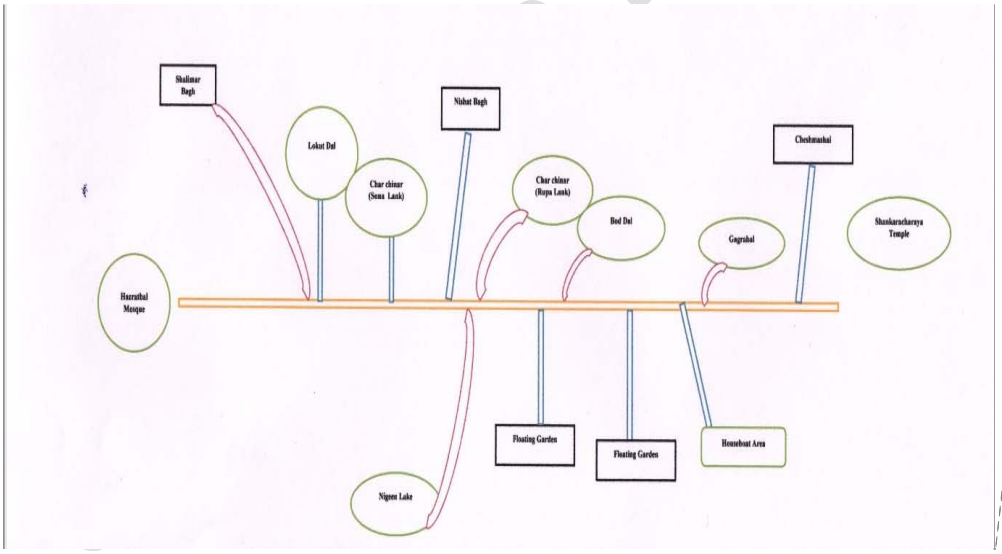
were also built in Srinagar, as per reports (Green Kashmir) an approximately around 12 to 15 outlets disposed untreated sewage directly into the lake.

Problems associated with river Jhelum

Lauded for its beauty and a vital source of hydropower and irrigation, the Jhelum plays a major role in the socio-economic upliftment of the people. The embankments of the river Jhelum are used by the Department of Tourism as perfect sites for camping and trekking and promises relaxing cruises down the river. The river not only flows in Kashmir, but also through some parts of Pakistan. During the years, the river is facing the threats of encroachment, pollution and siltation. Most encroachments have taken place during early 1990s to 2005, in southern districts of Anantnag and Pulwama, when the armed conflict in Kashmir was at its peak. Similarly, the un-authorised encroachment problem is worsened by pollution and siltation and the floods of 2014 and 2015, triggered by siltation and encroachment of the Jhelum, an increased change in land use, ranging from rampant deforestation to unplanned urbanisation and reckless use of agriculture chemicals, is deteriorating the water quality of the Jhelum.



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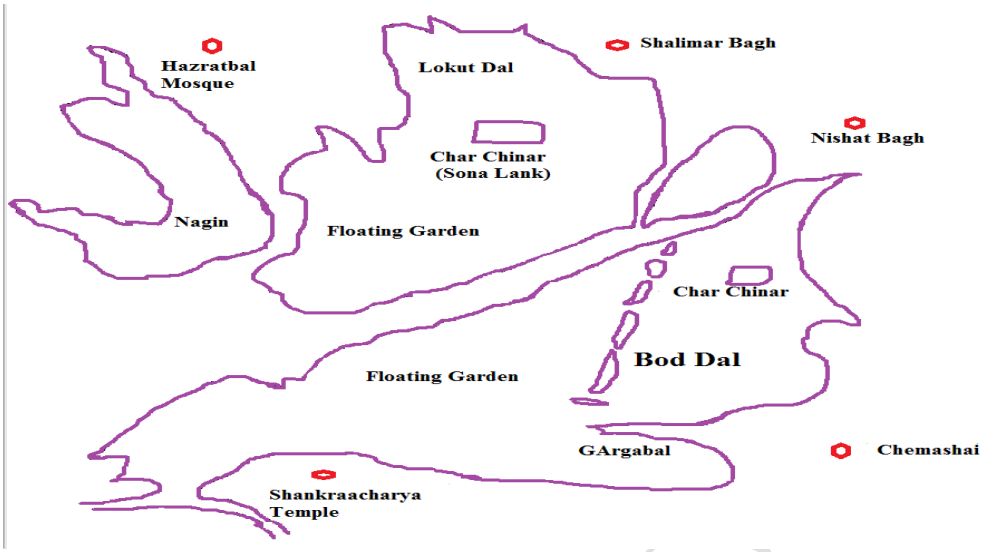

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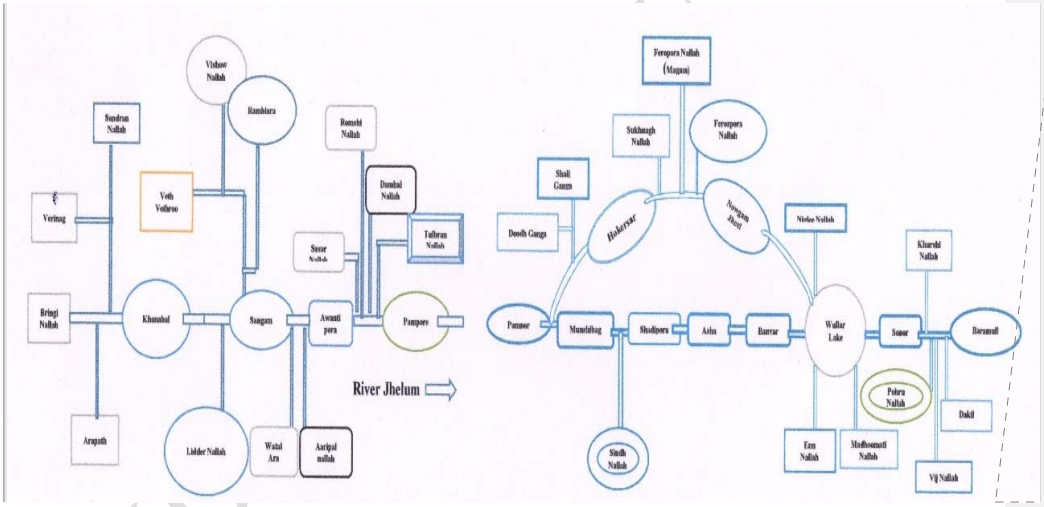

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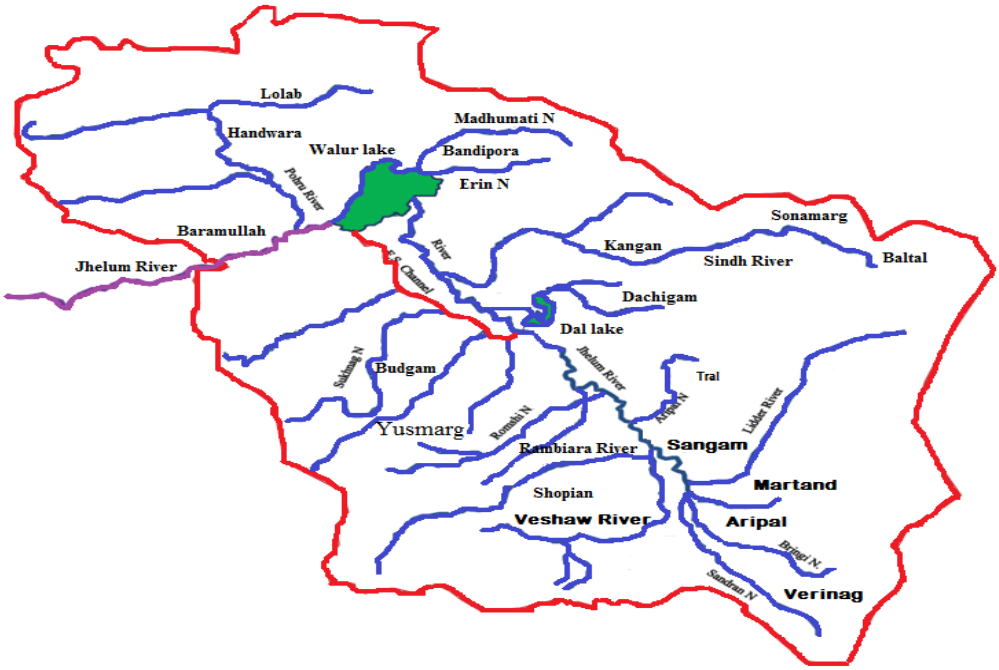

Diagrammatic and graphical representation of study area

The study is comparative in nature and is based on both primary and secondary data. The secondary data was collected from various official reports of Government of Jammu and Kashmir, the primary data was obtained through a well-designed pre-tested schedules from stakeholders, like agriculturalists, houseboat owners, shikara owners, hoteliers, transporters, parking owners, sand extractors, fishermen, laundry service providers NGO's, visitors etc. Well-designed separate schedule after pre-testing was prepared for each type of respondent. Both direct and indirect contingent valuation methods were employed on the date obtained from the primary sources. The type of valuation approach is known as the travel cost method (TCM). The Contingent valuation method (CVM) elicits consumer preferences of goods and services that are not traded directly to the consumer in the market. One of the most important concepts in CVM is willingness to pay (WTP) that is also employed in this study. WTP is 'the maximum amount consumers are prepared to pay for a good or service' (ADB 2007). More specifically, WTP is the amount of money that a person is willing and able to pay to enjoy recreational facilities (McConnell 1985). It measures whether an individual is willing to forego their income in order to obtain more goods and services, and is typically used for non-market goods.

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Table 1: Educational setup of different stakeholders

Education in (%)	Primary level		Secondary level		Graduation & above	
	Dal dwellers	Jhelum dwellers	Dal dwellers	Jhelum dwellers	Dal dwellers	Jhelum dwellers
Agriculturists	16.18	55.56	13.29	33.33	1.16	11.11
Houseboat owners	6.35	46.67	50.79	30.33	11.11	23.00
Shikarawala	12.77	58.33	24.47	41.67	14.89	0.00
Fisherman	20.33	75.00	3.38	25.00	0.00	0.00
Transport owners	9.09	10.00	21.21	50.67	36.36	39.33
Sand Extractors	-	66.67	-	33.33	-	0.00
Laundry service providers	-	40.00	-	60.00	-	0.00
Visitors	-	10.00	-	50.67	-	39.33

Different types of communities are living along side of both the water bodies in Kashmir Valley. Both the water bodies are providing livelihood to many communities be they skilled or unskilled in nature. The educational setup of the respondents associated with two water ecosystems in Jammu and Kashmir are presented in Table 1. Dal lake being concentrated in the Srinagar city and therefore 16.18 per cent of the agriculturists around Dal lake are having primary level of educational attainment as compared to 55.56 per cent with the Jhelum, similarly, 11.11 per cent of the agriculturists have acquired higher studies in case of Jhelum dwellers and only 1.16 per cent have acquired higher studies, the reason being that around Dal lake the dwellers are vulnerable sections. Houseboat owners in case of Dal ecosystem have acquired 12.77 per cent, 50.79 and 11.11 per cent of primary, secondary and graduation level of education and in case of Jhelum the houseboat owners have acquired 46.67 per cent, 30.33 per cent and 23.00 per cent of primary, secondary and graduation level of education. Fishermen community mostly dominant along Jhelum water ecosystem and mostly having primary level of education (75.00 per cent) compared to 9.09 per cent of the fisherman along Dal lake. The educational attainment of transport owners is highest in case of Jhelum water ecosystem as 50 per cent of the transport owners are having secondary level of educational attainment compared to 21.21 per cent in case of Dal lake transport owners. There are a few services like sand extractors, laundry service providers, that are relevant to Jhelum water ecosystem and they are mostly having primary or secondary level of education.

Table 2: Revenue generation from Dal Lake and River Jhelum by different stakeholders

Estimated annual net revenue generated by sampled stakeholders		
	Net returns (US$)	
Stakeholders	**Dal Lake**	**River Jhelum**
Sand Extraction	-	40.55
Fishing	0.4	2.35
Shikara	1.5	-

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Laundry Services	-	4.02
Transport	1.3	2.36
Houseboat	22.0	36.11
Hotels	85.1	-
Agriculture		149.2
Vegetables	0.7	-
Nadroo	0.3	-
Hydro power	-	62.2

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River and Lake ecosystems have the potential to provide a wide range of benefits to society. Many social benefits derived from Rivers and Lakes are dependent on good 'all round' river health, including cultural and aesthetic values, or secure livelihoods such as those based on inland fisheries or agriculture. Economic benefits, such as those derived from commercial agriculture or hydropower in case of river ecosystem, tend to rely on just a few aspects of river health or lake health (such as flow, the depth etc.). Table 2 shows the annual net revenue generated by different stakeholders associated with the two water ecosystem bodies in Jammu and Kashmir. Sand extraction activity is only associated with Jhelum ecosystem and the annual net revenue generated by the stakeholders is 40 million US$. The net revenue generated by the fisherman community from the two water ecosystems is 0.4 million US$ (Dal lake) and 2.35 million US$ (Jhelum river). Shikara owners in case of Dal lake ecosystem earns 1.5 million US$ annually, but this activity is not applicable in case of Jhelum river ecosystem. Laundry services are applicable in case of Jhelum ecosystem and the annual revenue generated from the service is 4.02 million US$. Transporters from both the ecosystems generate a revenue of 1.3 million US$ (Dal) and 2.36 million US$ (Jhelum) annually. The houseboats in both the water eco systems are usually stationary. They are usually tied at the edges of the water body. The houseboats are usually rented out to tourists and a section of society is dependent on the houseboats for their livelihood. The revenue generated by the houseboat owners from the two water bodies is 22.0 million US$ for Dal lake and 36.11 million US$ for Jhelum river. Generating revenue from hotels and restaurants is mainly limited to cities and towns. Hospitality setting involves creating new strategies and tactics to generate revenue and earn livelihood. The revenue generated by the hotels and restaurants around the Dal water body in Jammu and Kashmir is 85.1 million US$ annually. River Jhelum is the backbone of valley's agricultural sector. Apart from irrigating the agricultural fields, the river along with its tributaries and wetlands acts as a natural drain to the catchment areas in times of excessive rains, and serves as a reservoir in times of dry

spells. As per the recent information provided by the Department of Irrigation and Flood Control (concerned directorate), the river Jhelum contributes about 42 per cent to the total irrigated area in the valley. Since most of the agricultural fields are on higher elevation than Jhelum, a lift irrigation system was introduced during 1970s; bringing more area under irrigation. Currently, (in 2010) the river irrigates more than 83 thousand hectares of agricultural land spread in the valley. The annual revenue generated by the agriculturists around the river Jhelum 149.2 Million US$ and the revenue generated from the agriculture around and inside Dal lake is 0. 7 million US$ of vegetables and 0.3 million US$ Nadroo cultivation. Hydro-power generation is the most important aspect of river Jhelum in terms of economic use value, being exploited for the generation of electricity. Out of about 3722 million units (mu) of hydro-power generated within the state, Jhelum contributes about 725 mu (19.5%). The installed capacity (actual production of the electricity) on Jhelum power houses alone is about 33 per cent of state's total installed hydro-power capacity. Therefore, lack of capital resource and lack of political will has been a constraint in harnessing full benefits from Jhelum's power generating potential. The estimated revenue generation from the River Jhelum in 62.2 million US$ annually and the power generation activity is not applicable to Dal lake ecosystem.

Table 3: Willingness to pay by different stakeholders for restoration of waterbodies in Kashmir

Willingness to pay for the restoration of Dal and River Jhelum (US$/respondent)		
Respondent	**Dal Lake**	**River Jhelum**
	US$	**US$**
Visitors	8.69	2.65
Hoteliers	120.62	-
Houseboats	39.70	-
Shikara	1.90	-
Fishermen	0.58	2.5
Transport	2.32	20.6
Residents	9.05	-
NGO's	25.09	-
Conscious citizens	16.29	-
Scientists/Intellectuals	36.11	-
Beautified river Banks	-	21.7
House price differential (per 1000 sq. ft plot)	-	26041.22

(-) denotes non applicability

Willingness to pay (WTP) is the maximum amount an individual is willing to hand over to procure a product or service. Every stakeholder in the study shows willingness to pay for preserving ecosystem, which pushes the non-use value of ecosystem beyond its use value. The respondents reveal their WTP for clean water, beautified river-banks and increased fish population. Every visitors for restoring the glory and environmental health of both the water bodies is willing to pay 8.69 US$ in case of Dal restoration and 2.65 US$ in case of Jhelum restoration respectively. Every hotelier residing along the banks of Dal lake is willing to pay 120.62 US$ per day for restoring the ecological health of Dal. Fishermen also along both the water bodies were willing to pay 2.50 US$ in case of Jhelum and 0.58 US$ in case of Dal lake as extra fee for fish licensing, whereas, the houseboat owner and Shikara owners in case of Dal Lake were willing to pay an extra amount of 39.70 US$ and 1.90 US$ once the river is restored. Similarly, residents, NGO's, Conscious citizens & Scientists/Intellectuals were willing to pay 9.05 US$, 25.09 US$, 16.29 US$ & 36.11 US$ respectively for the restoration of Dal lake and the same is not relevant for the Jhelum river because, mostly these people does not prefer to live near river ecosystem. Since, the river Jhelum flows through residential areas starting from south Kashmir to north Kashmir including the main city of the valley, house price differentials (using the Hedonic Property Method) reflect the homeowner's willingness to pay for restoration of river. Further the property located along banks of the river Jhelum has more value than those away from river even if they are far from main roads and markets owing to the scenic view provided by the river. The price differential for Jhelum banks was calculated from average to 26041.22 US$ per 1000 sq. ft plot.

Conclusion

Natural resource endowments of a nation determines its status in the world economic order. The natural resource of a country comprises of biodiversity and other ecosystems around. Though every natural reserve is having utmost importance for the sustenance of life on this planet, out of these resources, water is of enormous prominence due to its usage in domestic consumption, agriculture, industrial, recreational and environmental activities besides its significant role in addressing the priority Millennium Development Goals (MDGs) of reducing hunger and poverty by providing food directly through its natural state and indirectly through nourishing our landscapes. Jammu & Kashmir state is one of the seven hill states of India rich in biodiversity and beautiful landscape. The state is rich in terms of water reserves which comprises of world famous lakes, springs, rivers and wet lands. Dal Lake and river Jhelum are the two water bodies' one flowing throughout the Kashmir valley and the

other one is housed in the summer capital of Kashmir, Srinagar. Both the water bodies are having its role in the livelihood and food security needs of the people in the valley. The economic value associated with these water bodies is in crores of dollars. Different communities in the valley are associated with these water bodies for their livelihood. But over the years due to population explosion in the valley, pollution and encroachment of the people the length of both the water bodies has reduced and has delimited the recreational value of the these water bodies. Though every stakeholder is willing to pay for the restoration of these water bodies. Thus to conclude a sound policy is required to save the water bodies for the future generations of the valley and to restore the glory of these water bodies.

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