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1.1 Introduction

The Convention on the Conservation of Waterfowl and Wetlands as the habitat of waterfowl, popularly known as the Ramsar Convention, defines wetlands as “areas of marsh, fen, peat land or water, whether natural 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” (Ramsar, 2017).

Globally there is about 1,280 million hectares of wetland. That includes inland and coastal wetlands (including lakes, rivers, and marshes), and man-made wetlands such as rice and reservoirs. Wetland ecosystems, including marshes, lakes, rivers, rice fields, and coastal areas, provide many services that contribute to human well-being. Water availability and fish supply are the two main wetland services which are declining day by day. (Cruz et al, 2005).

Wetlands are responsible as highly productive ecosystems, providing many important benefits. The benefits are in sense of ‘goods and services’, functions (e.g. Ground flood control, Ground water recharge,), its products (i.e. Site for wood collection or research site) and their attributes (i.e. aesthetic component of the landscape, religious significance) (Brander & Schuyt, 2010).

Like the other environmental goods, the wetlands are also common property and are degraded day by day. Lack of information some considered wetlands as wastelands which is the reason for degraded wetlands and their services. Since, 1900 half of the world’s wetlands have been disappeared (Acharya & Barbier, 2000). And are converted into agricultural lands and infrastructure etc. These conversions are due to different factors like inadequate govt policies for preservation and conservation of wetlands in Pakistan. There is no awareness about the indirect benefits and services.

Pakistan having 225 national wetlands covering 8,906,339.4 - 9,189,089.4 ha area which is about 9.7 percent of the total land area, and 19 have been recognized as Ramsar sites of global significance covering 1,343,807 ha (Ramsar, 2017). Ramsar Convention on Wetlands divides wetlands into three main categories of wetland habitats; marine/coastal wetlands¹, inland wetlands², man-made wetlands³.

¹The marine and coastal wetlands include estuaries, inter-tidal marshes, brackish, saline and freshwater lagoons, mangrove swamps, as well as coral reefs and rocky marine shores such as sea cliffs.

² Inland wetlands refer to such areas as lakes, rivers, streams and creeks, waterfalls, marshes, peat lands and flooded meadows.

³ man-made wetlands include canals, aquaculture ponds, water storage areas and even wastewater treatment areas.

Pakistan is blessed of all types of wetlands. These different types include Inland water which covers biggest portion of 7,800,000 hectares, Lakes and reservoirs of 472,070 hectares area, Fish farms and ponds consists of 334,019.4 hectares area, Delta marshes of 300,000 hectares area and the Mangroves covers of about 250,000 to 283,000 hectares area (Khan & Arshid, 2014).

Wetlands are preserving the natural ecology by sustaining a big concentration of aquatic wildlife, mammals, native and migratory bird species, permanent resident amphibians, reptiles and additional species of insects etc. in addition, they are also essential accumulation of fauna and water reservoir (Wild Life Warrior, 2017). There have been many benefits that these wetlands provide in the ecosystem. Some of these functions are. Regulation function are related to ecological processes that contribute to a healthy environment. Recycling of nutrients and human waste, watershed protection, natural flood control and flow regulation, Carbon sequestration and Water treatment are some of the examples. Carrier function provide space for activities such as human settlement, cultivation, energy production, habitat for animals, Wildlife cropping/resources, Tourism and recreation and also habitat and nursery for plant and animal species. A production functions provides resources for people such as food, water, raw materials for building, clothing, genetic resources, raw materials for building and construction and industrial use are the sources of the production function. Wetlands are also a source of Information because wetlands contribute to mental health by providing scientific, aesthetic and spiritual information which is an information function of the wetlands (Schuyt & Brander, 2004). Due to the industrial wastes and pollution many wetlands are degraded and facing number of threats including over harvesting, agricultural intensification, lack of awareness and ineffective govt policy.

1.2 Problem Statement

Lack of awareness about the environmental services in general and wetlands services in particular have been the main problem in Pakistan. Pakistan's losing its wetlands, as environmental good the wetlands have no marketed value and people are unaware how important this is?

1.3 Objectives

This research study is aimed to analyses the functions of the wetlands in Pakistan. The objective of the study is to measure the economics benefits of these wetlands to quantify it in the monetary benefits so by quantify its value in monetary terms their degradation will reduce, and people starts wise use of the wetlands. The value of the characters and benefits we are getting will be analyzed by comparing with the standard values for each characters which is introduced by the WWF.

2 LITERATURE REVIEW

The role in providing flood protection especially in coastal and river flooding has been recently recognized as not only economically and technically feasible, but also being known for providing a multitude of provisioning services such as carbon storage, tourism and recreation (Assessment, 2005; Russi et al., 2012; & Forslund, 2009). Being aesthetically valuable and inhabiting high animal and plant diversity, wetlands are major spots for tourists and generate income for local communities and thus supporting rural economies, provided the sites are accessible (Assessment, 2005). Wetland ecosystems are an example of planet's life-support system, and if degraded, can risk livelihoods and income and in broader dimension can also lead to political conflicts over resource use (Corvalan et al. 2005). Verma, (2011) has explored that wetlands are complex ecosystems that are responsible for providing a wide array of unmeasured goods and services that benefit people. The livelihoods of millions of people in India are also dependent on these ecosystems. The wetland valuation, function and benefits generally as well as for the Bhoj wetland (India) are discussed. The paper is about parts the one is functions and valuation techniques. The second part is about the importance of water resources for the area Bhoj. the methodology used for the economic valuation are primary as well as secondary data. Through questionnaire and observations, the primary data are collected.

The wetlands provide often unrecognized benefits and services, such as provisioning of food and fiber production, regulating services such as water balance, groundwater recharge, flood mitigation and storm protection; cultural and social functions such as sacred and religious importance; providing recreation and tourism opportunities; and supporting functions such as soil formation and sediment retention. Making such policies, which avoid the threats and issues of wetlands like climate change, extension of agriculture land and pollution have become the need of the day to overcome wetland degradation (Chaudhry, 2010).

Blankespoor et al, (2012) has calculated the rough estimate of the economic value of the goods and services produced by wetlands at risk is approximately \$630 million per year in 2000 U.S. dollars. These estimations are calculated by using SLR analysis, and DIVA GIS database from secondary source. They have further warned that due to global warming, the sea level rises to 1 meter in 21st century and due to this rise, 61 percent of brackish/saline wetlands are at risk, 64 percent of the freshwater marsh, 66 percent of Global Lakes and Wetlands are receding. In East Asia, China and Vietnam would bear the brunt of these losses. In the Middle East and North Africa, Libya and Egypt would see the most losses.

The significance for national and international tourism cannot be overlooked. Socio-economic conditions of a region, for the most part, are dependent upon good quality wetlands. To overcome the pressure on wetlands many other marshes and manmade

wetlands have also been built. Not only in Pakistan but all over the world, wetlands are facing continuous threats and going to be included in most threatened ecosystems. There are many reasons for the degradation of wetlands such as expansion of settlements and human activities, construction of dams, disturbance of natural drainage, industrial wastes and so on. Economic development and inconsistencies in the policies of government also play an important role in this regard. Along with other parts of the world, wetlands of Pakistan are also under a tremendous stress imposed by natural as well as human factors (Khan & Arshid, 2014). Wetlands contain numerous goods and services that have an economic value not only to local populations but also to people living outside the periphery of the wetland. These values can be made more explicit through economic valuation studies. The economic value of wetland goods and services reflect the economic importance of wetlands for the people that depend on these goods and services. Wetland services, such as cleansing and recycling capacity, are conditions and processes through which natural ecosystems sustain and fulfil human life. They maintain biodiversity and the production of wetland goods, like wood, water and medicine which will be problem if wetlands are degraded at this fast speed in Africa and also worldwide (Schuyt K. D, 2000).

Mahlalela (2014) Using primary data, has analysed the environmental valuation techniques to estimate the annual economic value of the wetland's fibre provisioning services and four notions of resource rent associated with the harvested fibre. 63 sample were collected from the Lawuba wetland (most important wetland of Swaziland) for the deteriorating of their quality and quantity also the study stated for the environmental valuation methods of the provision of the fibre production. Economic valuation is concerned ultimately with the allocation of wetland resources to improve human welfare (Acharya & Barbier, 2000).

Dehlavi & Adil (2011) have estimated the value of the recreational site by the travel cost approach. Keenjhar lake, Pakistan's largest freshwater lake and a Ramsar site is estimated to provide a value of PKR 3.46 billion (USD 42.2 million) as a recreational use by using poisson regression model.

Generally, four methods are used for the valuation of wetlands. The Net Factor Income (NFI) method is most appropriate. Willingness to pay, cost benefits analysis and Non-market values such as Travel Cost (TC), Contingent Valuation (CV), or Hedonic Pricing (HP) methods are mostly used for wetland's economic valuation (Woodward & Wui, 2000).

Turner, et al., (2000) The paper explained three problems responsible for the loss of the wetlands and also explain the solution for the failure of information of the governmental policies through the wetland valuation, integrated modelling, stakeholder analysis, and multicriteria evaluation for the management policies. The methodology used is the monetary valuation techniques and cost benefit analysis through primary data.

Davidson (2014) stated the comprehensive study of wetlands losses by examine the assesment of 189 wetlands which stated that about 64-71% loss of wetlands occure in 20th century and specifically Asian wetlands loss are even high. His assesment state that inland wetland are about 69-75 % declined while the coastal wetlands declined 62-63 %.

Hartig et al, (1997) Had discussed the function of wetlands and due to climate change induced impacts to agriculture, precautionary management options are reviewed. The purpose of the paper is to examines potential climate change impacts on freshwater and tidal wetlands in Eastern Europe, with emphasis on Bulgaria, Czech Republic, Estonia, and Russia. Barbier, (2013) Explains that tropical wetlands may have crucial economic role to play in development. The paper explains the importance and value of tropical wetlands by the methodology of cost- benefit analysis and asses the cost of wetlands loss and the value of nonmarket benefits.

3 Research Methodology

In the study two major wetlands complexes of Pakistan are analyzed namely Central Indus Wetland Complex (CIWC) and Makran Coast Wetlands Complex (MCWC) map attached in annexure . The valuation of these wetland complexes is based on an analysis of various secondary data of international wetlands to find out an approximate economic benefit of the wetlands in Pakistan. For this purpose, the functions of wetlands of international standards, i.e. Ramsar Convention, ecological and environmental protection agency, are analysed to find out the monetary benefits of wetlands in Pakistan.

The preparation of this document involved comprehensive desk study, covering the information about the benefits of wetlands, functions and economic values of these wetlands complexes of Pakistan. The study relies on secondary sources including World Wildlife Fund (WWF), International Union for Conservation of Nature (IUCN), World Bank(WB) data indicators. The aim of the research is mainly to analyses the importance of wetlands their economic functions and their values. Functions such as Regulation Functions, Carrier Function, Production Functions and Information Function I.e. Life support, Supply of raw materials, Absorption of waste products, Supply of amenity services are evaluated. For this purpose, each benefit is evaluated by comparing with world's wetlands for market valuation (Schuyt & Brander, 2004).

In order to find the Importance and economic value of the wetland of Pakistan based on the information generated from WWF, Ramsar convention of Pakistan sites and from the research journals are monetarized in millions of US \$ per hectare. The Pakistan major complexes of wetlands are analysed, and each complex size is converted into per hectare and their economic function in monetary form is calculated in US \$ Million per hectare per year. The function and services of each complex is derived according to their characteristics from secondary source i.e WWF, IUCN and from paper while these functions are than analysed by the value transfer from the international standard which include the WWF report on "The Economic Values of the World's Wetlands" and Ramsar standard of wetlands. The methodology used is value transfer for each characteristic of the complex and per hectare value is analysed.

4. Analysis

Economic Valuation of Central Indus Wetland Complex (CIWC)

It is freshwater river system present in Sindh province extending among the Chashma in the North and Sukkur City in the South, this complex lies along the main stem of Indus River. Consists of braided stem and oxbow lakes and seasonally inundated depressions in the flood plain. The entire complex is 970000 ha (WWF Pak, 2017).

In carrier function irrigation of agricultural products like cotton, wheat and vegetable are the main crops grown, hunting and habitat of many migratory birds. Also, the Indus Water Dolphin is the important biodiversity in the region. CIWC is a principal flyway for migrant bird species like waterfowl, migration route used by 66 different birds including threatened ones. CIWC are source of information function like Astola island having spiritual and architectural site of Hindu temple and Muslim prayer yard. CIWC provide production function which includes materials like tall reed, grasses I.e. Walayati Keekar, Munj/Wood grass are found. Also, water and wood for the local people (WWF Pak, 2017).

Indus river within the Makran Coastal Wetland Complex support more than 95% of the surviving population of the endangered and endemic Indus River Dolphin. The area fosters many species of natural vegetation.

Table 4.1

Sr.NO	FUNCTION/ SERVICES	STANDARD RATE OF EACH FUNCTION × TOTAL AREA	VALUE \$ US (millions per year)
1.	Dolphin fish habitat	77.81 × 970000	75.480
2.	Grassland	2.65 × 970000	2.570
3.	Agricultural grounds	5.39 × 970000	5.229
4.	Habitat of Migratory birds	10.417 × 970000	162.960
5.	Recreational Hunting	123 × 970000	119.310
6.	Habitat nursery	201 × 970000	194.970
7.	Food production (crop, wheat, rice etc.)	21 × 970000	10.105
8.	Spiritual and historical	0.108 × 970000	0.105
9.	Water supply	45 × 970000	43.650
10.	Materials (reed, grass etc.)	45 × 970000	43.650
11.	Total		658.0295

Source WWF Pak (2017) and Khan & Arshid, (2014)

In the above table, the valuation is carried out by ‘value transfer’ from the World Wetlands Economic Values of WWF report, which involved predication of the value of CIWC given the knowledge of its benefits and socio-economic characteristics. The function includes fishing of value equal to 77.81, grassland of value 2.65 US\$ per Hectare and agriculture grounds value of 5.39 US\$ per Hectare, are calculated from Lake Chilwa Wetland, Malawi. Food production in the CIWC like crops, wheat, rice etc of value 10.417 US\$ per Hectare value transfer from Pantanal wetland, Brazil. Some regulation function like Nature protection function values 21 US\$ per Hectare is value transfer from the Dutch Wadden Sea, Netherlands. Habitat of migratory birds of 201 US\$ per Hectare value, Hunting of 123 US\$ per Hectare, and water supply and materials of value 45 US \$ per Hectares which value transfer from the Medium Wetlands Economic Values.

Economic Function of Makran Coastal Wetland Complex (MCWC)

Makran Coastal Wetlands Complex (MCWC), Extending westwards along Baluchistan’s Makran Coast from the Basol River to Jiwani on the border with Iran. It is coastal and inland wetland covers an area of approximately 12774 Hectares. MCWC is internationally recognized as Ramsar Site and consists of five wetlands (Annexure 04).

Astola Island (Haft Talar) is located 25 km in south of the desert coast of Baluchistan and spreads over 5,000 hectares with 6 km in length. It is the only significant offshore island along the north coast of the Arabian Sea, and as such maintains the genetic and ecological diversity of the area. It is important for endemic reptiles i.e. Green turtles and Hawksbill turtle which are the most endangered species of the island. Also, a recreational site because of architectural remains of an ancient temple to the Hindu goddess Kali Devi, as well as a prayer yard constructed for a Muslim saint associated with oceans (Ramsar, 2017).

The Makran coastal wetland complex like other complexes are important and provide services to local as well as peripheries. MCWC provide production function like fuel wood, raw material and fishing for commercial purpose and biodiversity of marines such as green turtle and hawksbill turtle are nesting in MCWC. Regulatory function like nature protection and maintenance of migration and nursery habitats like 66 different birds including threatening ones are nesting. It provides carrier function like tourism and recreation, people visit the MCWC its coasts and enjoy fishing. Also provides grasslands.

Table 4.2

Sr.NO	FUNCTION/ SERVICES	STANDARD RATE OF EACH FUNCTION × TOTAL AREA	VALUE \$ US (millions per year)
1.	Fuel wood	14 × 12774	0.178
2.	Raw Materials	350 × 12774	4.470
3.	Fishing	21.74 × 12774	0.270
4.	Biodiversity	214 × 12774	2.773
5.	Habitat of nursery	201 × 12774	2.146
6.	Tourism and Recreation	492 × 12774	6.284
7.	Nature protection	21 × 12774	0.268
8.	Total		16.389

Source WWF Pak (2017) and Khan & Arshid, (2014)

In the above table, the valuation is carried out by ‘value transfer’ from the World Wetlands Economic Values of WWF report, which involved predication of the value of MCWC given the knowledge of its benefits and socio-economic characteristics. The function includes fishing of value equal to 21.74 US\$ per Hectare, which are calculated from Lake Chilwa Wetland, Malawi. Some regulation function like Nature protection function values 21 US\$ per Hectare the value transfer from the Dutch Wadden Sea, Netherlands. Habitat of nursery of 201 US\$ per Hectare value, fuelwood value of 14 US\$ per Hectares, biodiversity of value 214 US\$ per Hectare transfer from the Medium Wetlands Economic Values. While the tourism and recreation value of 492 US \$ per Hectare.

Conclusion

Products of wetlands include Fishes (about 2 third of globally fish harvesting from Inlands wetlands), food, water for drinking, irrigation purpose, timber etc. Also, the wetlands services include ecosystems protection, water treatment, pollution reservation. Capture fisheries in coastal waters alone contribute \$34 billion to gross world product annually (Cruz et al, 2005).

The monetary or economic value of the MCWC and CIWC are approximately equal to 674.419 million US \$ per hectare value obtained directly and indirectly in one year. According to this analysis these values includes different functions and services. Indirect benefits of wetlands are source of the atmospheric maintenance. It is carbon sink and help to moderate global climatic conditions. Wetland are valuable for us as it filters the water and protect human from diseases. Millions of people are directly or indirectly dependent on wetland ecosystems to obtain water, food, fibre, fuel, timber and non-timber products. It acts as natural pollution filter and can store flood water. Wetland of Pakistan like Keenjhar Lake (a Ramsar site) provides fresh water to the Karachi city and provide lively hood source of about 5000 people of the area (Indus Forever, 2017). Wetlands also provide many recreational, educational, and research opportunities. In the United States, more than half of all the adults (98 million) hunt, fish, birdwatch or photograph wildlife, annually spending a total of \$59.5 billion in the process (Wetland Functions and Values, 2017). Globally, the areal extent of wetland ecosystems ranges from 917 million hectares (m ha) (to more than 1275 m ha with an estimated economic value of about US\$15 trillion a year ([MEA, 2005](#))).

These services and benefits are not valued properly that is why the policy makers and public consider wetlands as wastelands. Every natural and common property service have a lot of benefits, but some indirect benefits are not calculated in monetarized form. Developed countries have calculated each and every service of the wetlands in the monetary form and country like India is building and promoting the artificial or the manmade wetlands for natural and treatment function because it is cheap and more easy method for protecting the environment especially water purification.

Recommendations

Improve special laws and regulations regarding wetlands, establish specialized management agencies; strengthen wetlands research and monitoring; and enhance public wetland conservation awareness.

Implementing Pigouvian tax on the industry or other firms which pollute the wetlands or other natural ecosystems.

Required policy technical and financial framework and generate positive public support essential for the mainstreaming of wetlands conservation.

Individual wetland valuation and its implementation.

Because of its eco system services provision, the national wetlands should be conserved and be utilized in sustainable manners. Meanwhile, artificial wetlands should be generated as like India.
