

# **WETLANDS OF PAKISTAN: DISTRIBUTION, DEGRADATION AND MANAGEMENT**

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## **ABSTRACT**

Wetlands are vital component of global ecosystem. They provide wide range ecosystem services related with water regulation and biodiversity, and have a considerable potential for tourism. Many people worldwide depend upon wetlands for their livelihood. Wetlands are usually viewed by their social and economic worth because they have substantial impact on various social and economic aspects of a country like agriculture, industry and tourism. Their 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 of 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. This paper looks into the current state of human awareness about the significance of wetlands, their distribution, degradation, and management with particular focus on to Pakistan. The prime objective of the study is to provide baseline information of the various aspects of world wetlands in general and of the wetlands of Pakistan in particular. The information provided is based upon personal field observations and various secondary sources.

**KEY WORDS:** Wetlands, Ecosystem services, Wetland degradation, Wetland management

## **INTRODUCTION**

Normally the lands covered by water are labeled as wetlands. According to National Wetland Policy of Nepal (2003) those water bodies which are perennial and created by under-ground sources of water and or rainfalls are classified as wetlands. It means wetlands are swampy areas with stagnant or flowing fresh or salty water. Wetlands may be long-lasting or short-term. They may represent boggy areas, watercourse flood plains, ponds, lagoons, areas of water storage, and arable lands. They may be natural or man made. Natural wetlands include rivers, streams, lakes, marshes, bogs and swamps, and man-made wetlands include canals, ponds, paddy fields, fish farms etc. They are filled with water perennially or seasonally and water may be stagnant or moving in the wetlands. They cover approximately six percent of surface area of the globe and occur almost in every country right from tundra region to tropical areas (Thorsell et al, 1997). The Ramsar Convention (explained in one of the next sections) have used a wide-ranging and broader definition of the various kinds of wetlands that were covered in its task, comprising rivers, lakes, swamplands and marshlands, humid grasslands and peat land parcels, deltas, estuaries, tidal flats and oases, mangroves, near-shore marine areas and coral reefs; and artificial sites such as fish and various other aquaculture ponds, reservoirs, salt pans, dams, irrigation culverts, rice paddies, and canals which are amongst the kinds of artificial swamplands. In addition to contributing regional and

global marshlands, artificial wetlands frequently provide habitation for fauna and flora and also benefit to mankind.

Wetlands are thus amongst the most resourceful environments of the world. They are also the foundation grounds of natural diversity. They provide water and essential production upon which innumerable plants and animal species depend for existence and survival. They help in maintaining natural ecosystem by supporting large concentrations of fish, mammals, variety of birds, amphibians, reptiles and other species of invertebrates. Furthermore, they are also imperative store-houses of plants genetic stuff. For instance, rice is a very common plant of wetlands which is the principal diet of over half of the world's population. Wetlands also provide a number of economic benefits such as they offer leisure, amusement and tourism opportunities, supply water, grounds for fisheries, agriculture and timber production. They are also a significant part of people's cultural heritage as they provide them a source of motivation and inspiration that form the base to keep alive native traditions. They are thus, regarded as the most precious ecosystems due to valuable functions performed by them such as;

1. Wetlands are important source of food supply and they are biological supermarkets as they are reservoirs of plant and animal species
2. They preserve bio-diversity and also are ascribed as kidneys of the landscape
3. They store nutrients and are regarded as most productive ecosystems
4. They work as reservoirs for water storage and provide attractive tourist places
5. Coastal wetlands provide protection against storms

Located at the fringe of water and land, wetlands are rich and complex ecosystems which support biodiversity, provide worthwhile ecological services, and have great potential for tourism. Millions of people in the world depend on wetland ecosystems to get water, food, fiber, fuel, timber and non-timber products needed for their survival. It is obvious that wetlands carry out an extensive array of utilities and roles of immense worth for public as they reduce pollution by acting as a natural pollution filter and by storing water during the course of heavy rains may prevent floods. They also support biota and act as a source of leisure. Such type of natural structures may offer security from a variety of natural disasters and destructive events. It is now common perception that ecological measures are more effective than technological measures in providing protection against disastrous events. Floral cover supports to check soil erosion and may lessen the chances of landslides, whilst mangrove forests and coral reefs work as barricades against tidal waves and shore hurricanes. Wetland ecosystems are, therefore, the most beneficial ecosystems that vary regionally in their functions and values. For the reason of acting as wide-ranging and rich food webs and biodiversity they are the most productive ecosystems in the world and, therefore, often are referred to as 'supermarkets'. Because they are large in number therefore, are classified in several ways according to the geographic or environmental characteristics of the regions (soil, animal species, vegetation, function, values etc.)

In the light of significance of wetlands, mentioned above, it is evident that their geographic studies can prove worthwhile. Current article is an attempt in this regard that may provide some interesting and useful information to the reader. Its main objective is to portray some chief aspects of world wetlands in general and of the wetlands of Pakistan in particular. Although, to some extent, description is based upon personal field observations collected during the visits of several wetlands like Lake Saiful-Maluk, Lake Banjosa (Rawalakot), Kalar Kahar Lake, Hamal Lake (Sindh), Hanna Lake, Khabikki Lake (Khushab, Punjab), Keenjhar Lake (Thatta, Sindh), Rawal Lake, Mangla Lake and so on, but most of the information has been collected from secondary sources.

## **THEORETICAL FRAMEWORK**

A strong view exists in the literature that marshlands are highly dynamic and lively systems which are incessantly experiencing natural modifications associated mainly to the subsidence, droughts, changes in sea level, deposition of sediments or in-filling with organic materials. Several wetlands are merely short-term features and remain only temporary part of the landscape for some time and they are likely to change over time or their form may change from time to time. They even may vanish and new wetlands may be created. They are, however, vital part of ecosystem. Wetlands and protected places are appreciated by the people for numerous motives like, preservation and maintenance of biodiversity, tourism and excursion, and fishing etc. (IUCN, 1994; Grimmett & Jones, 1989). Many sources of knowledge are available now that provide information about the values and benefits of wetlands (i. e. Spalding et al, 1997; Scott, 1989 & 1995; Ellison, 1994; Scott, 1993a; Dugan, 1993; Hughes & Hughes, 1992; WCMC, 1990; Patten, 1990; Grimmett & Jones, 1989; and Saenger et al, 1983;). Some researchers such as Dugan (1993) and Patten (1990) contributed to provide some details about the benefits and worth of wetlands for global-ecology, specifically for vegetation, animals and people. Scott (1993a) described the benefits and significance of the Oceania's wetlands. Scott (1995) and Al Wetaid and Faizi (1993) summarized various details about the extraordinary importance of the wetlands of arid zone for flora, fauna and humans. Spalding et al (1997), Ellison (1994 & 1996) and Saenger et al (1983) have pointed out the worth and benefits of mangroves. They revealed that mangroves protect the coastal areas, reduce flooding and sediment deposition, provide nurseries for crustaceans and fish, and function as a vast number of human uses. Maltby et al (1996) and Legoe (1981) supplied details about the significance and benefits of peat land swampy forests along with their regulating influence on entrance of water into drainage systems. They mentioned further that such swamplands play important role in maintaining nutrient reservoir and in regulating life assuring biogeochemical cycles. Grimmett and Jones (1989), based on the worth as breeding and feeding inhabitation for birds have pointed out significant wetlands of Europe. Schwartz and Bird (1990) have worked on the significance of wetlands from the development viewpoint and illustrated the importance of the role of artificial beaches and seaside wetlands in protecting human values and human uses like tourism and excursion, housing and other

infrastructure. In a study on the benefits of artificial wetlands conducted in Portugal, Dugan (1993) also mentioned the significance of saline swamps for migratory bird populations in the country. Furthermore, Michael (1987) provided information about the production of paddy rice, fish farming and fish ponds found in various parts of the world and also about the oyster racks in coastal areas of Japan. Except for North America and Europe, there is extremely modest information found or effort made to compute wetlands loss on an organized scientific basis. For South America, Africa, large part of Asia, and South Pacific Islands only a few published studies dealing quantitative aspects are available (Moser et al, 1996). Most of the information presently available for these areas is descriptive, having just areal estimation and few other details. For instance, Gopal and Wetzel (1995) have described wetland losses and degradation in developing countries like Pakistan, Bangladesh, Sri Lanka, Ghana, Tunisia, Malaysia and Papua New Guinea. Scott (1995) provided some data about wetland losses and reasons of their degradation in the Middle East region. Correspondingly, Denny (1985) provided some information about African shallow water bodies and swamps. Wetland-related volumes of the *World Series* contain some wetland loss and degradation data on a national or regional basis (Chapman, 1977; Gore 1983; Taub, 1984; Michael, 1987; Cushing et al, 1995). All these sources of information on the issue indicate that there is an urgent need for the improvement of this knowledge base.

Although, the significance of wetlands has been documented throughout the world, the geographical work on the benefits and values of wetlands of Pakistan, however, is very sporadic. The current article may prove a foundation step in this direction.

## **RAMSAR CONVENTION ON WETLANDS AND PAKISTAN**

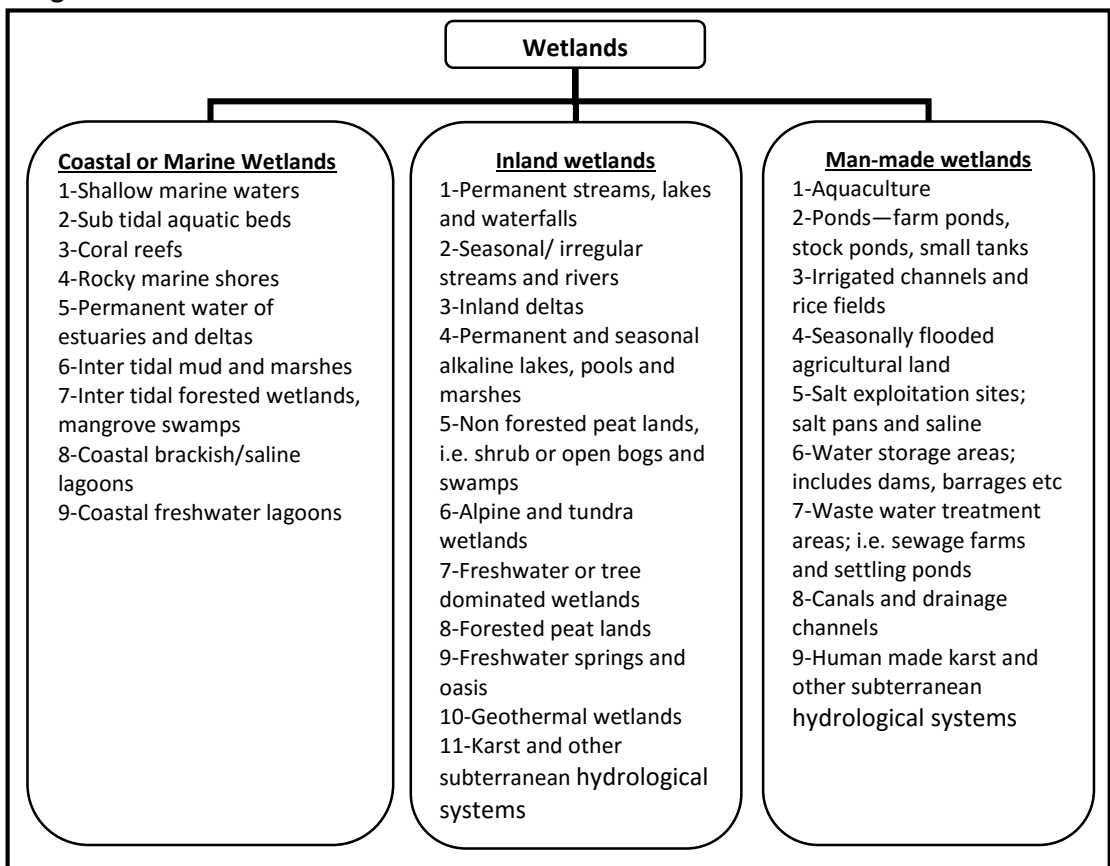
The Convention of International Importance, held on Wetlands is called the Ramsar Convention (RC). It is an intergovernmental treaty that was developed and adopted by participating nations at a meeting held in the Ramsar which is an Iranian city located on the bank of Caspian Sea. The treaty was approved on 2<sup>nd</sup> February 1971 and was implemented on 21<sup>st</sup> December 1975. The convention member countries cover almost all the geographic regions of the world. Comprising about 160 member countries, it is the only international environmental agreement which deals with a specific ecosystem. Pakistan is also a member of this convention. Basically, the convention provides a guideline for national action and international cooperation for the protection and management of wetland ecosystems and their resources. The Convention's task is preservation and wise use of all wetland ecosystems with the help of local and national actions and international cooperation. This in turn can contribute towards the goal of achieving sustainable global development. Main focus of RC philosophy is on the 'wise use' concept that emphasizes the conservation and sustainable use of wetlands and their resources for the benefit of mankind. Pakistan is also working in line with the recommendations of convention to conserve wetlands. Including Pakistan, World Wetland Day (WWD) is observed each year on 2<sup>nd</sup> February which marks the day of signing of the global treaty on Wetlands. At this occasion, government and non

government organizations, and groups of public at various levels of the society have taken benefit of the opportunity to carry out actions that are aimed at raising the level of public awareness about the worth and usefulness of wetlands. However, endeavors are not enough and many people are still unaware of the significance of this crucial component of global ecosystem, therefore, further efforts are needed in this regard.

## CLASSIFICATION OF WETLANDS OF PAKISTAN

According to the list of Ramsar, the Wetlands of International significance currently include 1,888 sites called as ‘Ramsar Sites’ which spread over an area of about 1.853 million sq km. This list includes 19 sites of Pakistan also which have been recognized as ‘Ramsar Sites’ and bear global importance. UK is credited as the country with highest number (168) of Ramsar Sites and Canada is the country with the largest area (over 0.13 million sq km) of listed wetlands also having the world’s biggest wetland Queen Mud Gulf Migratory Bird Sanctuary. This wetland alone extends over an area of about 62,800 sq km ([http://en.wikipedia.org/wiki/Ramsar\\_Convention](http://en.wikipedia.org/wiki/Ramsar_Convention)).

**Figure 1:** Wetlands classification



**Source:** Ramsar Convention classification system of wetlands

Likewise, in the decade of 1970s USA's fish and wildlife service (USFWS) has developed a scheme of classification of the national wetlands inventory which is generally known as Cowardin classification (Cowardin et al. 1979). Since origin it has turn into the most commonly accepted and utilized classification for the wetland ecosystems of USA. The five chief wetland ecosystems identified by this scheme of classification in ascending order are; Palustrine, Riverine, Lacustrine, Estuarine, and Marine. However, in case of Pakistan, it is more apt to group the wetlands into three broader types namely, marine or coastal, inland, and man-made wetlands. Each of these types consists of further several sub-types. Marine or coastal wetlands include nine, inland wetlands include eleven, and man-made wetlands include nine sub-groups as displayed in figure (fig 1).

### **WETLANDS INVENTORY OF PAKISTAN**

Literature and data sources pursued supply information about area and distribution of wetlands of Pakistan and other countries with large contradiction and inconsistency. For some sites and countries sufficient data is not available due to a dearth of acceptable accounts or maps. Regardless of general arid nature, Pakistan supports wetlands that occupy sizeable surface area of the country (table 1). Pakistan wetland GIS database has recognized 225 significant wetland sites in the country out of which 112 have been given in table 2. Of these, 19 are recognized internationally by RC Beareu. According to Pakistan wetland program, natural fresh water and marine wetlands of Pakistan support a unique combination of biodiversity, and sustain about 144 million permanent residents and 3 to 4 million shifted people from adjoining countries.

**Table 1:** Wetland types and area in Pakistan

| Sr.        | Wetland type         | Continental area (in hectors)   | Data sources          |
|------------|----------------------|---------------------------------|-----------------------|
| 1          | Inland waters        | >7, 800, 000                    | Scott (1989)          |
| 2          | Delta marshes        | 300, 000                        | Scott (1989)          |
| 3          | Mangroves            | 250–283, 000                    | Scott (1989)          |
| 4          | Lakes and reservoirs | 472, 070                        | Gopal & Wetzel (1995) |
| 5          | Fish farms and ponds | 334, 019.4                      | Gopal & Wetzel (1995) |
| Total Area |                      | 8,906,339.4-9,189,089.4 hectors |                       |

**Source:** Scott (1989) and Gopal & Wetzel (1995)

The meaning and significance of the wetlands of Pakistan, for the first time, was brought into the notice of international community in 1967. Pakistan signed the treaty and became member of the RC in 1976. At that time, the total wetland area was about 7,800 sq km and the total number of globally significant wetlands was only nine. Afterwards, in 2001, this number raised to 16 and now to 19 recognized as Ramsar Sites out of which, seven are situated in the Sindh province. The mangroves of the Indus delta and Indus dolphins of the Indus wetland region are the addition of international magnitude in the biodiversity of the Pakistan.

**Table 2: Wetlands of Pakistan (names, number, location & status)**

| Sr. No.  | Name of wetland  | No. of wetlands | Location area/province | Status   |
|--|--|-----------------|------------------------|--|
| 1  | Baghsar Lake, Banjosa, Chatta Katha Lake, Garhi Dupatta, Mangla Lake, Nardi Lake, Phoolawaei Lake, Ratti Gali Lake, Saral Lake, River Neelum   | 10              | AJK                    | Not protected                                  |
| 2  | Akara Dam, Astola (Haft Talar) Island, Astola Sea Mount, Band Khushdil Khan, Boji Point, Chakhon, Dasht Khor, Hamun-i-Lora, Hamun-i-Mushkel, Hanna Lake, Jiwani Estuary, Kalimat Khor, Marav Lake, Miani Hor, Pasni Bay, Qamardin Karez, Ras Malan, Siranda Lake, Spin Karez, Wasta Dam, Zhob River, Zangi Nawar   | 22              | Balochistan            | Not protected =15, Protected=04, Not known =03 |
| 3  | Rawal Lake   | 01              | Islamabad              | Part of national park                          |
| 4  | Borith Lake, Deosai Plateau, Gasho Lake, Sai Nullah, Hundrup Lake, Jutial Lake, Kachura Lake, Kharfaq Lake, Naltar Lakes, Satpara Lake, Rama Lake, Sarfaranga Lake, Phander Lake   | 12              | Northern areas         | Not protected =05, Protected =01, Not known=06 |
| 5  | Baran Dam, Chashma Lake, Gandiali Dam, Indus Waterfowl Refuge, Kandar Dam, Khanpur Dam, Kheshki Reservoir, Kurram River Valley, Lake Shandur, Broghal or Yarkhun Lake, Maho Dhand, Tanda Dam, Malugul Dhand, Saif ul Maluk, Tarbela Dam, Thanedar Wala, Zebi Dam, Lulusar Wetland Complex, Dodibagh Sar Lake, Indus Game Reserve   | 20              | NWFP                   | Not protected=14, Protected=(05, Not known=01  |
| 6  | Bajwat, Ghamaghar Lake, Head Islam, Jahlar Lake, Kalar Kahar Lake, Khabbaki Lake, Kharrar (Kharal) Lake, Lal Suhanra Lake, Mangla Dam, Marala Headworks, Nammal Lake, Qadirabad Barrage, Qadirabad Link Canal, Rasool Barrage, Soan River, Ucchali Lake, Taunsa Barrage  | 17              | Punjab                 | Not protected=05, Protected=11, Not known=01   |
| 7  | Badin and Kadhan Lagoons, Beroon Kirthar Canal, Charwo Lake, Clifton Beach, Drigh Lake, GhauspurJheel & Sindhi Dhoro Lake, Hab Dam, Haleji Lake, Hadeiro Lake, Khango (Khowaj) Lake, Hawkes Bay / Sandpit, Indus Dolphin Reserve, Ketu Bunder North, Ketu Bunder South, Khipro Lakes, Khinjar (Kalri) Lake, Korangi and Gharo Creeks, Hamal Katchri Lake, Langh (Lungh) Lake, Mahboob Lake, Manchar Lake, Shahbunder & Jafri Lake, Phoosna Lakes, Pugri Lake, Rann of Kutch, Sadhori Lake, Nara Canal, Soonhari Lake, Tando Bago Lake, Sanghriaro Lake | 30              | Sindh                  | Not protected=19, Protected=11                 |
| Total No. of identified wetlands in Pakistan = 112 |  |                 |                        |  |

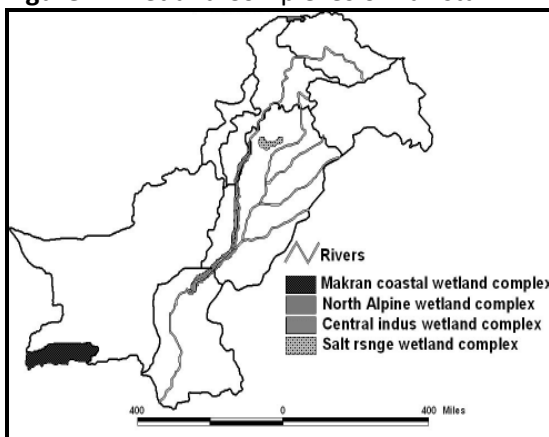
Source: <http://pakistanwetlands.org/webpages/major%20wetlands.htm>

It is evident that at regional level, wetlands can provide important basis for sustainable development as they support an extensive array of biodiversity and are used for waste water treatment and energy production. Wetlands of Pakistan play an important role in cultural and socioeconomic value of international recognition also. Majority of those Pakistanis who live near the inland and coastal wetlands depend for their food and livelihood on them. Local communities of the Sindh province, for instance, who live near the wetlands are substantially using this valuable resource right from forefathers since centuries. Nonetheless, during current period, the increasing pressure of population augmentation is threatening the resource usage and consequently it is no longer sustainable. In addition to this, increasing urban demands for water resources have resulted in the construction of water reservoirs, irrigation systems, barrages, dams etc putting extra burden on wetland systems. On the other hand, these systems supply an extensive variety of services, a number of which are taken for granted in planning and development projects and processes of the government, and hence underestimated and undervalued. It is intrinsically difficult to quantify the number and area of the wetlands lost, and the total area vanished is doubtful until a comprehensive study particularly focusing on to this aspect is available. However, a wetland does not necessarily need to be exclusively vanished or to decrease its worth. In this regard, concerned departments are required to frame out effective wetland policies which must incorporate conservation within the government framework of land use planning, and necessarily understand and apply the 'Wise Use Concept' that is looking and dealing these resources in such a way that they can offer maximum benefit to the largest number of people for the longest period of time without any threat of serious damage.

## **MAJOR WETLAND COMPLEXES OF PAKISTAN**

The four major wetland complexes have been demarcated in Pakistan (fig 2). They are, the North Western Alpine wetland complex, the wetland complex of Salt Range, the wetland complex of Central Indus Plain, and the wetland complex of Makran Coast

**Figure 2:** Wetland Complexes of Pakistan





### **THE NORTH WESTERN ALPINE WETLAND COMPLEX**

Comprising an area of about 1760 sq km, 70 km long and 23 km wide this important complex is situated in the upper Yarkhun River Valley at elevations ranging from 3,000 to 4,200 meters. It consists of a few of the highest wetlands on the globe that are biologically active. Amongst the high mountainous peaks of this complex, six are located at an elevation of over 6,000 meters from sea level and characterized with continuing snow accumulation zones, glaciers and ice fields. The typical plant species found in the valley bottoms of this complex are, *Myricaria elegans*, *Populus ciliate*, *Salix viminalis*, and *Hippophae rhamnoides*. The human communities present in this region are known as Wakhi pastoralists. Seasonal pastoralism assisted by hunting of migratory waterfowl and alpine ungulates is the main source of survival in the eastern part of the region having elevations over 3,300 meters. Major problem of the region is availability of fuel for space heating and cooking. Therefore, an important activity of the region is collection of plants and peat from the marshes, stream beds and surroundings of the lakes which is dried, stored and burned when required. Necessary livestock is retained during harsher winters by stalk-feeding. Usually cut and dried emergent vegetation from alpine wetlands is used as fodder. Additional livestock are shifted down the valleys where the climate is relatively milder. Seasonal migration leads to over-crowding of domesticated animals along the permanent water resources. Remote water bodies, like kettle lakes on perched plains, become bare of emergent flora by the closing stages of summers.

### **THE WETLAND COMPLEX OF SALT RANGE**

Salt range wetland complex consists of many independent wetlands which are shown in table 3. The entire complex is 175 km long and runs from Jehlum in the east to Kalabagh in the west. Uchali wetland complex comprising Khabeki and Jahlar is of international importance recognized by RC Bureau.

**Table 3:** Wetlands of Salt Range complex

| Sr. | Name         | Location province | Location district | Status              |
|-----|--------------|-------------------|-------------------|---------------------|
| 1   | Kallar Kahar | Punjab            | Chakwal           | Wild life sanctuary |
| 2   | Khabbeki     | Punjab            | Khushab           | Wild life sanctuary |
| 3   | Ucchali      | Punjab            | Khushab           | Ramsor site         |
| 4   | Jahlar       | Punjab            | Khushab           | Not protected       |
| 5   | Namal lakes  | Punjab            | Khushab           | Wild life sanctuary |

Source: Pakistan Wetlands Program

(<http://pakistanwetlands.org/webpages/major%20wetlands.htm>)

### **THE WETLAND COMPLEX OF CENTRAL INDUS PLAIN**

Extending among the Chashma in the North and Sukkur city in the south, this complex lies along the main stem of Indus River. It includes various braided streams and oxbow lakes and seasonally inundated depressions in the flood plain. It is 708 km long and 9-23 km wide and occupies an area of 9,700 km. Being home of Pakistan's famous Indus

Dolphin, the region depicts a picture of exhaustive use of resource to meet up survival oriented requirements of the people. Application of harmful fishing techniques, over-fishing, extensive use of agro-chemicals, urban and industrial wastes, hunting and removal of wetlands flora is causing the serious damage to the wetlands and associated biodiversity in this region. It bears great potential for several other revenue producing activities, like eco-tourism which can be encouraged to generate earnings for the inhabitants who largely depend upon existing wetland resources of the region.

### **THE WETLAND COMPLEX OF MAKRAN COAST**

In Balochistan five significant sites are found (table 4). Two sites, Astola island and Jiwani coastal wetlands are recognized as wetlands of international value. Astola island also known as Haft Talar is situated about 25 km in south of the desert coast of Balochistan, and spreads over 5,000 hectors and 6 km in length. It is the most significant island in the north of Arabian Sea, and important for endemic reptiles as green turtles and hawksbill turtle which are the most endangered species of the island. This site is of considerable worth for maintaining and conservation of the genetic and ecological diversity in the area. Lobsters, oysters and fishes are caught between May to September. Sea bird population has been reduced in this region. Jiwani coastal wetland complex is located around the Delta of Dasht river in Balochistan which spreads over an area of 4,600 hectors. This wetland is important due to the presence of mangrove forest where especially the species *Avicennia Marina* is present. Endangered species of green turtles and Olive Ridley are found. Thousands of migratory water birds visit the complex.

**Table 4:** Wetlands of Makran Coastal complex

| Sr. | Name             | Location province | Location district | Status             |
|-----|------------------|-------------------|-------------------|--------------------|
| 1   | Akara Dam        | Balochistan       | Makran            | Not protected      |
| 2   | Astola island    | Balochistan       | Makran            | Wildlife Sanctuary |
| 3   | Astola Sea Mount | Balochistan       | Makran            | Not protected      |
| 4   | Jiwani Estuary   | Balochistan       | Makran            | Not protected      |
| 5   | Kalimat khor     | Balochistan       | Makran            | Not protected      |

Source: Pakistan Wetlands Program

(<http://pakistanwetlands.org/webpages/major%20wetlands.htm>)

### **WETLANDS LOSS AND DEGRADATION**

With rapid augmentation of population and intensification of human activities, pressure on all kinds of resources has increased tremendously and wetlands are no exception. Degradation of wetland ecosystem is in fact the damage of their functions caused by human activities and wetland loss is the loss of their area due to human actions (Moser et al, 1996). Various activities of man are perhaps the most common reason of wetlands damage (Moore & Dalva, 1993). Disruption of natural drainage system is damaging for lakes and ponds. Construction of pavements and diversion of water flow alters the soil hydrologic-system and the presence of moisture in soil. Various natural events like

droughts and floods may also pose some serious threats to wetlands. Although wetlands act like a sponge and can store water for a long span of time but they cannot perform this function for ever. A number of wetlands may dry out in due course of time if they are not rejuvenated. Overgrazing is another threat to wetlands because animals can trim down the plants making wetlands prone to erosion.

Although, wetlands act as a buffer against weather incidences and natural calamities, but serious floods may cause irreparable losses to wetlands in the form of soil removal, diminished vegetation and run-off pollution. Not only in Pakistan but globally wetlands are depleting due to various kinds of developments and risks to human sustainability are increasing due to the loss of 'natural buffers' on a number of levels. During the last five decades, people have altered wetlands and other eco-systems more extensively and quickly than any other span of time in previous history of mankind. The alterations are largely associated to the activities carried out to meet rapidly increasing needs for fresh water, fiber, food, timber and fuel. Unplanned developments have caused the rapid deterioration of wetlands, fuelled largely by residential or industrial needs (Parikh & Datye, 2003). Expansion of infrastructure and intensification of economic activities have caused great and mostly irreversible loss to biodiversity and other benefits of wetlands all over the globe. Although, alterations made in eco-systems have added noticeably to net gains in human well-being and economic development, but at the expense of ecosystems depletion. While altering an ecosystem we must remember that natural resources have their own inherent value, that is, they are important for their own sake apart from their functional value. Through different activities wetlands are subjected to various losses and degradation. Most of the losses have been caused by population pressure, over-harvesting, infra-structure development, land conversion, pollution, ineffective planning processes, and poor financial policies. During the 20<sup>th</sup> century onwards, enhanced fresh water use for various purposes has decreased the ecological character of various inland water systems. However, it is believed that primary and direct source of wetland degradation is conversion of land uses, growth of human population and economic development. Almost half of the world's big cities, including Karachi, are situated within the distance of 50 km from the coast where population densities are several times larger than the inland regions. This is the consequence of urban growth and expansion of sub-urban areas, and increasing demands for agriculture. Coastal populations largely depend upon the food obtained from water. For that reason, coastal fishing is depleting the stocks of finfish, crustaceans and mollusks disrupting the marine food web.

### **RATE AND EXTENT OF WETLAND LOSS AND DEGRADATION**

It has been estimated that worldwide loss of those wetlands which are present since 1900 is about 50% (OECD, 1996; Dugan, 1993). Most of this loss turned out during the first half of 20<sup>th</sup> century mostly in the countries located in northern hemisphere. Since 1950s, wetlands of sub-tropical and tropical regions have been damaged progressively or lost due to conversion into agricultural land use. It is another common view that

agriculture is the chief reason of wetlands loss through out the world. It was estimated in 1985 that 56% to 65% of existing wetland has been converted to intensive agricultural use in Europe and North America, 27% in Asia, 6% in South America and 2% in Africa, pointing to a total loss of 26% to agriculture globally (OECD, 1996).

The rate and extent of loss to wetland and their degradation is notably related to the concern of water allocation and supply, which, in recent times, has become exceedingly crucial and is likely to turn into further so in coming times. To meet the ever increasing demands for hydroelectricity and irrigation water, flow of several rivers round the globe, including the rivers of Pakistan, has been regulated to a great extent by constructing headwork, barrages and dams. The resulting impacts on rivers, lakes, swamps and other water bodies include increasing salinity, receding underground aquifers, retreating biodiversity and diminishing fish stocks because of degraded habitation and hindered migration (Gopal & Wetzel, 1995; Liu, 1984; Bolen, 1982). Many countries including Pakistan are now confronting the issue of sedimentation of water reservoirs. Taub (1984) in a study conducted on Japan revealed that increasing water demand has resulted in the construction of several dams and lakes on almost every river system of the country, but a decline of 70% to 80% in water volume, caused by siltation was noted within a span of 20 to 30 years. Growing population and associated developments are also causing augmentation in the release of domestic, industrial, agricultural and other pollutants to the wetlands. Even though, there have been sporadic studies in many developing countries like Pakistan, on pollutants and their harms, specifically in the field of fisheries (Gopal & Wetzel, 1995). Such kind of impacts are not restricted to inland wetlands, the marine wetlands are also under a tremendous threat. A study conducted on coral reefs, tells that almost 58% of the global reefs are at moderate to high danger merely due to human interruption (WRI, 1998). Worldwide, 12% of the total reefs were grouped as endangered by marine pollution, 22% by inland pollution, 30% by coastal development and 36% by over-exploitation. Moser et al (1996) pointed out that data provided by Ramsar contracting agencies tells that 84% of Ramsar listed wetlands had undergone or were in danger by ecological change. Almost similar results were obtained when main threats to wetlands were studied for Asia (Scott & Poole, 1989) and for tropical region (Scott & Carbonell, 1986). Some serious threats were noted to wetland sites in Asia and in the tropics. Expansion of settlements, urbanization, drainage for agriculture, hunting and pollution appeared to be the top five major threats in these regions (Moser et al, 1996). It can be clearly observed just by visiting the sites that, Kabul, Soan, Malir and Layari rivers of Pakistan are extremely polluted due to unchecked inflow of sewage and industrial waste. It has also been brought into the notice that aquatic weed invasions influence about 182,118 hectors of wetlands in Pakistan and badly affect the fish output (Gopal & Wetzel, 1995).

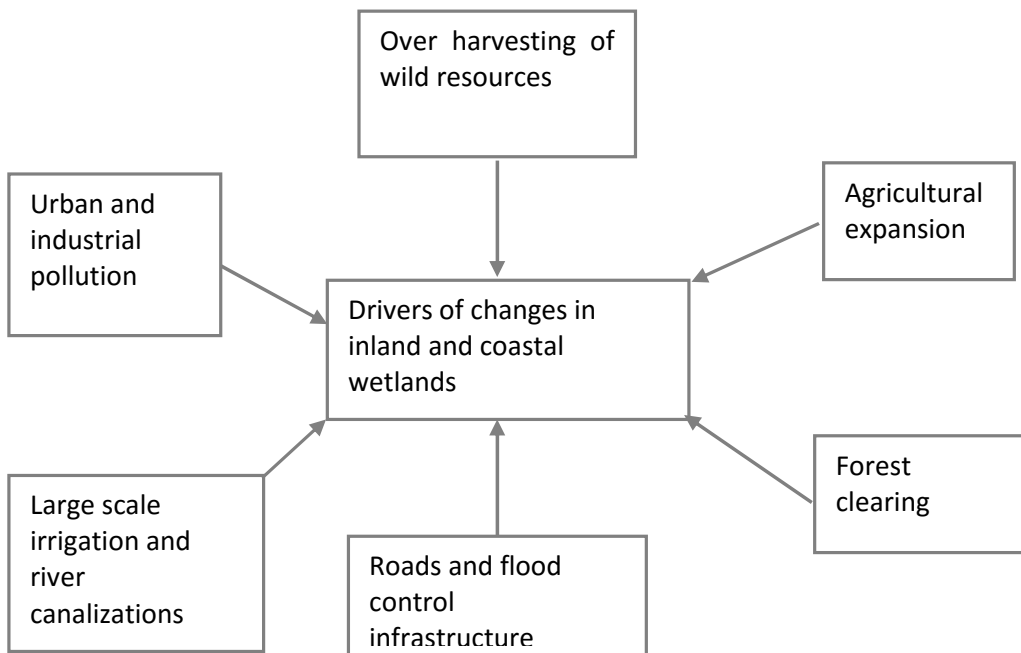
Scott (1993b) suggested that considerable thought should be given as to how available and new wetland inventories can be utilized as a foundation for examining wetlands loss, mainly by updating and standardizing them.

### MAJOR CAUSES OF WETLAND DEGRADATION IN PAKISTAN

Some of the major causes of wetlands degradation in Pakistan are listed below as well shown in fig 3.

1. Lack of effective policies and inadequate management and conversion of wetland areas and their surroundings into agricultural and other uses.
2. Changes occurring in water flow system due to rapid expansion of population
3. Pollution due to organic and inorganic pollutants and unsustainable use of wetlands, e.g. extraction of more water than their refilling capacity.
4. Over-use and misuse of wetland resources by the people and physical alterations in wetland eco-systems are other important threat to Pakistan's wetlands. The foremost activities causing such changes are deforestation, overgrazing in catchments areas, agricultural expansion to marginal lands etc.
5. Off-site activities causing physical and chemical changes in wetlands e.g. addition of polluted water draining into wetlands from upstream agricultural, industrial or other activities.
6. Another factor of wide ranging impact is global warming which is associated to extended drought conditions and overall rise in the temperature of water bodies that is leading to loss of species and bleaching of coral reefs.

**Figure 3:** Major causes of wetland degradation in Pakistan



Moreover, during the field visits of a number of lakes such as Lake Saif-ul-Maluk, Lake Banjosa (Rawalakot), Kalar Kahar Lake (Salt Range), Rawal Lake, Mangla Lake, Simbly Lake, Khanpur Lake and several other wetlands, it was noted that level of awareness among the visitors and people living in the adjacent areas of wetlands is incredibly low. They do not care at all while throwing solid and liquid pollutants in the waters of wetlands. Many people have developed their businesses in nearby areas to serve the visitors. Number of small hotels and shops of edible items is rapidly increasing year by year without any check and balance. A substantial increase in various leisure activities like the horse-riding etc, which were as entirely absent in the near past, are seriously damaging to the natural beauty of wetlands and must be checked. The stakeholders should take care of the worth of these places and should get pleasure and gratification from natural beauty for which they reach there. It must be kept in mind that for the sake of minor and short-term profits we may lose long-term benefits.

## **SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF WETLANDS IN PAKISTAN**

The most widely accepted and used definition of sustainable development is the 'Development which meets the needs of the present without compromising the ability of future generations to meet their own needs' (UN World Commission on Environment and Development, 1987). The significance of wetlands and the severity of threats to their veracity and reliability were internationally accepted and taken into account in 1960s and afterwards RC was held in 1971, in acknowledgment of the importance and worth of wetlands as well as in recognition of the need to protect them from intrusions at global scale. Currently, Pakistan's wetland program is working to protect and promote globally significant biodiversity of the country. Primarily, it has two main objectives;

1. To create and maintain enabling environment for sustainable and effective conservation of natural wetlands at local level.
2. To implement sustainable wetland conservation strategy at four representative sites that will serve as model for subsequent wetland conservation.

The program is actively working in four representative areas namely, Lakes of the alpine region, Lakes of the Salt Range, Coastal wetlands, and Riverine wetlands. At present, all these different kinds of Pakistan's wetlands are providing support for earning livelihood of the local people who are largely dependent on agriculture, livestock raising and fish catch. The program is working on two main dimensions at the same time. First is to promote sustained yield management models that maintain these survival oriented activities and second is to protect and conserve the biodiversity of concerned regions.

Moreover, for the conservation of Pakistan's wetlands and for environmental education WWF Pakistan has established a wetland centre at Sandspit, located in west of Karachi. WWF Pakistan wetland projects are aimed at to conserve the wetlands of Pakistan, identify the wetland complexes, enhance biodiversity, create awareness among the people, and prepare and implement national wetland conservation strategies for

sustainable development of wetlands. However, despite all these positive things, many people are still unaware of the worth of this crucial component of global ecosystem, thus, research based planning and further efforts are needed in this regard. In sum, natural environment and human culture are two mutually dependent factors and thus we cannot comprehend and cope with the natural environment until and except we know the cultural environment that shapes it. For that reason, cultural values are imperative in strengthening the relations of humans to wetlands. Knowledge of these relations is a precondition for the conservation and sustainability of wetlands and the sustainable use of their services and resources.

## **CONCLUSION**

The study concludes that Pakistan is home of different types of wetlands which are of the immense worth for the development of country. However, various factors are putting serious stress to these valuable resources and for this reason their conservation is an important need of the time. The chief driving forces at the back of wetlands working are their hydrology and hydrodynamics. Therefore, any sort of change in these forces associated to human activities can alter the vital functions and services of wetlands. Under a wide range of anthropogenic pressure, the wetlands of the country are generally deteriorating. At present, the main factors that are causing changes and can potentially alter the natural hydrology of wetlands of Pakistan are disruption of natural drainage systems, diversion of water flow, construction of infrastructure and dams in drainage basins, overgrazing, and deforestation. Thus, conservation of wetlands is dire need of the time to avoid severe and multiple damages. Increasing awareness among the people can help a lot in this regard. For sustainable development, wetlands need the attention of government and local people at the regional level. Although, Pakistan's Wetland Program is playing an important role in this connection and each year 2<sup>nd</sup> February is observed as wetland day along with other nations of the world, but, lot more is required to be done to save this precious resource. If we succeed in creating awareness among the people about the conservation and 'Wise Use Concept' of wetland resources, these can expectantly not only benefit us for long period of time but can serve our future generations also. In this regard, more scientific studies are also required to be conducted on the recognition and application of techniques for the sustained management of wetlands of the country in the wake of climate change and expansion of man economic activities.

## **SUGGESTIONS**

To manage properly the wetland of Pakistan, study puts forward following suggestions;

1. At the outset a national wetland inventory based on modern scientific techniques should be prepared, preferably in line with the directions of RC and using an approach similar with other international level wetland inventories that have been completed or in progression.

2. For the proper understanding of the importance and values of wetlands, awareness among the people at local and national level is required. It should be treated as an essential ingredient of wetland conservation and management strategy. And for the sake of adequate information, quantitative studies of wetland depletion and services losses should be conducted.
3. Wetland protection and sustainable use legislation should be made practical and effective according to the instructions of RC.
4. Information about wetland inventory should be utilized to point out priority areas for protection and management and action should be taken in the light of their evaluation. In future, in addition to hard form, information about wetland inventories should be made available electronically, as in this way accessibility and regular updating of information can be made easy.
5. Devising a standardized, flexible and effective approach and preparation of generic wetland inventory database can be very handy to be used in all regions of the world and at the same time accommodating inventory objectives as well.

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