

The Indus Delta is landmark of Pakistan's coastline extending up to 150 km along the Arabian Sea. It comprises of 17 major and numerous minor creeks, an extensive area of mud flats and mangrove forests. The delta holds 97% of the total mangrove forests of Pakistan. Nearly 95% of the total mangrove cover in the delta is comprised of *Avicennia marina*. The Indus Delta occupies almost 6,00,000 ha area located mainly in Badin and Thatta districts of Sindh Province. Indus Delta mangroves, one of the largest tracts of arid mangroves in the world, used to cover an approximate area of 2,50,000 to 2,83,000 ha till early 1980s but the area dropped drastically to 1,60,000 ha in 1990s. A recent study by WWF - Pakistan (2006) has estimated the existing cover of the Indus delta mangroves around 73,000 ha. Historically, there used to exist eight species of mangroves which have declined to four species at present. Legally, mangrove forests of the Indus Delta have been notified as "Protected Forests" on 29th August 1958.

Ecologically, the Indus Delta mangroves constitute a complex ecosystem with the following outstanding significance:

- Providing habitat, shelter and breeding ground for economically important marine plants, animals and migratory birds;
- Protecting coastline and sea ports from storms, cyclones and Tsunamis;
- Meeting fuelwood requirements of local communities and fodder for their livestock;
- Sustaining livelihoods of coastal population of more than 1,00,000 people;
- Serving as laboratory for marine research;
- Serving as nursery for fish, shrimp and crabs those spend at least a part of their lives in mangroves.



INDUS DELTA

A VANISHING ECOSYSTEM

Socio-economic Profile

Most of the inhabitants of deltaic region are fisher folk who fish in river, estuaries, lakes and creeks and their livelihood is mainly dependent on natural resources. Apart from fresh water fisheries, about 200 fish species have been recorded from the delta region. Export of fisheries resource contributes almost 2% of the total national exports amounting to 8.8 billion rupees annually. Of the total export, shrimp contributes 60% while the rest 40% is from fish. Besides fishing, many coastal people are engaged in agriculture and livestock rearing.

The average household size in the deltaic areas is of 8 members. The coastal belt of deltaic region is inhabited by casts like Shaikh, Syed, Memon, Lund, Mallah, Jaat, Korai, Pir, Talpur, Abra and others. Sindhi is the language of the majority of the population. The extreme coastal areas where communities are exclusively engaged in fishing, Mallah is the dominating clan with the majority of Dabla sub-clan. Thatta and Badin are the principal districts of Indus delta with an estimated population of 2.3 million.



Livelihoods

Local people of deltaic region are engaged in different professions as under:

Fishing: 90%

Agriculture & Forestry: 8 %

Services Sector: 2%

Biodiversity

The Indus Delta and the surrounding habitats constitute diverse ecosystems including; riverine forests, irrigated plains, fresh water and brackish wetlands. The land along the main course of River Indus is very fertile and supports a diversity of agricultural crops like wheat, maize, cotton, sugarcane, rice and a multitude of fruit orchards such as Bananas, mangoes, Date palm, Ber and Coconut palm. Fisheries include Indus Baril, Indus Garua, Golden Mahasheer and famous Palla fish.

Riverine forests along the banks of River Indus comprise species like Tamarix (Lai), Prosopis cineraria (Kandi), Acacia nilotica (Babur) and Saccharum sp. These forests provide abode to a variety of birds, mammals, reptiles and amphibians. Keenjhar and Haleji are the two important fresh water lakes lying at the apex of the coastal region. These lakes are wildlife sanctuaries and have been declared as wetlands of international importance under the Ramsar Convention.

Important Ecosystems of Indus Delta

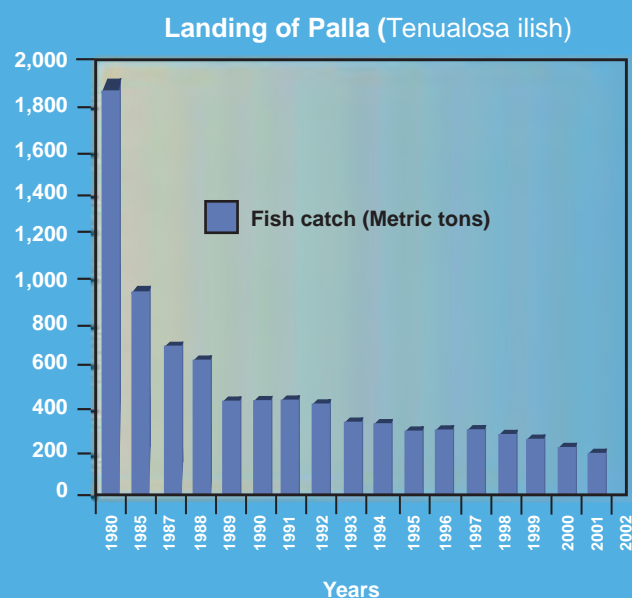
- Riverine Forests ■ Freshwater Lakes
- Mangroves ■ Brackish and Salt Lakes
- Coastal Belt



Status of Palla Fish (Tenualosa ilisha)

The famous prized Palla fish (*Tenualosa ilisha*) has migratory habits and for breeding it ascends upstream in River Indus from the Arabian Sea. The fish had been reported to ascend as far as Multan before the construction of barrages on River Indus but presently it is reported to travel up to Kotri Barrage for breeding (from July to September). Subsequently, the fish fries and the adults return to Arabian Sea and this activity pattern continues year after year.

Due to very low discharge of Indus and lack of flooding, the fish has been unable to migrate upstream for breeding and, hence, the stocks of Palla fish have depleted at an alarming pace during the last 15 years. In the past, it reportedly comprised of 70% of the total catch. However, presently it hardly constitutes 15 % of the total catch. The decline in the catch of this fish can be visualized from the chart.

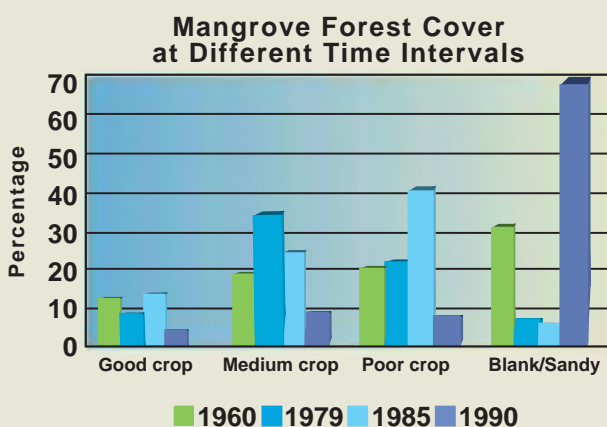


Palla Fish: A delicacy that is diminishing sharply

Major Stresses on Deltaic Ecosystems

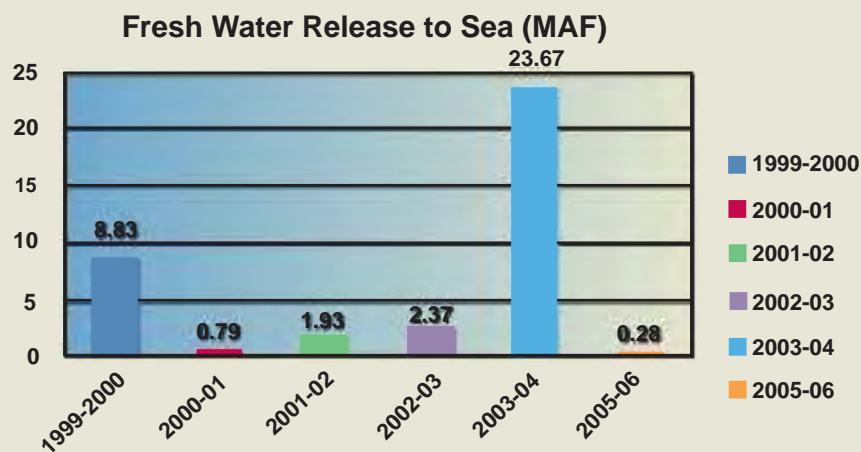
The riverine, irrigated and wetland ecosystems in the deltaic region are subject to several anthropogenic pressures causing severe damage to the coastal and inland ecosystems and their biodiversity values.

Mangrove vegetation in the Indus Delta has declined significantly from the period between 1960 and 1990. Some of the important factors responsible for this degradation are discussed as under:



i. Reduced River Flow

The survival of the Indus Delta is dependent on the silt-laden freshwater discharges from River Indus which has been curtailed due to diversion of water for agriculture, power generation, and other uses in the upper reaches. The freshwater flows into the delta during the recent years have been inconsistent and mostly below the minimum required quantity as shown in the following figure:



The reduction in the inflow of freshwater has exposed this complex ecosystem to several environmental and social stresses in the form of loss of habitat and biodiversity and a decline in the productive values of the ecosystem. The salinity in the delta has been enhanced to 50 ppt and deposition of alluvium—the fine-grained nutrient-rich soil—has reduced from 400 to 100

million tons per year, creating the conditions unfavourable for mangroves and associated biodiversity.

Due to these stresses the catches of two commercially important (migratory) finfish species, Palla (*Tenualosa ilisha*) and Dangri (*Lates calcrifer*) have declined from 600 tons in 1986 to 200 tons in 1995. Palla used to dominate the fishery of Sindh with a record catch of 7900 tons in 1959 (Hoekstra, et.al. 1997).

ii. Sea Water Intrusion

The continuous reduction in fresh water inflow below Kotri Barrage is resulting in salt water intrusion, changes in the geomorphology of the delta and nutrient imbalance of the ecosystem. It is estimated that the sea water intrusion has taken place upto 67 km resulting in damage to deltaic ecosystem and adversely affecting the ground aquifers.

iii. Gradual Increase in Sea Level

The general phenomenon of sea level rise is attributed to global warming. It is reported that over the last 100 years, the sea level near Karachi has been rising at a rate of 1.1 mm per year and this may increase with global warming. Pakistan has been listed among the ten countries most vulnerable to the impacts of rising sea levels. It is estimated that mangroves, with significant discharge from the land, can maintain themselves by accumulating deposited silt with sea level rise as high as 2.5 mm/year.

iv. Marine and Coastal Pollution

Pollution of the marine environment is another proximate cause of biodiversity loss in the coastal areas of Pakistan. Untreated industrial effluents and agricultural run off are the major sources of coastal and marine pollution. Effluents containing Lead, Mercury and other heavy metals mainly from tanneries are most harmful to marine life. It is estimated that about 37,000 tons of industrial waste is being dumped yearly in the coastal environment of Karachi whereas, 20,000 tons of oil finds its way to beaches and harbours and the fishing grounds of Karachi annually. High concentration of these pollutants results in bioaccumulation of toxic compounds and eutrophication. The situation is worsening with every passing day and resulting in huge losses to economic productivity and biodiversity.

v. Meandering and Erosion of Creeks

The meandering of small creeks and channels is also one of the causes of natural death of the mangroves stands. This natural process results in habitat changes because some of the areas are cut-off from regular flood waters, while the others receive additional soil deposits, resulting in creation of high lying areas. The erosion of creek banks destroys woody vegetation on these banks. This phenomenon is particularly evident along creeks near the sea where tidal movement is the fastest.

Apart from the factors described above, there are several other anthropogenic factors such as browsing by camels and grazing by cattle, fodder harvesting, wood cutting and effluents from drainage schemes.

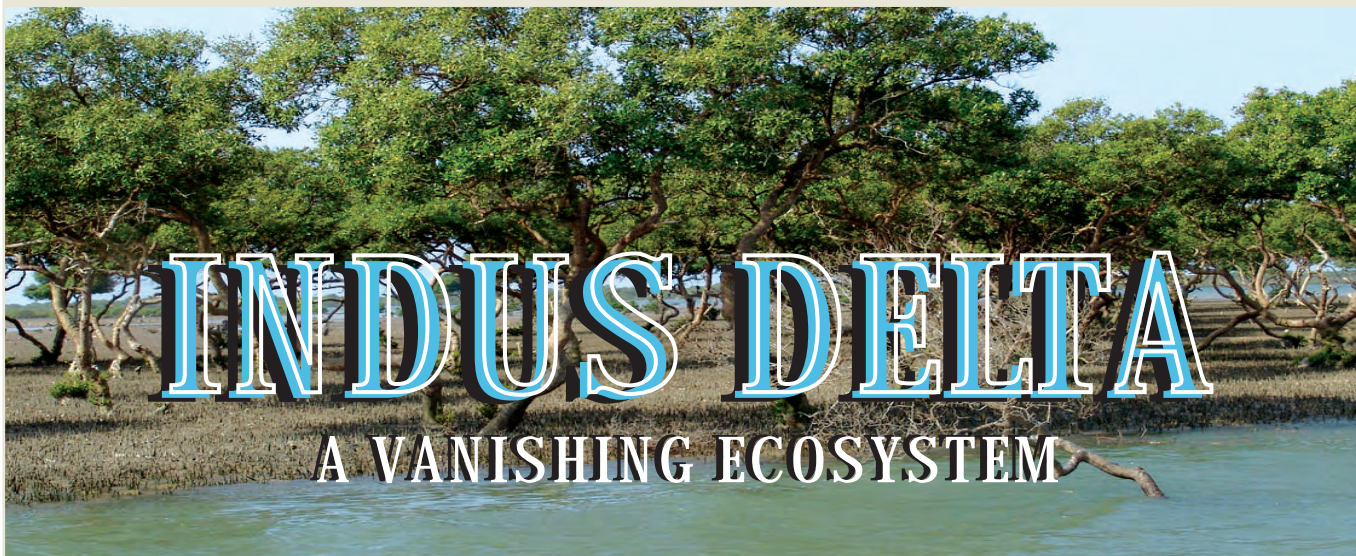
The process of retrogression of riverine and deltaic ecosystems has already approached the alarming levels which would have far reaching impacts on the natural resources and the ecology of the tract as a whole. If, the future water resource management is such, as in fact it is, that little or no water is allowed to flow into the delta, the economic and ecological benefits provided by these ecosystems will be lost.

Indus flooding is the lifeline for the survival of these ecosystems without which their sustainability would be at risk. The United Nations report on Global Environmental Outlook for 1997 listed Pakistan among the three countries in Asia, besides Maldives and Bangladesh, which are most likely to face environmental problems. The report puts Pakistan among the eight drought-prone countries of the region. We are already experiencing this situation in the form of frequently occurring natural disasters.

We, therefore, need to adopt a holistic approach towards the management of our ecological assets so as to sustain them for our needs and that of our future generations. Adoption of environment-friendly policies and strategies is required to heal the injuries inflicted upon ecosystems. Indus Ecoregion Conservation Programme is one such step which needs support from the government, civil society and the concerned citizens to keep our natural heritage flourishing.

Short-term Measures

- The 1991 Water Accord should immediately be re-visited so that the amount of water being released down stream of Kotri Barrage is assessed and minimum critical need to maintain deltaic ecosystems in a healthy state should be determined.
- Holistic policies ensuring conservation of mangroves and the associated biodiversity in the area should be formulated.
- Livelihood opportunities for the local communities with particular focus on fisheries resource should be enhanced.
- Shortage of drinking water for local population is a serious problem and needs to be resolved on priority basis to make community's life a bit easier.
- Disaster relief and mitigation measures need to be taken up on war footings. Cyclones, sea storms and tsunamis will be now frequent than ever before because of the global climate change. There is need that Elevated Emergency Platforms on the entire coastline are built at appropriate locations for timely rescue and relief operations.



Long-term Measures

- A comprehensive land-use plan focusing clearly on the areas fit for different developmental and environmental interventions now and in future is seriously required. This plan must be built and later monitored through satellite data.
- Fisheries sector plays a vital role not only for the well being of the local communities but, also contributes significantly to the national income. This important resource has not received attention from the government for its long-term sustainability. A comprehensive plan is required to address the issues hampering the development of this vital resource with particular focus on proper jetties, ban on use of illegal nets, fish storage and processing facilities and elimination of fisher folks' debt cycle.
- Social services sector needs to be critically examined as the entire Indus Delta region lacks proper facilities of education, health and communication.

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"Only when you have felled the last tree, caught the last fish and polluted the last river, will you realize that you can't eat money."

Native American Saying

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WWF - Pakistan

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