

LOSS OF WETLANDS A GREAT THREAT TO ECOLOGICAL BALANCE

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ABSTRACT

Wetlands are among the world's most productive environments. They are cradles of biological diversity, providing potable water and primary productivity upon which countless species of plants and animals depend for survival. They support large numbers of birds, mammals, reptiles, amphibian, fish, and invertebrate and microorganism species. Wetlands in India are facing an ecological imbalance. Uncontrolled siltation, discharge of waste water and industrial effluents, denudation of aquatic vegetation, aquaculture in coastal areas, construction of dykes, dams and seawalls, discharge of pesticides, herbicides, filling for solid waste disposal are some of the major threats to wetlands.

Keywords: *Wetlands, Ramsar sites, Values, Loss, Ecological imbalance, Problems, Conservation.*

Introduction

Wetlands are defined as 'lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitsch & Gosselink 1986). The value of the world's wetlands are increasingly receiving due attention as they contribute to a healthy environment in many ways. They retain water during dry periods, thus keeping the water table high and relatively stable. During periods of flooding, they mitigate flood and to trap suspended solids and attached nutrients. Thus, streams flowing into lakes by way of wetland areas will transport fewer suspended solids and nutrients to the lakes than if they flow directly into the lakes. The removal of such wetland systems because of urbanization or other factors typically causes lake water quality to worsen. In addition, wetlands are important feeding and breeding areas for wildlife and provide a stopping place and refuge for waterfowl. As with any natural habitat, wetlands are important in supporting species diversity and have a complex of wetland values. The present review is aimed at providing in a nutshell, the distribution of wetlands, the value of wetlands, the causes and consequences of the loss of wetlands. The review attempts to provide a glimpse of the use of modern spatial technology tools, viz. Remote Sensing / GIS for obtaining an assessment, description and monitoring of inland wetlands. The review also gives a methodology for an ongoing nationwide attempt on evolving a conservation area network or a protected area network of inland wetlands.

Distribution of wetlands in India

India, with its annual rainfall of over 130 cm, varied topography and climatic regimes support and sustain diverse and unique wetland habitats. Natural wetlands in India consists of the high altitude Himalayan lakes, followed by wetlands situated in the flood plains of the major river systems, saline and temporary wetlands of the arid and semi-arid regions, coastal wetlands such as lagoons, backwaters and estuaries; mangrove swamps; coral reefs and marine wetlands, and so on. In fact with the exception of bogs, fens and typical salt marshes, Indian wetlands cover the whole range of the ecosystem types found. In addition to the various types of natural wetlands, a large number of man-made wetlands also contribute to the faunal and floral diversity. These man-made wetlands, which have resulted from the needs of irrigation, water supply, electricity, fisheries and flood control, are substantial in number. The various reservoirs, shallow ponds and numerous tanks support wetland biodiversity and add to the countries wetland wealth. It is estimated that freshwater wetlands alone support 20 per cent of the known range of biodiversity in India (Deepa & Ramachandra 1999) Wetlands in India occupy 58.2 million hectares, including areas under wet paddy cultivation (Directory of Indian Wetlands). Majority of the inland wetlands are directly or indirectly dependent on the major rivers like, Ganga, Bhramaputra, Narmada, Godavari, Krishna, Kaveri, Tapti. They occur in the hot arid regions of Gujarat and Rajasthan, the deltaic regions of the east and west coasts, highlands of central India, wet humid zones of south peninsular India and the Andaman and Nicobar & Lakshwadeep islands.

Ramsar Convention and its Importance

The Ramsar Convention on Wetlands is an intergovernmental treaty which provides the framework for international cooperation and national action for the conservation and the wise use of wetlands and their resources by the member nations. It was signed in a city of Iran called **Ramsar** in 1971 and also known as the **Convention on Wetlands**.

The purpose to declare Ramsar Sites under Ramsar Convention is to stop the worldwide loss of wetlands and to conserve them, through wise use and management. This aim requires international cooperation, policy making, capacity building and technology transfer. Wetlands for the list are selected because of their ecological, botanical, zoological, limnological or hydrological importance. India signed Ramsar convention on wetlands on 1st February 1982. The Ramsar treaty encourages the designation of wetland sites containing representative, rare or unique wetlands, or wetlands that are important for conserving the biological diversity. After a site is added to the Convention's List of Wetlands of International Importance it become known as Ramsar sites. When a wetland is declared as a Ramsar site, the host country agree to establish and oversee a management framework for conserving the wetland and ensuring its wise use.

There are 75 Ramsar sites in India as of now in 2023, of which Keoladeo Ghana NP in Rajasthan and Chilka Lake in Orissa were together declared first Ramsar sites in India on 1.10.1981. Sundarbans Wetland in West Bengal having 4230 Sq. Km. area is largest Ramsar site in India. Renuka Wetland in Himachal Pradesh having 0.2 Sq. Km area is the smallest Ramsar site in India

Values of Wetlands

Wetlands provide many services and commodities to humanity. Regional wetlands are integral parts of larger landscapes, their functions and values to the people in these landscapes; depend on both their extent and their location. Each wetland thus is ecologically unique. Wetlands perform numerous valuable functions such as recycle nutrients, purify water, attenuate floods, maintain stream flow, recharge ground water, and also serve in providing drinking water, fish, fodder, fuel, wildlife habitat, control rate of runoff in urban area, buffer shorelines against erosion and recreation to the society. The interaction of man with wetlands during the last few decades has been of concern largely due to the rapid population growth- along with intensified industrial, commercial and residential development further leading to pollution of wetlands by domestic, industrial sewage, and agricultural run-offs as fertilizers, insecticides and feedlot wastes.

The fact that wetland values are overlooked has resulted in threat to the source of these benefits. Wetlands are often described as “kidneys of the landscape” (Mitsch & Gosselink 1986). Hydrologic conditions can directly modify or change chemical and physical properties such as nutrient availability, degree of substrate anoxia, soil salinity, sediment properties and pH. These modifications of the physiochemical environment, in turn, have a direct impact on the biotic response in the wetland (Gosselink & Turner 1978). When hydrologic conditions in wetlands change even slightly, the biota may respond with massive changes in species composition and richness and in ecosystem productivity. Traditional limnological methods of assessment of water quality are time consuming and uneconomical,

but using remote-sensing data assessment of water quality and productivity in surface impoundment is both cost effective and fast. The indicators useful for such an assessment include suspended materials visible to the human eye, which include suspended inorganic material, phytoplankton, organic detritus and dyes.

Diversity of Aquatic Plants and Birds

Aquatic biodiversity is dependent on hydrologic regime; geological conditions and efforts are being made to conserve the biodiversity found in wetlands, streams and rivers. The goal of this irreplaceable biodiversity is to minimize its loss through sustainable management and conservation practices. The first step in conservation of biodiversity is to assess the diversity of natural resources present and identify those, which are important and most irreplaceable (Groombridge & Jenkins 1998). Awareness of the unique nature of biodiversity, the plethora of factors contributing to decline in habitat quality and species populations has been growing in the past decade.

In India, lakes, rivers and other freshwaters support a large diversity of biota representing almost all taxonomic groups. Algae in open waters represent the floristic diversity and macrophytes dominate the wetlands. It is difficult to analyze the algal diversity in India with reference to different habitats, endemism to India, as well as the changes that occur due to anthropogenic disturbances. From an ecological point of view, the diversity of species present in the wetlands is an indication of the relative importance of the aquatic biodiversity issue as a whole. The total numbers of aquatic plant species exceed 1200 and a partial list of animal for aquatic and wetland system is given by Gopal (1995). Wetlands are also important as resting sites for migratory birds. Aquatic vegetation is a valuable source of food, especially for waterfowl. In the winter, migratory waterfowl search the sediment for nutritious seeds, roots and tubers. Resident waterfowl may feed on different species of aquatic vegetation year-round.

Diversity of fishes

The Indian fish fauna is of two classes, viz., Chondrichthyes and Osteichthyes. The Chondrichthyes are represented by 131 species under 67 genera, 28 families and 10 orders in the Indian region (Kar *et al.* 2000). The Indian Osteichthyes are represented by 2,415 species belonging to 902 genera, 226 families and 30 orders, of which, five families, notably the family Parapsilorhynchidae are endemic to India. These small hill stream fishes include a single genus, viz., Parapsilorhynchus that contains 3 species. They occur in the Western Ghats, Satpura mountains and the Bailadila range in Madhya Pradesh only. Further, the fishes of the family Psilorhynchidae with the only genus Psilorhynchus are also endemic to the Indian region. Other fishes endemic to India include the genus Olytra and species *Horaichthys setnai* belonging to the families Olytridae and Horaichthyidae respectively.

Loss of Wetlands – a threat to ecological balance

Wetlands are one of the most threatened habitats of the world. Wetlands in India, as elsewhere are increasingly facing several anthropogenic pressures. Thus, the rapidly expanding human population, large scale changes in land use/landcover, burgeoning

development projects and improper use of watersheds have all caused a substantial decline of wetland resources of the country. Significant losses have resulted from its conversion threats from industrial, agricultural and various urban developments. These have led to hydrological perturbations, pollution and their effects. Unsustainable levels of grazing and fishing activities have also resulted in degradation of wetlands. The current loss rates in India can lead to serious consequences, where 74% of the human population is rural (Anon. 1994) and many of these people are resource dependent. Healthy wetlands are essential in India for sustainable food production and potable water availability for humans and livestock. They are also necessary for the continued existence of India's diverse populations of wildlife and plant species; a large number of endemic species are wetland dependent. Most problems pertaining to India's wetlands are related to human population.

India contains 16% of the world's population, and yet constitutes only 2.42% of the earth's surface. Indian landscape has contained fewer and fewer natural wetlands over time. Restoration of these converted wetlands is quite difficult once these sites are occupied for nonwetland uses. Hence, the demand for wetland products (e.g., water, fish, wood, fiber, medicinal plants etc.) will increase with increase in population. Wetland loss refers to physical loss in the spatial extent or loss in the wetland function. The loss of one km² of wetlands in India will have much greater impacts than the loss of one km² of wetlands in low population areas of abundant wetlands (Foote Lee *et al.* 1996).

Problems of Wetlands

Some of the major problems of wetlands are as follows.

1. Agricultural conversion

In the Indian subcontinent due to rice culture, there has been a loss in the spatial extent of wetlands. Rice farming is a wetland dependent activity and is developed in riparian zones, river deltas and savannah areas. Due to captured precipitation for fishpond aquaculture in the catchment areas and rice-farms occupying areas that are not wetlands, water is deprived to the downstream natural wetlands. Around 1.6 million hectares of freshwater are covered by freshwater fishponds in India. Rice-fields and fishponds come under wetlands, but they rarely function like natural wetlands. Of the estimated 58.2 million hectares of wetlands in India, 40.9 million hectares are under rice cultivation (Anon. 1993).

2. Deforestation in wetlands

Mangrove vegetation are flood and salt tolerant and grow along the coasts and are valued for fish and shellfish, livestock fodder, fuel wood, building materials, local medicine, honey, bees

wax and for extracting chemicals for tanning leather (Ahmad 1980). Alternative farming methods and fisheries production has replaced many mangrove areas and continues to pose threats. Eighty percent of India's 4240 km² of mangrove forests occur in the Sunderbans and the Andaman and Nicobar Islands (Anon. 1991).

But most of the coastal mangroves are under severe pressure due to the economic demand on prawn culture. Important ecosystem functions such as buffer zones against storm surges, nursery grounds and escape cover for commercially important fishery are lost. The farms also caused excessive withdrawal of freshwater and increased pollution load on water like

increased lime, organic wastes, pesticides, chemicals and disease causing organisms. The greatest impacts were on the people directly dependent on the mangroves for natural materials, fish proteins and revenue. The ability of wetlands to trap sediments and slow water is reduced

3. Hydrologic alteration

Alteration in the hydrology can change the character, functions, values and the appearance of wetlands. The changes in hydrology include either the removal of water from wetlands or raising the land-surface elevation, such that it no longer floods. Canal dredging operations have been conducted in India from 1800s due to which 3044 km² of irrigated land has increased to 4550 km² in 1990 (Anon. 1994). Initial increase in the crop productivity has given way for reduced fertility and salt accumulations in soil due to irrigated farming of arid soils. India has 32,000 ha of peat-land remaining and drainage of these lands will lead to rapid subsidence of soil surface.

4. Inundation by Dams

Present there are more than 1550 large reservoirs covering more than 1.45 million ha and more than 100000 small and medium reservoirs covering 1.1 million ha in India (Gopal 1994). By impounding the water, the hydrology of an area is significantly altered and allows for harnessing moving water as a source of energy. While the benefits of energy are well recognized, it also alters the ecosystem.

5. Alteration of upper watersheds

Watershed conditions influence the wetlands. The condition of the land where precipitation falls, collects and runs-off into the soil will influence the character and hydrologic regime of the downstream wetlands. When agriculture, deforestation or overgrazing removes the water-holding capacity of the soil, then soil erosion becomes more pronounced. Large areas of India's watershed area are being physically stripped of their vegetation for human use.

6. Degradation of water quality

The latter occur from the Gulf of Kutch to Trivandrum coast. The endemic fish families form 2.21 per cent of the total bony fish families of the Indian region. 223 endemic fish species are found in India, representing 8.75 per cent of the total fish species known from the Indian region and 128 monotypic genera of fishes found in India, representing 13.20 per cent of the genera of fishes known from the Indian region.

Water quality is directly proportional to human population and its various activities. More than 50,000 small and large lakes are polluted to the point of being considered 'dead' (Chopra 1985).

The major polluting factors are sewage, industrial pollution and agricultural runoff, which may contain pesticides, fertilisers and herbicides.

7. Depletion of Ground Water

Draining of wetlands has depleted the ground water recharge. Recent estimate indicates that in rural India, about 6000 villages are without a source for drinking water due to the rapid depletion of ground water.

8. Introduction of Exotic species and extinction of native biota

Wetlands in India support around 2400 species and subspecies of birds. But losses in habitat have threatened the diversity of these ecosystems (Mitchell & Gopal 1990). Introduction of exotic species like Water hyacinth (*Eichornia crassipes*) and Salvinia (*Salvinia molesta*) have threatened the wetlands and clogged the waterways competing with the native vegetation. In a recent years an attempt has been made giving importance of wetlands for conservation. Samant (1999) noted that as many as 700 potential wetlands do not have any data to give importance and many of these wetlands are threatened.

Strategies for conservation of wetlands

The following are strategies for the conservation of wetlands are as follows

i. Protection

The prime necessity today is to protect the existing wetlands. Of the many wetlands in India only around 68 wetlands are protected. But there are thousands of other wetlands that are biologically and economically important but have no legal status yet.

ii. Planning, managing and monitoring

Wetlands that come under the protected area network have management plans but others do not. It is important for various stakeholders along with the local community and corporate sector to come together for an effective management plan. Active monitoring of these wetland systems over a period of time is essential.

iii. Comprehensive inventory

There has been no comprehensive inventory of all the Indian wetlands despite the efforts by the

Ministry of Environment and Forests, Asian Wetland Bureau and World Wide Fund for Nature.

The inventory should involve the flora, fauna, and biodiversity along with values. It should take into account the various stakeholders in the community too.

iv. Legislation

Although several laws protect wetlands there is no special legislation pertaining specially to these ecosystems. Environment Impact Assessment needed for major development projects highlighting threats to wetlands need to be formulated.

v. Coordinated approach

Since wetlands are common property with multi-purpose utility, their protection and management also need to be a common responsibility. An appropriate forum for resolving the conflict on wetland issues has to be set up. It is important for the ministries to allocate sufficient funds towards the conservation of these ecosystems.

vi. Research

There is a necessity for research in the formulation of national strategy to understand the dynamics of these ecosystems. This could be useful for the planners to formulate strategies for the mitigation of pollution. The scientific knowledge will help the planners in understanding the economic values and benefits, which in turn will help in setting priorities and focusing the planning process.

vii. Construction awareness

For achieving any sustainable success in the protection of these wetlands, awareness among the general public, educational and corporate institutions must be created. The policy makers, at various levels along with site managers need to be educated. As the country's wetlands are shared, the bi-lateral cooperation in the resource management needs to be enhanced.

viii. Use of remote sensing and GIS

Remote sensing data in combination with Geographic Information System (GIS) are effective tools for wetland conservation and management. The application encompasses water resource assessment, hydrologic modeling, flood management, reservoir capacity surveys, assessment and monitoring of the environmental impacts of water resources project and water quality mapping and monitoring (Jonna 1999).

Present scenario of Wetlands

Wetlands are not bordered under any specific administrative jurisdiction. The major responsibility for the management of these ecosystems is in the hands of the Ministry of Environment and Forests. Although some wetlands are protected after the framing the Wildlife Protection Act, the others are in great danger of extinction. So efficient coordination between the different ministries such as energy, industry, fisheries, revenue, agriculture, transport and water resources, is very essential for the protection of these ecosystems.

Due to urbanization or human interference, the wetland and its unique ecosystem biodiversity are in danger. After entering into Ramsar Convention, 1971, different acts have been passed in India for conservation of wetlands, along with conducting general awareness program for the local people by the government, conducting different programs, management of wetlands, and research by the government, NGOs and other institutions.

Some of the Protection Laws and Government Initiatives for the conservation of wetlands

Wetlands conservation in India is indirectly influenced by number of policy and legislative measures (Parikh & Parikh 1999). Some of the important legislations are given below:

- The Indian Fisheries Act - 1857
- The Indian Forest Act - 1927
- Wildlife (Protection) Act - 1972
- Water (Prevention and Control of Pollution) Act - 1974
- Territorial Water, Continental Shelf, Exclusive Economic Zone and other Marine Zones Act - 1976
- Water (Prevention and Control of Pollution) Act - 1977

- Maritime Zone of India (Regulation and fishing by foreign vessels) Act - 1980
- Forest (Conservation act) – 1980
- Environmental (Protection) Act - 1986
- Coastal Zone Regulation Notification - 1991
- Wildlife (Protection) Amendment Act - 1991
- National Conservation Strategy and Policy Statement on Environment and Development – 1992
- National Policy and Macro level Action Strategy on Biodiversity-1999.

Conclusion

India is an also signatory to the Ramsar Convention on Wetlands and the Convention of Biological Diversity since 1982. Apart from government regulation, development of better monitoring methods is needed to increase the knowledge of the physical and biological characteristics of each wetland resources, and to gain, from this knowledge, a better understanding of wetland dynamics and their controlling processes. India being one of the mega diverse nations of the world should strive to conserve the ecological character of these ecosystems along with the biodiversity of the flora and fauna associated with these ecosystems. We can also utilize satellite based remote sensors and minimum cost, affordable GIS tools for effective management and monitoring. Efficient coordination between the different ministries such as energy, industry, fisheries, revenue, agriculture, transport and water resources, is much needed for the protection of these wetlands.

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