RESTORATION, REMEDIATION AND CONSERVATION STRATEGIES OF WETLAND ECOSYSTEMS IN INDIA

Dr. V. SUBHASHINI,

HOD Zoology, KBN College, Vijayawada

subhashini_vsn@yahoo.co.in

ABSTRACT

Wetlands are most productive and biologically rich ecosystems on earth and are also among the most endangered. Historically, they have served as the life-blood to societies that depend on them for their livelihood in providing resources. Wetlands may benefit directly as components/products such as fish, timber, recreation and water supply or indirect benefits which arise from the functions occurring with in the ecosystem such as flood control, ground water recharge and storm protection. The mere existence of wetlands may hold great significance to some people as a part of their cultural heritage. Yet these are fragile ecosystems and are susceptible to changes even with little change in its composition of biotic and abiotic factors.

Wetlands are one of the most threatened habitats of the world. In India, the rapidly expanding human population, large-scale changes in land use/land covers, 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 .Due to urbanization or human interference, the wetland and its unique ecosystem biodiversity are in danger. The results of wetland loss leads to environmental and ecological destruction, and depreciation of socio-economic benefits that have largely gone unnoticed where communities depend on wetland resources for survival. After Ramsar Convention, 1971, different acts have been passed in India for conservation of wetlands. There is an urgent need for the Restoration, Remediation and Conservation Strategiesof Wetland ecosystems in India. This can be done by conducting general awareness programs, for the people by the government, NGOs and other institution. Management of wetlands, and research must be encouraged to save and protect the wetlands.

Introduction:

In the text of the RAMSAR Convention (Article 1.1), wetlands are defined as "areas of marsh, fen, peatland 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 metres.

Wetlands, often known as biodiversity "hotspots" as well as pollution filters are being important for carbon sequestration and emissions. These are important storehouses of plant genetic material. Wetlands are among the world's most productive environments. They are cradles of biological diversity, providing 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. The ability of wetlands to adapt to changing conditions, and to accelerating rates of change, is crucial to human communities and wildlife everywhere as the full impact of climate change on our ecosystem lifelines is felt and there is a worldwide focus on wetlands and their services to us.

The value of the world's wetlands is increasingly receiving due attention as they contribute to a healthy environment in many ways. The government identifies 648,507 hectares as wetland in India and it is estimated that freshwater wetlands alone support 20% of the known range of biodiversity in India. The multiple roles of wetland ecosystems and their value to humanity have been increasingly understood and documented in recent years. This has led to larger expenditures to restore lost or degraded hydro-biological and biological functions of wetlands. But it is not enough - the race is on to improve practices on a significant global scale as the world leaders try to cope with the accelerating water crisis and the effects of climate change and this at a time when the world's population is likely to increase by a million every year for the next 20 years.

Global scenario - An Overview of Status of wetlands:

It is interesting to know that, there are nearly 14×10^2 cubic kilometres of water on the planet in which more than 97.5% of the total water in the hydrosphere is deposited in the oceans that cover 71% of the earth's surface. Wetlands are estimated to occupy nearly 6.4% of the Earth's land surface. Nearly 30% is made up of bogs, 26% fens, 20% swamps and 15% flood plains. The amount of fresh water on earth is very small (covers 2.53 % of the earth's water) compared to seawater. Of the Earth's fresh water 69.6% is locked away in the continental ice, 30.1% is in under ground aquifers and 0.26% is composed of rivers and lakes. In particular, lakes are founded to occupy less than 0.007% of world's fresh water (UNEP 1994).

Indian Scenario on Status of Wetlands:

India is blessed with water resources in its numerous rivers and streams. Also, India by virtue of its geographical sketch and varied terrain and climate supports a rich diversity of inland and coastal wetland habitats. The association of man and wetlands is ancient. It is not surprising that the first sign of civilization are traced to wetland areas. The flood plains of the Indus, the Nile delta, and the fertile crescent of the Tigris and Euphrates rivers provided man with all his basic necessities. Water may be required for various purposes like drinking and personal hygiene, fisheries, agriculture, navigation, industrial production, hydropower generation and recreational activities. Obviously, a wide variety of wetlands like marshes, swamps, bogs, peat land, open water bodies like lakes and rivers, mangroves, tidal marshes etc., which can be profitably used by man for his various needs and for environment amelioration. But now, with increasing environmental pressure of unplanned urbanization and growing population, wetland benefits are disappearing.

Distribution of Wetlands in India:

India has totally 67,429 wetlands, which cover an area of about 4.1 million hectares. Out of these, 2,175 wetlands are natural, which cover an area about 1.5 million hectares and 65,254 are man made which occupy about 2.6 million hectares. According to Forest Survey of India, mangroves cover an additional 6,740 sq km. area. Though accurate results on wetland loss in India are not available, the Wildlife Institute of India has conducted a survey on the loss rates and revealed that some 70 - 80 percent of individual fresh water marshes and lakes in the Gangetic flood plains have been lost in the last five decades. Indian mangrove areas have been almost halved from 700,000 hectares in 1987 to 453,000 hectares in 1995.

Threat to Wetlands is a Threat to Ecological Balance

The current loss rates in India can lead to serious consequences, where 74% of the human population is rural (Anonymous, 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. India contains 16% of the world's population, and yet constitutes only 2.42% of the earth's surface. The 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 non-wetland uses. Hence, the demand for wetland

products (e.g. water, fish, wood, fiber, medicinal plants, etc.) will increase with the increase in population. The loss of one km^2 of wetlands in India will have much greater impacts than the loss of one km^2 of wetlands in low population areas of abundant wetlands (Lee *et al.,* 1996).

The Most Seriously Threatened Wetlands in India

Dal Lake, Logtak Lake, Wular Lake, Salt Lakes swamp, Harike Lake, The Sunderban, lheelsin the vicinity of Haldergarh, Chilka Lake, Dahar and Sanj lheels, Kolleru Lake, Southern Gulf of Kutch, Estuaries of the Karnataka coast, Gulf of Khambhat, Kaliveli Tank and Vedayanthhtu Estuary, Khabartal, The Cochin Backwaters, Dipor Bheel, Wetlands in the Andaman and Nicobar Islands.

Wetland Management

Management is the manipulation of an ecosystem to ensure maintenance of all functions and characteristics of the specific wetland type. The loss or impairment of wetland ecosystem is usually accompanied by irreversible loss in both the valuable environmental functions and amenities important to the society (Zentner, J. 1988). Appropriate management and restoration mechanisms need to be implemented in order to regain and protect the physical, chemical and biological integrity of wetland ecosystems.

Management of wetland ecosystems requires an intense monitoring, increased interaction and co-operation among the various agencies (state departments concerned with environment, soil, natural resource management, public interest groups, citizen groups, agriculture, forestry, urban planning and development, research institutions, government, policy makers, etc). Such management goals should not only involve buffering wetlands from any direct human pressures. Wetland management has to be an integrated approach in terms of planning, execution and monitoring requiring effective knowledge on a range of subjects from ecology, economics, watershed management, and planners and decision makers, etc. All this would help in understanding wetlands better and evolving a more comprehensive solution for long-term conservation and management strategies.

Protection Laws and Government Initiatives

India is also a signatory to the Ramsar Convention on Wetlands and the Convention of Biological Diversity; Apart from government regulation, development of better monitoring methods is needed to

increase the knowledge of the physical and biological characteristics of each wetland resource, 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. Wetlands conservation in India is indirectly influenced by an array of policy and legislative measures (Parikh and Parikli,1999). Some Ofthe key legislation is given below :

- The Indian Fisheries Act - 1857
- The Indian Forest Act - 1927
- Wildlife (Protection) Act - 1972
- Water (Prevention and Control of Pol1ution)Act - 1974
- Territorial Water, Continental Shelf, Exclusive Economic Zone and other
- Marine Zones Act - 1976
- Water (Prevention and Control of Pollution) Act - 1977
- Forest (Conservation Act) - 1980
- Environmental (Protection) Act - 1986
- Coastal Zone Regulation Notification - 1991
- National Conservation Strategy and Policy Statement on Environment and I Development - 1992
- National Policy And Macro level Action Strategy on Biodiversity-1999

Restoration

Restoration means re-establishment of pre-disturbed natural and a self regulating/perpetuating system that is integrated ecologically with the landscape and the functions the wetlands perform. The goals for any restoration program should be realistic and tailored to individual regions, specific to the problems of degradation and based on the level of dependence. The restoration program should mandate all aspects of the ecosystems, including habitat restoration, elimination of undesirable species and restoration of native species from the ecosystem perspective with holistic approach designed at watershed level, rather than isolated manipulation of individual elements. This often requires reconstruction of the physical conditions; chemical adjustment of both the soil and

water; biological manipulation, reintroduction of native flora and fauna, etc.

Restoration goals, objectives, performance indicators (indicates the revival or success of restoration project), monitoring and assessment program should be viably planned, so that, project designers, planners, biologists and evaluators have a clear understanding. Monitoring of restoration endeavour should include both structural (state) and functional (process) attributes. Monitoring of attributes at population, community, ecosystem and landscape level is appropriate in this regard. Restoration strategy developed in collaboration with the government, researchers, stakeholders at all levels and the NGOs should address the following.

➢ Set principles for priority setting and decision-making.

➢ Prioritising goals, assessment and monitoring strategies based on specific roles they perform, level of dependency and type of problems faced by wetlands.

➢ Innovation in financing and use of land and water programs for better and sustainable usage of these resources.

➢ It is deemed important to give priority to repair those systems that would have lost without any form of intervention. A framework is to be developed categorising by the level of interventions required for prioritisation (Committee on Restoration of Aquatic Ecosystems et al, 1992) as follows:

➢ Those that recover without any intervention.

➢ One's that can be restored close to their former condition to serve their earlier functions considering cost involved, technical review of the restoration plan etc based on the goals and objectives set.

➢ One's that cannot be restored to any agreeable degree viably.

Methods for Restoration of Wetlands
Creation of Buffer Zones for Wetlands Protection:

• Creating buffer zones limiting anthropogenic activities around the demarcated corridor of the wetland could revive its natural functioning. The criteria for determining adequate buffer size to protect wetlands and other aquatic resources depend on (Castelle et al. 1994):

- Identifying the functional values by evaluating resources generated by wetlands in terms of the economic costs, etc.
- Identify the magnitude and the source of disturbance, adjacent land use and project the possible impact of such stress in long term, etc.
- Buffer characteristics - vegetation density and structural complexity, soil condition and factors.

COMMUNITY SUPPORT:

Wetland management, restoration or conservation of wetland ecosystem requires an integrated, broad-based inter-agency partnership all working towards a common goal involving the educational institutions, Forest department, City Corporation, Irrigation department, Public Works Department (PWD) and Pollution Control Board. The active participation of local community, conservation organisations, NGO's, and citizens' groups with active support from the media at all levels of planning, executing and monitoring is required for implementation of measures to meet the set goals.

Schools and Colleges

The active participation from schools and colleges in the vicinity of the waterbodies may value the opportunity for hands-on environmental education further entailing setting up of laboratory facilities at site. Regular monitoring of waterbodies (with permanent laboratory facilities) provides vital inputs for conservation and management.

Research

There is a necessity for research in the formulation of a 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.

Building Awareness

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

Use of Remote Sensing and GIS in Wetland Management

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

Conclusion

It is noteworthy that even a small country like UK could designate 161 wetlands as Ramsar Sites, India being a mega-diversity country, so far managed to delineate a mere six sites to date. There is obviously much ground to be covered in our conservation efforts for wetlands. In addition, a paradigm shift in our conservation ethic is also a strong need of the hour. This shift is necessary and perhaps mandatory due to the very nature of the resource being conserved and 'protected'. Because wetlands are a common property resource, It is an uphil task to protect or conserve the ecosystems unless the principal stakeholders are involved in the process.

The restoration program with an ecosystem perspective through Best Management Practices (BMPs) helps in correcting point and non point sources of pollution wherever and whenever possible. This along with regulations and planning for wildlife habitat and fishes helps in arresting the declining water quality and the rate in loss of wetlands. These restoration goals require intensive planning, leadership and funding along with the financial resources and active involvement from all levels of organisation (governmental, NGOs, corporate conglomerates, citizen groups, research organisations, media, etc.) through interagency and intergovernmental processes all made instrumental in initiating and implementing the restoration programs. The dynamic nature of wetlands necessitates the widespread and consistent use of satellite-based remote sensors and low-cost, affordable GIS tools for effective management and monitoring.

References

- Chakrapani, B. K., Ramakrishna Parama V. R., 1996. Quality of lake waters in and around Bangalore and Maddur. Water birds and wetlands of Bangalore., 1996.

- Deepa RS, Ramachandra TV. Impact of Urbanization in the Interconnectivity of Wetlands. Paper presented at the National Symposium on Remote Sensing Applications for Natural Resources: Retrospective and Perspective. Bangalore: Indian Society of Remote Sensing; (XIX-XXI, 1999).

- IUCN 1999. Environmental Policy and Law paper No. 38, Published by IUCN, Gland, Switzerland and Cambridge, UK in collaboration with IUCN Environmental Law Centre, Bonn, Germany, pp. 3-21.

- Kiran, R and Ramachandra, T.V., 1999. Status of wetlands in Bangalore and its conservation aspects. ENVIS Journal of Human Settlements, March 1999: 16-24.

- Kiran, R., Deepa, R.S, and Ramachandra, T. V, 1998. Comparative water quality assessment of Bannergatta and Yediur lakes of Bangalore, in proceedings of the National seminar on "Environmental Pollution: Causes & Remedies", P. E. S. Institute of Technology, Bangalore, pp: 166-182.

- Krishna, M.B, Chakrapani, B.K and Srinivasa, T.S, 1996. Water Birds and Wetlands of Bangalore, Karnataka State Forest Department, Bangalore, pp 4- 10, 17- 25, 42 -43 & 49- 57.

- NEERI (National Environmental Engineering Research Institute), 1988. Water and wastewater analysis, pp. XV.

- Prasad AG, Venkataramana GV, Thomas M. Fish diversity and its conservation in major wetlands of Mysore. J Environ Biol 2009; 30:713-8.

- Ramsar Information Paper no. 1. What are wetlands? Convention on Wetlands. Ramsar, Iran, 1971