Management Strategies of Lakes in India

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ABSTRACT

The importance of lakes, ponds and reservoirs as key elements of the aquatic ecosystem which provide valuable habitat for fish, wildlife and plants and important recreational opportunities for people.

This paper provides an overview of the lake management in India. Lakes all over the country are exhibiting varying degrees of environmental degradation caused by encroachment, eutrophication & siltation lakes gets polluted from anthropogenic activities in their catchments. Actions to control & prevent these problems are addressed, with a focus such as role of government in conservation of lakes, various NGO's, public interest litigation, the national lake conversation plan, the promises made in 12th World lake conference held in Jaipur on 29th Oct. 2007. The management of some lakes are discussed in the paper.

Finally the issues related to lack of coordination of people, ineffectiveness of legislation are discussed and possible solution to these impediments is explored.

INTRODUCTION

Water is one of the most abundant substances on the earth. It covers approximately 77 % of the globe. It is estimated that 97 % of the total quantity of water is in the oceans and 3% is fresh water, however only a small portion of the fresh water is available to humans, animals and plants.

Lakes, water reservoirs and streams are the most valuable source of drinking water for the earth's population. The lives of many people depend on both natural lakes and artificial reservoirs which provide water for drinking, agriculture and industrial development.

India has a large number and huge variance of lakes. Many of our lakes are valuable from the historical, cultural, biological and functional point of view. Some lakes in India have significance from religious point of view. The city of Amritsar in Punjab which is famous for the Golden Temple got this name (Amritsar means the lake of water, the drink of Gods. He who drinks water becomes immortal) because of the holy lake. Lakes like the holy pushkar, devoted to Lord Brahma – attract million of devotees and tourists from all parts of the world every year.

Depending upon the depth of water and uses, the lakes are known by different names in different parts of the country like, Jheels, Bheels, Marshes, Talab and Tanks.

India is well known for the huge variance in its lakes, but the data is nebulous. There is no orderly or scientific census of lakes. Though there is a distinction between fresh water lakes and brackish water lakes, just as the lakes of southern peninsular India are distinct from those of the Himalayan region and natural lakes from manmade reservoirs, there is no scientific evaluation. Most of the large reservoirs (formed by construction of dams) have been constructed during the last 50 years.

The water spread areas of rivers; lakes, reservoirs, and brackish water have not been comprehensively surveyed. The Table at Annex 1 gives an overview of the same.

ADVANTAGES OF LAKES

- Lakes are used by humans for many commercial purposes, including fishing, transportation, irrigation, industrial water supplies, and receiving waters for wastewater effluents.
- Aside from their importance for human use, lakes have intrinsic ecological and environmental values.
- They moderate temperatures and affect the climate of the surrounding land.
- They store water, thereby helping to regulate stream flow; recharge ground water aquifers; and moderate droughts.
- They provide habitat to aquatic and semi aquatic plants and animals, which in turn provide food for many terrestrial animals; and they add to the diversity of the landscape

CLASSIFICATION OF INDIAN LAKES

There is no unique or rigid classification. It depends on the context and the classifier. The commonly perceived classifications are the following.

- Geographical classification like Himalayan, Peninsular, Coastal etc.
- Liminological Classification like Fresh Water, Brackish Water etc
- Functional classification like Irrigation, Water Supply, Hydropower etc.
- Water quality classification
- Management classification.

For the present review, the last classification under the following broad categories is relevant:

Table 1 Summary of inland water resources of various types (expressed as 100 000 ha, unless otherwise noted)

Name of state/UT	Rivers and canals (km)	Reservoirs	Tanks and ponds	Beels, oxbow lakes and stagnant waters	Brackish waters
Andhra Pradesh	11514	2.34	5.17	–	0.64
Assam	4820	0.02	0.14	1.00	–
Bihar	3200	0.60	0.95	0.05	–
Goa	250	0.03	Neg.	–	0.04
Gujarat	1192	2.04	0.09	–	0.95
Haryana	5000	Neg.	0.10	0.10	–
Himachal Pradesh	3000	0.40	0.06	–	–
Jammu and Kashmir	27781	0.07	0.11	0.04	–
Karnataka	9000	2.22	2.37	2.37	0.08
Kerala	3100	0.30	0.03	2.43	2.43
Madhya Pradesh	12000	2.91	0.69	–	–
Maharashtra	3200	1.65	0.53	–	0.14
Manipur	3360	Neg.	0.03	0.29	–
Meghalaya	1000	0.01	0.02	Neg.	–
Nagaland	1600	2.27	0.50	Neg.	–
Orissa	NA	2.56	0.59	1.80	5.74
Punjab	15270	Neg.	0.07	–	–
Rajasthan	NA	1.20	1.80	–	–
Sikkim	NR	NR	NR	NR	NR
Tamil Nadu	4493	0.53	2.24	5.24	0.56
Tripura	1200	0.06	0.07	0.06	–
Uttar Pradesh	31200	1.50	1.62	1.33	–
West Bengal	2526	0.17	2.76	0.42	2.10
Arunachal Pradesh	2000	–	0.01	0.03	Neg.
Andaman and Nicobar	48	Neg.	Neg.	–	1.15
Chandigarh	2	–	Neg.	Neg.	
Delhi	150	0.04	–	–	–
Lakshadweep	–	–	–	–	–
Pondicherry	247	–	Neg.	Neg.	Neg.
Total	164153	18.92	19.96	15.16	13.83

NA, not available; Neg., negligible; NR, not received; UT, Union Territories.

Source: Adapted from Handbook of Fisheries 1988, Ministry of Agriculture (Fisheries Division).

URBAN LAKES

- Non-Urban Lakes
- Inland Fresh water
- Inland Brackish water
- Sacred Lakes/Tanks
- Coastal Estuarine lakes
- Ephemeral Lakes

Urban Lakes are however, only a subset of all fresh water bodies, i.e., Reservoirs, Lakes, Ponds, Tanks, etc. Annex 2 gives a list of lakes restored, under restoration and in need of restoration.

ENVIRONMENTAL STATUS OF LAKES IN INDIA

The lakes and reservoirs, all over the country without exception, are in varying degrees of environmental degradation. The degradation is due to encroachments eutrophication (from domestic and industrial effluents) and silt. There has been a quantum jump in population during the last century without corresponding expansion of civic facilities resulting in lakes and reservoirs, especially the urban ones, becoming sinks for contaminants. The main causes for the impaired conditions of the lakes could be summarized as under.

Pollutants entering from fixed point sources

- Nutrients from wastewater from municipal and domestic effluents
- Organic, inorganic and toxic pollution from industrial effluents
- Storm water runoff.

Pollutants entering from non- point sources

- Nutrients through fertilizers, toxic pesticides and other chemicals, mainly from agriculture runoff
- Organic pollution from human settlements spread over areas along the periphery of the lakes and reservoirs

Problems of Indian Lakes (Identified Problems)

The different problems encountered in the lake include excessive influx of sediments from the lake catchment, discharge of untreated or partially treated sewage & industrial waste waters/ Solid waste disposal, entry of diffused source nutrients from agricultural and forestry, improper management of storm water/combined with over abstraction, over-exploitation of lake for activities like recreation, fishing, encroachments, land reclamation resulting in lake shrinkage, shoreline erosion and impact on lake hydrology, deterioration in water quality and impact on bio diversity, climate change etc.

During recent years, due to alteration of landscape in India by denuding forests, urbanization Increasing tourist activities, waste discharge in the lakes, sedimentation and eutrophication of Lake water have increased. Even many high altitude lakes in Kashmir and in Garhwal Himalayas, which have remain cleaned and without eutrophication for centuries, are showing Signs of deterioration.

The famous Dal lake of Kashmir is also deteriorating. Almost half of Renuka Lake, the biggest Lake of Himachal Pradesh in the lesser Siwaliks,is slowly filling up with sediments. Things are much worse in the plains or in Peninsular India. Upper lake in Bhopal, Poondi, Red Hills In Madras and Osmansagar in Hyderabad, sources of drinking water for their cities have Shrunk considerably in the recent past causing great hardship to the city dwellers. As a result, many lakes in India are experiencing eutrophication.Occurence of inorganic nutrients in water and the resulting increase in plant productivity has become a serious water quality Consideration all over the country.

Growth of water hyacinth has been prolific in many lakes resulting in breeding of vectors and consequently causing endemic diseases; Loktak Lake, Bhopal lakes, Ropar Lake, Ukna Lake, Kanjli Lake, and Pong Dam Lake are classic examples.

Cultural siltation in the form of immersion of Idols during specific festivals, an annual feature in India, has been a source of serious metallic pollution of lakes. Examples of such actions are the Bhoj Wetlands, the city lakes of Bombay, Hyderabad, and Bangalore etc.

In many lakes, the uncontrolled tourist pressure has resulted in disturbance to the bio-diversity of flora and fauna, which thrive on the lake. Examples are the high altitude lakes of Tsomori, Pongsho, Dal, etc.

Water shortages in the lakes, with sources of replenishment seriously impaired, have resulted in bird sanctuaries and fisheries getting affected seriously. Examples are the Keoladeo National Park (Bharatpur Lake), the Nalsarovar Bird Sanctuary Lake, Dal Lake etc.

MONTRAUX RECORD

The problems in Chilika, Loktak, and Keoladeo lakes were so severe that they were put on the "Montraux Record of lakes" based on their high degree of pollution and environmental /ecological deterioration. The purpose was to undertake urgent remedial measures for their conservation, supplemented with adequate monitoring. Chilika has been recently taken out of the Montraux Record, in the light of improved conditions in the lake.

MANAGEMENT MEASURES

Special Purpose Vehicles (SPVs)

SPVs for Lake Management and conservation with a unified mandate have been set up. These are - the Bhoj Wetland Authority in Bhopal (Madhya Pradesh), the Chilika Development Authority (CDA) in Orissa, the Loktak Development Authority (LDA) in Manipur, Lake Development Authority in Bangalore (Karnataka), J&K Lakes and Waterways Development Authority in Jammu and Kashmir, Hyderabad Urban Development Authority in Andhra Pradesh, and Jal Vikas Samiti in Udaipur, Rajasthan. More such organizations are being planned.

LAKE TREATMENT

The following are several palliative measures under taken to remove eutrophication and improve quality of lake water.

- Dredging and de-silting – as in the Bhoj wetlands, Dal and Nagina Lakes, the Sukna Lake, the Ropar Lake, and the Renuka Lake.
- De-weeding/hyacinth control or removal (biological, chemical, mechanical and manual measures, bio-composting) – as in the Loktak, Bhoj Wetlands, Harike and Kanjli lakes.
- Bio-remediation (Clean up with bio-products - natural bacteria breakdown, and aerators to churn the lakes) as in the Powai Lake in Mumbai, Ooty and Kodaikanal lakes in Tamil Nadu, and Mirik Lake in West Bengal.
- Introduction of composite fish culture/larvivorous fish species to control mosquitoes (Sasthamkotta lake, Ashtamudi lake, etc)
- Engineering measures (hydraulic) to improve flow of seawater into the lake to maintain salinity levels in coastal lakes e.g opening of lake's outer channel into the sea ensured better exchange of salinity level in Chilika lake;
- Revival of traditional drainage system to replenish lake storage and drain out flood waters to improve rabi cultivation of Tals, Chaurs, and Oxbow lakes.
- Lake water supplementation through irrigation canal systems in the area as in the case of Nalsarovar bird sanctuary and the Keoladeo National Park
- To declare important lakes as National Parks or Wildlife Sanctuary.

ROLE OF GOVERNMENT IN RESTORATION PLANS/ACTIONS

Several wide ranging policies, strategies and action plans have been formulated by Government of India which directly or indirectly supports wetland (including lakes) conservation in India. The National Conservation Strategy and Policy Statements on Environment and Development (1992) highlights conservation and sustainable development of wetlands (lakes), including coastal areas, riverine and island ecosystems. The National Forest Policy and the National Wildlife Action Plan emphasize conservation

of wildlife on scientific principles of evolution and genetics, as well as social and cultural ethos of the country.

Under MoEF/UNDP sponsored project on Capacity 21 programme, a draft National Strategy has been formulated which is under consideration of the Government of India.

Government role to raise awareness among people

One of the important components, which could work as a catalyst is building awareness about values and functions of wetlands. Under management action plans financial assistance has been provided to the State Governments by the Ministry of Environment and Forests. Several activities have been undertaken by the State Governments of Punjab, Orissa, Jammu & Kashmir, Madhya Pradesh, Himanchal Pradesh, Manipur and Kerala to build awareness among various target groups including school children, youth and major stakeholder groups through audiovisuals, posters, nature camps, films etc.

The Ministry of Environment and Forests conducts National Environmental Awareness Campaign every year to create awareness and environmental conservation among people. This campaign makes use of the communication skills, both conventional and non-conventional, to get across the desired message. For these campaigns, NGOs, schools, colleges, universities, professional bodies, women and youth organisations are involved in organizing seminars, workshops, padyatras, folk dances, street theaters, etc. to create environmental awareness. WWF-India and Centre for Environmental Education, Ahmedabad have established Interpretation Centre at Keoladeo National Park, Bharatpur and several other such centres are being planned for other wetlands (lakes also)including Chilika, Harike and Renuka. The environmental awareness programmes concerned with wetlands (including lakes) emphasize conservation and wise use of wetlands (lakes).

Legal support and policy frame work to stop degradation of lakes

The Lakes & Wetlands are presently not covered by any specific legal statute but several Legislations enacted till date have relevance & provisions for conservation of lakes. Some of these are:

The Forest Conservation Act, 1980, the Wildlife Act, 1972, the Water (Prevention & Control of Pollution) Act, 1974, and the Environment (Protection) Act, 1986. Besides these, some of the States have individual State level legislations for protection & conservation of their lakes & water bodies. The National Environment Policy (NEP), 2006 also seeks for setting up of a legally enforceable regulatory mechanism for lakes & wetlands to prevent their degradation and enhance their conservation.

Till any specific regulatory framework for lakes & wetlands is formulated, the Lake

Conservation may be covered under the provisions of existing Central and State Legislations.

GUIDE LINES FOR INTEGRATED MANAGEMENT ACTION PLANS

In the guide lines issued by MOEF for management of wetlands (including lakes), mangroves and corals, the main components of the management action plan are a) description of the site, b) problem/ threats, c) Management objectives (short term and long term), d) strategies for achieving the objectives - the tentative list of actions identified are under the headings i) protection measures, ii) watershed management, iii) restoration measures, iv) hydrological measures, v) pollution control measures, vi) Socio-economic development through community participation, vii) monitoring and evaluation, viii) public awareness and education, and ix) legislative and administrative measures. Research priority areas for conservation of wetlands have also been identified.

INSTITUTIONAL MECHANISM

Several organizations, both Government, Non-Government and at Community levels, have been participants in lake restoration. However, the coordination between these agencies is only marginal. At present, the National Lake Conservation Plan (NLCP) of the MOEF is playing an important role in restoration of lakes.

NATIONAL LAKE CONSERVATION PLAN (NLCP)

Ministry of Environment and Forests has been implementing the National Lake Conservation Plan (NLCP) since 2001 for conservation and management of polluted and degraded lakes in urban and semi-urban areas. The major objectives of NLCP include encouraging and assisting state Governments for sustainable management andconservation of lakes.

NLCP has attempted to learn from its experience in the field for makingimprovements in the existing system of project formulation and implementation.It lays down guidelines for preparation of detailed projectreports and focuses upon the responsibilities of the State Governments to work in closepartnership with the Government of India in protection, conservation and sustainablemanagement of lakes.

OBJECTIVE

The objective of the scheme is to restore and conserve the urban and semi-urban lakes of the country degraded due to waste water discharge into the lake and other unique freshwater eco systems through an integrated ecosystem approach.

ACTIVITIES COVERED UNDER NLCP

Prevention of pollution from point sources by intercepting, diverting and treating

the pollution loads entering the lake. The interception and diversion works may include sewerage & sewage treatment for the entire lake catchment area.

1) In situ measures of lake cleaning such as de-silting, de-weeding, bioremediation,
2) Aeration, bio-manipulation and nutrient reduction. Depending upon the site conditions.
3) Catchment area treatment which may include afforestation, storm water drainage, silt traps etc.
4) Strengthening of bund, lake fencing, shoreline development etc.
5) Lake front eco-development including public interface.
6) Prevention of pollution from non-point sources by providing low cost sanitation.
7) Public awareness and public participation.
8) Capacity building, training and research in the area of Lake Conservation.
9) Any other activity depending upon location specific requirements.

ROLE OF INTERNATIONAL INSTITUTIONS

International institutions such as the WWF, UNDP, UNEP, ADB, World Bank and many other funding agencies are involved in providing technical and financial assistance to the MOEF and the State organizations responsible for the upkeep of the lakes and reservoirs. In this effort, the wetland restoration policy is also a key factor as it encompasses lakes and reservoirs as well.

The international conventions which cover all aspects of lakes, in the name of wetlands, and on which India has been a signatory, are detailed below.

Ramsar Strategic Plan

India has been a contracted party to the Ramsar Convention since 1st February 1982. India has now 19 sites identified as "Ramsar sites". They include 16 lakes and reservoirs (Annex 2). These wetlands broadly represent Himalayan freshwater wetlands, Himalayan High altitude wetlands, coastal lagoons, floodplain systems and semi arid & arid zone wetlands. Their protection is envisaged through notification of the above (Lakes) under the provisions of Environment (Protection) Act, 1986, as ecologically fragile areas. Ramsar Convention also provides funds under Small Grants Fund (SGF) as emergency assistance to Ramsar sites, which have suffered damage or are in imminent danger of damage.

Conservation and management of wetlands is a high priority area of the Ministry of Environment and Forests, Government of India. A programme for the conservation and management of wetlands, including mangroves and coral reefs was initiated in 1985-86. Guidelines have been formulated for preparation of management action plans. The various activities under these action plans include protection, catchment area treatment, pollution control, weed control, wildlife conservation, sustainable fisheries development,

environmental education and people's participation. These management plans are supported by the Government of India under centrally sponsored schemes on "Wetlands" and "Mangroves".

The major activities carried out under the programme on conservation and management of wetlands are:

Catchment area Development

Catchment area is an integral component of the wetland ecosystem. The anthropogenic activities in catchment areas such as deforestation, overgrazing and developmental activities are causative factors for the accelerated soil erosion and consequent siltation of wetlands. In view of these factors, several activities for catchment area development, including afforestation, vegetative contour bunding, construction of water harvesting structures, gully control, check dams, stream bank erosion control, etc., have been undertaken in several wetlands such as Chilika, Loktak, Harike, Kanjli, Wular and Bhoj.

Conservation of Endangered and Threaten species

One of the important components of management action plans is conservation of endangered and threatened species. Several programmes have been initiated by the Ministry of Environment and Forests for the conservation of wildlife under in-situ conditions and supplemented through ex-situ conservation measures in identified cases. Some of the endangered species particularly Rhinoceros and Sangai - the brow antlered deer have been reintroduced in the wetlands. Certain portions of Chilika, Kabar and Loktak wetlands have been declared as sanctuaries especially for the protection and conservation of wildlife. Construction of mounds and ponds has also been undertaken in some wetlands for developing them as suitable waterfowl habitats.

Convention on Biological Diversity

India signed the Convention on Biological Diversity on 5th June 1992, ratified it on 18th February 1994 and brought it into force on 19th May 1994. This convention provides a framework for the sustainable management and conservation of India's natural resources.

Indiscriminate fishing and reclamation of wetlands have drastically affected the biological diversity and fish production. Construction of fish ponds and other manmade barricades, though initially triggered the fish production, proved counterproductive in the long-term. Hence, conservation of wetlands for sustainable supply of fish resources is emphasized rather than the short-term maximisation of the resources. Guidelines for sustainable development and management of brackish water aquaculture have been drawn up. Some State Governments like Tamil Nadu and Andhra Pradesh have also

developed their own aquaculture guidelines and regulatory measures in the coastal zone areas. The State Government of Orissa has formed a Task Force to look into the various aspects of prawn farming along the coastline.

World Heritage Convention

India ratified the World Heritage Convention in 1977 and since the following five natural sites have been inscribed as areas of 'outstanding universal value'.

1) Kaziranga National Park
2) Manas Wildlife Sancturay
3) Keoladeo National Park
4) Sundarbans National Park
5) Nandadevi National Park

Convention on Conservation of Migratory Species of Wildlife Animal (CMS)

A Memorandum of Understanding concerning conservation measures for Siberian Cranes was signed in 1993 by India, Iran, Kazakhstan, Pakistan and Russian Federation under the Convention on Conservation of Migratory Species of Wildlife Animals (CMS). The agreement aims at coordinating efforts to save the central and western Asian population of this highly endangered species.

A, memorandum of understanding has been signed by India in 1993 with Iran, Kazakhstan, Pakistan and Russian Federation For conservation of Siberian Cranes under CMS. Action has been initiated for conservation of marine turtles with the range countries. The agreement aims at coordinating efforts to save the Central and Western Asian population of this highly endangered species.

Participation of non government organizations in the implementation of the convention

There are several NGOs working on wetlands in the country. However, a break-up of the major NGOs working on wetlands are:

International/ Regional

- Wetlands International - South Asia

National

- World Wide Fund for Nature - India
- Bombay Natural History Society
- Salim Ali Centre for Ornithology
- M.S. Swaminathan Research Foundation

Provincial

- Ecological Society - Pune
- Institute for Restoration of Natural Environment

NGOs are represented in the National Committee on Wetland several projects have been funded to NGOs to carry out studies on wetlands. WWF-India has a NGO - Ramsar Committee which has contributed substantially to promote conservation and wise use of wetlands of Ramsar Convention in India.

NGOs are active in the following themes of the Convention

- Generating awareness about values and functions of wetlands and role of Ramsar Convention
- Inventorisation of wetland resources
- Identification of new Ramsar sites
- Wise use of wetlands
- Waterfowl census
- Conservation of migratory species

MANAGEMENT OF LAKES IN INDIA

In India management of many lakes has been carried out but following lakes are discussed here

Chilika Lake

Chlika is the largest brackish water lagoon that sprawls along the East coast of India in the Mahanadi delta. Chilika supports some of the largest congregations of aquatic birds in the country, particularly during the winter.

Several endangered, rare, threatened and vulnerable species are found here;eg. Irrawady dolphin, dugong, green sea turtle, spoonbill.

Social & Cultural Values

The rich fishing grounds support a large number of fisherfolk. Prawn culture is an important activity. Fish production has social, economic and cultural ramifications

Siltation

Changes in salinity level Increase in weeds and aquaculture activites. These had pushed Chilika into the Montreux Record - a comprehensive list of wetlands which have experienced changes in ecological character and need urgent conservation intervention.

Conservation measures

A management action plan for Chilika Lake has been drawn up and is being

implemented by Chilika Development Authority. The Government of Orrisa engaged the services of National Institute of Oceanography of Goa, Central Water Resources and Power Station (CWRPS, Pune) and Indian Institute of Technology, Madras to study the flow of marine water and its mixing pattern in the lake with the objective of restoration of appropriate salinity regimes. Based on the recommendations of these studies, de-siltation near the mouth of the Lake communicating with the Bay of Bengal has been undertaken for restoration of salinity regimes. To supplement these activities a comprehensive catchment area treatment programme is being implemented to control silt load in the lake. Government of Orissa has initiated several other activities for the conservation of the lake which include habitat improvement of Nalabana Bird Sanctuary, setting up of visitor's interpretation centre, building database and ecotourism development. Guidelines have been formulated for ecotourism development for ecotourism development of Chilika Lake. Efforts are also being made to remove encroachments and other manmade barricade interfering with water current and migration of faunal species.

Loktak Lake

Loktak Lake is situated 38 km. South of Imphal city, the capital of Manipur State. It is the largest natural freshwater lake in the north - eastern region of India and plays an important role in the ecological and economic security of the regio. A large population living in and around the lake depends upon the lake resources for sustenance. The staple food of Manipur is directly linked to Loktak Lake.

Social & Cultural Values

Loktak Lake has been considered to be the lifeline for the people of Manipur due to its importance in their socio-economic and cultural life, besides influencing the climate of the State. The socio - economic values of the lake include hydropower generation (Loktak Hydel National Project), irrigation of 24,000 ha of agricultural land, fisheries, control of floods, supply of drinking water, production of aquatic organisms of food and of commercial importance, and the many uses of phoomdi and water transport.

Threats

The root-cause problems can be traced to loss of vegetal cover in the catchment construction the degradation of the catchment area has led to the problems of siltation and increased flow of nutrients. Inundation of agricultural lands and displacement of people from flooded lands; and. Loss of fish population and diversity.

Conservation measures

Ministry of Environment and Forests has constituted a Technical Advisory Committee to look into the issues of Loktak Lake and prepare a comprehensive management action plan. A draft action plan has been prepared by the Loktak Development Authority in consultation with the Ministry of Environment and Forests.

The measures undertaken for the conservation of Loktak Lake so far include afforestation of indigenous species including fruit trees, control of silt by limited engineering measures, catchment area treatment, removal of floating lands called locally phumdis in some pockets of the Lake and generating awareness about the values and functions of the wetland. Loktak Development Authority has adopted several measures to control the prolific growth of phumdis and water hyacinth. Phumdis which have occupied more than 70% of the lake area are removed mechanically Loktak Development Authority in collaboration with Wetlands International -South Asia is implementing a project on Sustainable Development and Water Resources Management of Loktak Lake which addresses the issues relating to water management, sustainable fisheries development, community participation and development, catchment area treatment and conservation of wildlife. This project is supported under India-Canada Environment Facility and is expected to provide scientific basis for sustainable development and water resources management of the Lake.

Wular Lake

The vale of Kashmir- be stowed with number of beautiful lakes, lush green meadows, dense forest, rich health resorts and refreshing streams is an unparallel piece of land on this earth.

The age of lake is not known. It is generally believed that it was once capital of Kashmir named Sind – Mantnager but subsequently due to violent earthquake land sank and river Vitasta got diverted and formed the lake.

Wular Lake is one of the largest freshwater lakes in Asia. It plays a significant role in the hydrographic system of the Kashmir valley by acting as a huge absorption basin for the annual floodwaters. The lake, along with the extensive marshes surrounding it, is an important natural habitat for wildlife. It is also an important habitat for fish, accounting for 60 per cent of the total fish production within the State of Jammu and Kashmir

Social & Cultural Values

The Wular Lake is of great socio - economic importance in the valley of Kashmir both in regard to its ecological and economic aspects. It offers sustenance to thousands of people living in and around the lake. More than eight thousand fishermen earn their livelihood from this lake About 60 per cent of fish yield in Kashmir is contributed by the Wular Lake.

Threats

Encroachments resulting in converting vast catchment areas into agriculture land; Pollution from fertilizers and animal wastes; Hunting pressure on waterfowl and migratory birds Weed infestation.

Conservation measures

Wular Lake is subjected to heavy siltation due to loss of vegetal cover of the area. The Department of Environment and Remote Sensing has prepared a comprehensive management action plan with a focus on catchment area treatment. Ministry of Environment and Forests has provided substantial support for afforestation of native species and limited engineering measures. Local communities have been involved in the afforestation of Erin Watersheds, which is a major source of silt load in the lake. For protection of wildlife and generating awareness funds have been also provided by the Government of India. The University of Kashmir has completed a project on Wular Lake which gives the information on flora, fauna, water quality and ecological characteristics of the lake.

DAL LAKE

The Kashmir valley is blessed with exotic natural beauty of landscape and water bodies, out of them, the most famous and appealing is the Dal Lake. Dal Lake is one of the most beautiful lakes of India and the second largest in the state of Jammu & Kashmir. The lake is surrounded by majestic mountains from three sides and a large number of gardens and orchards have been laid along the shores.

Social and Cultural vales

The hundreds of uniquely decorated houseboats which float on the Dal Lake afford an opportunity to tourists to reside on the lake in an atmosphere of peace and tranquility. The areas surrounding the Dal Lake are lined with sloping roofed houses on islands, while other parts appear lush and green like well-laid gardens. A Large population living in and around the lake depedds upon the lake resources for sustenance.Boating in Dal lake is the main lifeline of people living their.

Threats

Over the years, urbanization, land use changes, sedimentation, release of solid and liquid wastes from house boats, human settelement, hotels, flow of fertilizers and pesticides from the catchment and encroachment of the lake area have resulted in environmental issues, which may be very difficult to resolve. It is well known that large quantites of silt flowing into the lake through Telbal Nallah originate from the highly eroded Dara-Danihama catchment.

Conservation measures

To implement the recommendations the state government created a new engineering department ,UEED.A high powered board was constituted to give directions to the UEED and monitor is functioning.Expert committees were constituted to discuss The lake conservation issues and a couple of new departments is created.In 1997,the Jammu

and Kashmir Lakes and Waterways Development Authority was created.In the following year, a PFR under NLCP of the Ministry of Environment and Forests, Government of India was prepared,which incorporated many proposals contained in earlier reports. Recently yet another DPR on the conservation and management of Dal lake has been prepared by the Roorkee University (now IIT) and submitted to the state government for implementation.

12th WORLD LAKE CONFERENCE

The World Lake Conference was first held in 1984 at Lake Biwa in Shiga Prefecture, Japan. Since then, it has been held biennially in wide-ranging locations including the United States, Hungary, China, Italy, Japan, Argentina, Denmark and Kenya. Established in 1986 as an international NGO collaborating with UNEP, ILEC has worked with host organizations in these countries and has been able to make important contributions to promoting scientific approaches in Lake Basin management, particularly for improving the state of lake environments in developing countries.

The 12th World Lake Conference is scheduled from October 28 to November 2, 2007, in Jaipur, India, and it is hosted by the Ministry of Environment and Forests, India and ILEC. It will be the first World Lake Conference to be held in South Asia.

The conference was organised by the ministry of environment and forests at Jaipur from 29 October to 2 November, 2007.

The conference has called for:

- Appropriate research methodologies be applied and data books be established to facilitate execution of management action plan
- Standards be developed for physical, chemical and biological promoters for lakes and wetlands
- Guidelines / protocols be developed on priority to control invasive aquatic species
- Innovative low-cost eco-friendly technologies be developed for enhancing the process of restoration of lakes and wetlands

Rational public private partnership be promoted in conserving lakes and wetlands and maintaining their ecological services

- Strong institutional and financial mechanisms be developed for regional and international cooperation in management and restoration of lakes and wetlands
- An Asian Centre of Excellence is established with international assistance for promoting research, training and education, and development of appropriate technologies for sustainable management and restoration of lakes and wetlands.
- Restoration and management of lakes and wetlands be promoted through twining arrangements with international support

Over 600 delegates, who participated in the five-day deliberations, adopted the "Draft Jaipur Declaration" which acknowledges the importance of lakes and wetlands for domestic, agricultural and recreational uses and improve habitats for conserving biodiversity.

The largest group was from Japan followed by China and Poland respectively... Delegations from all neighbouring countries including an official delegation from Sindh and Karachi in Pakistan participated.

Scientist, environmentalists, policy makers, Non-government Organizations (NGOs and academicians from all over the world are participating in this conference.

CONCLUSION

All the lakes, all over the country, without exception, are in varying degrees of environmental degradation.The main cause for continued degradation of Lake Environment has been public apathy and government indifference. The situation has changed in the last decade due to public awareness of the need for sustainable environment in general, not of lakes alone. This awareness has led to public protestations, legal interventions and also public participation in restoration actions.

The legal framework for protection of lakes and reservoirs (wetlands) is at present indirectly covered under several acts and notifications issued by the MOEF. Some lakes/ wetlands have been provided protection under the Wildlife Protection Act, which is generally ineffective. This is due to lack of pragmatic regulatory regime for an integrated development and management of a drainage basin and involving joint decisions of several sectoral agencies.

The NLCP is envisaged to play an important role in restoration of lakes.

International institutions such as the WWF, UNDP, UNEP, ADB, World Bank and many other funding agencies are all involved in providing technical and financial assistance.

Several organizations, both Government, Non-Government and at Community levels, have been participants in lake restoration. But it is seen that the coordination is a major stumbling block in effective management of water resources in the country.

THE WAY FORWARD

The way forward for better management of the lakes, reservoirs and tanks in the country could be achieved by evolving strategic integrated management action plans. The guidelines issued by MOEF in this regard are a good beginning. They need to be pursued to ensure their effective implementation.

The first step is to survey and inventorise all water bodies and categorize them, utility, problem, and region wise, to enable impact analysis of ecosystem and evolve suitable restoration works for problem lakes. The surveys should cover Post Project Evaluation of the SPVs and Hydrological studies of the lakes, as part of the drainage basins.

The next step is to initiate action on Integrated Water Resources Management (IWRM) with specific emphasis on lakes and reservoirs at the basin or sub-basin levels. Lake Management should be a subset of IWRM at the basin level. Permanent solution depends on Institutional restructuring for effective governance.

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