

Management of Kawar Lake

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ABSTRACT

Kanwar Lake is one of the largest ox-bow lakes located in the north-eastern part of the Indo-Gangetic plain. It is highly productive and supports wide range of economic and other activities. Its management problems are unique and complex. It is transitional in nature. Its water spread area varies from nearly 7,400 hectares during monsoon months to 300-400 hectares in summer. The local fishermen have the fishing rights and the rich land owning farmers have the rights to cultivate the land on the periphery of the lake including mudflats exposed after the monsoon. This is a major source of conflict between the two sections of the society. The lake has very rich bio-diversity and is home to many resident and migratory birds. Essentially, its conservation is the main objective of management. So far the focus of management has mainly been fishing and agriculture, but the rational approach lies in integrated holistic management of the entire lake ecosystem. Efforts may be made to grow floating rice as they do in Tonle Sap lake in Cambodia and to produce aquatic crops like *makhana* and *singhara* etc rather than draining out the lake for conventional agriculture. For making it sustainable, people's co-operation and participation must be ensured.

INTRODUCTION

Ramsar Convention (1971) defines wetlands as 'areas of marshes, pens, peatlands of water whether natural or artificial, permanent or temporary with water which is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which at low tide does not exceed 6 metres'. In other words, 'wetlands are lands of transition between terrestrial and aquatic systems wherein water table is usually at or near the surface of the land or the land is covered with shallow water'. They support a wide range of functions that are essential for plant, animal and human life and also for maintaining the quality of environment. The direct and indirect benefits derived from them are: high productivity, water storage, flood control, prevention of soil erosion, sediment trapping, water purification, nutrient recycling, aquifer recharge, aesthetic beauty, cultural uplift, recreation, and high biological diversity especially waterfowl habitat. They are particularly valuable as repositories of many unique varieties of flora and fauna and serve as priceless source of food and fuel for millions of people.

Indian sub-continent is rich in number of wetlands and wetland bio-diversity (estimated to be 19,221 species falling under 24 groups of animal kingdom inhabiting

fresh, marine and brackish water). The directory of wetlands prepared by the Ministry of Environment and Forests (1990) lists 2,175 natural wetlands covering 15,37,226 hectares and 65,254 artificial wetlands comprising nearly 25,89,266 hectares located in different geographic regions of the country (Alfred et. al, 2002). As with other natural systems, these wetlands are in imminent danger of extinction as consequence of thoughtless and unplanned development in addition to population pressure.

The Ganga and its tributaries flowing through flat plain are constantly vulnerable to changes in their courses. These meandering rivers changed their directions in the past leaving many natural depressions which are later fed by rain water forming ox-bow lakes. One such large lake situated in the Indo-Gangetic plain is Kavar lake, along with 14 other lakes forming a complete ecosystem, situated 22 kilometres north-west of Begusarai town in Bihar state. It lies between the Burhi Gandak, the old Bagmati and the Kareh rivers (Figure 1). It is located at 25°30' north latitude and 87°05' east longitude. The average altitude is 32-45 metres above the mean sea level. The land system is the product of 3 successive meander regimes of the Bagmati, the Burhi Gandak and the Balan in north Bihar. The average rainfall in the area ranges from 1,140 to 1,270 millimetres per year of which 80-85% occurs during monsoon months only. The lake gets its water from rains and / or from the nearby overflowing rivers such as the Burhi Gandak and the Bagmati. The water spread area extends to about 7,400 hectares during monsoons and to 300-400 hectares during summer due to heavy letting off of water for agriculture. During the post-monsoon period over 2,800 hectares of the exposed mudflats are converted into paddy fields. On the basis of the large size and rich bio-diversity this lake has been selected as a Wetland of National Importance.

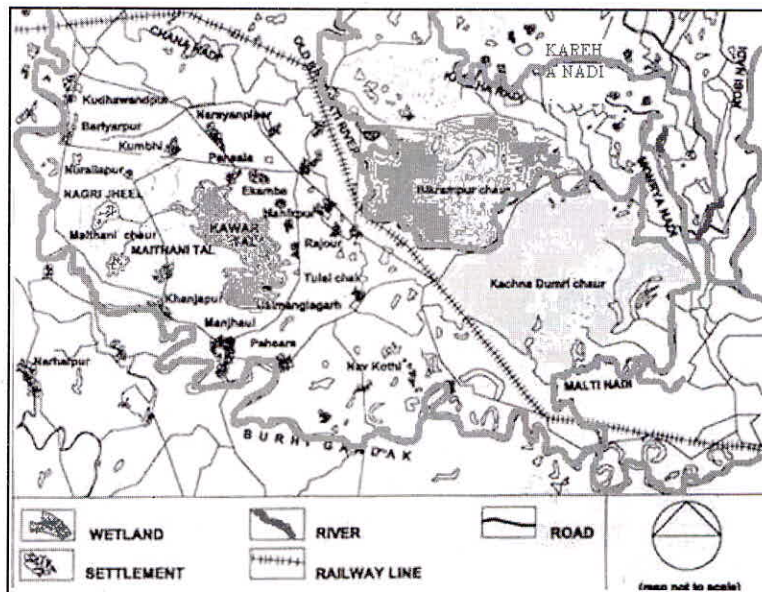


Fig. 1: Index map of Kavar Lake

RESOURCES AND UTILITY

Kawar lake is highly productive and greatly provides economic support to the local people, particularly, the *Sahani* community. *Sahanis* are landless fishermen living around the lake whose only source of sustenance is the lake and its resources. They hold the fishing rights and use the lake during monsoon months when the lake is flooded to its capacity. When the water recedes the exposed lake bed is used by the land owners for cultivation. The lake functions as bio-filter and sediment trap and helps in flood moderation and recharge of ground water. A large number of aquatic plants and animals, useful as food and prized for their commercial values, are produced in the lake area. Many fruits and vegetables are grown, most important ones being *makhana* (*Euryale ferox*), *ramdana* (*Amaranthus*) and *singhara* (*Trapa bispinosa*). Incidentally, *makhana* has a very high nutritional value (protein – 9.7%, carbohydrate – 76.9%, fat – 0.1%, mineral – 1.3% and water – 12%). It has been traditionally used to treat diseases, such as beri beri, and is found to be a cardiac stimulant.

Kawar lake is an important waterfowl habitat. It is home to millions of birds. Nearly 107 and 59 species of resident and migratory birds respectively are recorded from the area. The migration of many species is not only national but also international. Some of them come from Malaysia, China, Japan and Siberia for feeding, breeding, wintering and nesting. Due to differential ecological niches and abundance of macrophytes and macroinvertebrates, large numbers of birds represent this lake throughout the year. Due to arrival of large number of birds from other countries, the lake was declared as 'Closed Area' bearing the name '*Kawar Jheel Pakshi Vihar*' by the Government of Bihar in 1987. Accordingly, killing, hanging and poaching of birds are completely prohibited in this area. In 1989 the Government notified the wetland as 'Kawar Lake Bird Sanctuary'.

The main fauna of the lake consists of fish. A variety of fish having different shapes and sizes suiting to the taste of various water birds is found in abundance. As many as 37 species are recorded. With the inclusion of the fish from the nearby rivers connected with the lake, the number of species would go up to more than 60 (Ramarao et. al, 2002). Abundance of fish in the lake can be judged from the fact that the average daily catch of fish is 1 to 2 tonnes. However, this continuous and heavy extraction has decreased the fish population.

Three major groups of reptiles occur in this lake: tortoise, snakes in the lake as well as on the adjoining land area and lizards in the vicinity. Relatively few mammals of truly marshy characteristics are found in this lake. However, outside the lake on land in the area, *nilgai* (*Boselaphus tragocamelus*), jackal (*Canis aureus*) and fox (*Vulpus bengalensis*) are seen.

There is a permanent island in the south-eastern corner of the lake. It is known as 'monkey island' due to frequent visit of monkeys. Palm trees abound on the island.

There is a temple dedicated to the deity '*Jaimangala*' (Goddess Durga or Bhawani) on the island. Archaeological ruins suggest the probability of the island being an ancient fort. This is corroborated by the fact that the place is called *Jaimangalagarh*. The temple and the fort have great historical significance and pilgrims from the neighbouring villages as well as from distant places visit them especially during *Durga Puja* and *Ramnavami*. The enchanting scenic beauty of the lake and the historic importance attached to it make this lake the most important tourist spot in the region. However, the number of people visiting it is not commensurate with the amount of attraction it provides. If properly developed and managed, it can serve as a beautiful spot for recreation, bird watching and water sports.

THREATS AND CONFLICTS

Wetlands are often wrongly viewed and treated by some people as wastelands. So is the case with Kawar lake. Fortunately, it is not subjected to urban and industrial pressures, yet modifications and anthropogenic pressures are posing serious threats to its ecosystem. There are numerous natural and man-made problems which call for urgent attention and action. The main threats are: trapping, hunting, poaching, poisoning and trading of birds; weed infestation choking the lake; agricultural run-off and eutrophication; land reclamation by draining out the lake and conversion of the same into agricultural land i.e. conflict between '*Pakshi Vihar*' and '*Krishi Vihar*'; tree felling on the islands in the lake area; encroachment by agricultural extension etc (Mishra, 2004). However, a brief description of some items follows.

Geological Hazards

The central part of the lake is saucer shaped and it receives runoff from the north-eastern side. During monsoon, when the lake is full to its capacity, spilling takes place through the south-eastern portion causing inundation. There are no forests worth the name in the catchment of the lake, but the number of plants in and around the villages has decreased over the years resulting in increased soil erosion in the catchment and consequent siltation of the lake. Another problem is the report of ground water salinity in several parts of the lake area.

Legal Problems

Kawar lake systems are transitional and their water spread area, depth and water quality are subject to variation during the year. The only source of sustenance for the landless fishermen of *Sahani* community is the lake and its resources. They were provided with the fishing rights by Calcutta High Court during the British Rule and the land reclaimed after the recession of water was sold to the farmers for cultivation. This has created conflict between the two sections of the society. In 1951 a scheme was prepared by the Government of Bihar in which all the smaller lakes around Kawar lake were joined with it through various channels. The lake was then joined with the Channa river through a

drainage channel which was later extended to the Burhi Gandak (Figure 2). Initially the drainage channel was deep enough to drain out the water of Kawar lake and the system worked well as the fishermen used to the lake area when it was covered with water and the farmers cultivated the same land when it was exposed. However, after a few years the drainage channel got silted up and stopped functioning as such efficiently. This caused loss to the farmers and under the situation they demanded exclusive rights of fishing and cultivation on their lands to which the fishermen did not agree for obvious reasons. The demarcation of the legal boundaries due to discontinuity during post-monsoon months is highly ticklish, controversial and practically difficult. However, the conflict between the people and legal managers regarding the ownership and rights has still not been resolved.

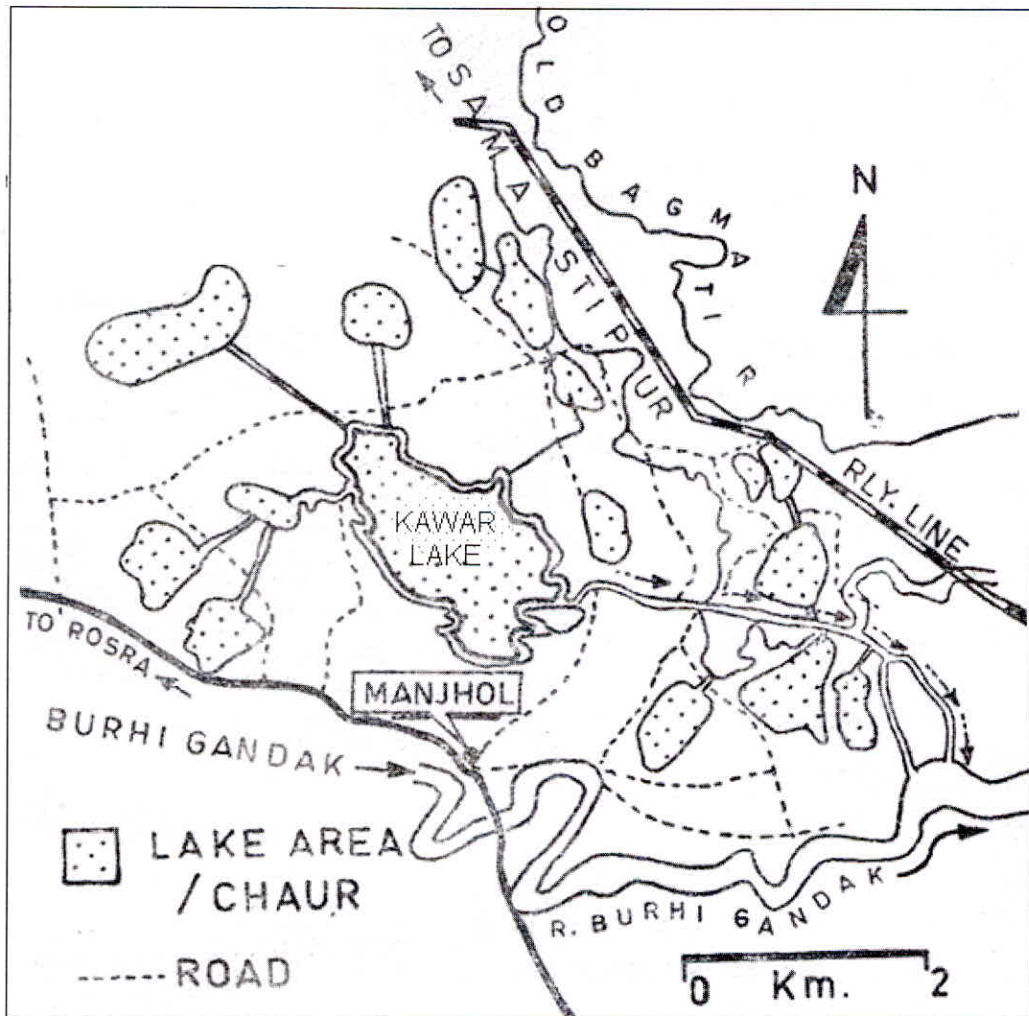


Fig. 2 : Drainage of Kavar Lake

Loss of Biotic Resources

Kawar lake offers an excellent example of macrophytic diversity (112 species recorded). The large number of aquatic plants produced in the lake are used as food for human beings, fodder for cattle, roofing and wall fencing of houses, shelter and roosting sites for birds, fishes and insects. They are of high commercial values and main source of income for the local people. During recent years their production has reduced due to excessive exploitation and poor management.

Weed Infestation

The application of fertilisers, pesticides and herbicides in the agricultural fields adjacent to the lake causes rapid deterioration of the water quality leading to the change in biota. Nitrogen leads to prolific growth of obnoxious aquatic weeds. Increased biological oxygen demand (BOD) is harmful to aquatic animals like fish. A number of waterfowl require habitat with good proportion of open water. In Kawar lake reduction in number of resident and migratory birds has been observed for the last few years. The decomposed organic matter is often exploited by the local people for piggery, but introduction of pigs in the lake bed during drier months deprives cranes of their food.

Encroachment

Fortunately, the encroachment in case of Kawar lake is not of permanent nature. However, due to recession of water during summer many islands emerge inside the lake and wide strips of land along the periphery, called *rahis*, get exposed which are cultivated by local farmers making a case for encroachment by agricultural extension. This leads to loss of aquatic flora and also loss of habitat.

Miscellaneous Issues

The productivity of both the agricultural and the aquatic produce is high. This creates tendency among the people to over-exploit the lake resources leading to degradation of lake environment and conflicts among the stakeholders. The farmers would like to see the lake filled up only for a few months so that it can be converted into paddy fields, but the economically weaker section of *Sahanis* prefers shallow lake with water for longer duration for traditional fishing. The Government has declared the lake as a bird sanctuary with no delineation and demarcation. This has fuelled additional worries to the traditional users. Indiscriminate bird poaching is going on in nearby villages with the result of reduction in the number of birds. Furthermore, the lake drainage system is not working properly. Water flushes out quickly as the channel was washed away in a portion in the flood in 1987. Even at present free discharge of water takes place and the lake bed gets exposed early for agricultural use. With no inlow-outflow mechanism in the lake it acts as a sink. This proves to be a boon to the farming community, but brings misery to the fishermen. The agricultural activities in the marginal areas close to the lake add silt and nutrients to the lake. The open defecation around the lake adds BOD load to the water body.

MANAGEMENT STRATEGY

Holistic Approach

Kawar lake is one of the largest fresh water lakes in eastern India. There are at least 14 other small and large lakes and wetlands situated in its neighbouring areas. All these are part of the Ganga and its tributaries and have close hydrological and ecological relationship amongst them. Therefore, the management of Kawar lake together with other lakes and wetlands in a comprehensive holistic manner is desirable. This will save the smaller lakes from extinction and will facilitate the rational management of Kawar lake to great extent. The main objective of the management is to reverse the trend of degradation of the whole ecosystems and to develop them maintaining sustainability.

Lake Area Zoning

The management strategy for Kawar lake which may include zoning of the lake area for avoiding problems due to conflicting uses has been suggested by the Department of Environment and Forests, Government of Bihar. Three alternatives for zoning have been proposed. In Alternative I, the areas which are likely to remain under water throughout the year are categorised as core zone already declared as *Pakshi Vihar* (Bird Sanctuary). The rest of the areas will constitute the buffer zone which is to be declared as *Krishi Vihar* (Agricultural Land). In Alternative II, the lake is divided into three parts according to the depth, the northern and the southern parts which are deeper are declared as core zones to be used exclusively for fishing and the area lying between the two core zones is taken as the buffer zone. In Alternative III, the whole lake having thick sheet of water is considered as a core zone and the areas around the lake as buffer zone which is to be further sub-divided into agricultural and non-agricultural zones. The area adjacent or immediately surrounding the buffer zone is to be used by tourists, but restricted to only agricultural activities.

Hydrological Measures

Hydrological balance is to be maintained at all costs for the sustained life of the lake. To achieve this objective the outflow of water from the lake must be properly regulated. As long as the lake provided benefits to both the fishing and the farming communities adequately, they maintained it by a mutually well devised system of conservation, but the trouble and conflict started when the outlet stopped functioning causing rise of the water level in the lake. This prompted the rich farmers to widen the channel to facilitate quick drainage of the lake. This situation is to be rationalised. A scientific study of inflow, outflow, frequency and magnitude of flooding in time series, pattern of changes in water level with respect to time, rate and load of sedimentation, ground water recharge etc may be undertaken and on the basis of the findings the mechanism of regulation of outflow may be designed. The present drainage channel is located on the south-eastern side of the lake, another channel on the north-western side through Nagri lake to the Burhi Gandak may

also be constructed with the provision of sluice gates so that the excess water from the river may flow into the lake as the levels of the river and the lake beds are almost equal. The length of this channel may be only about 8 kilometres. The immediate use of water flowing into the lake by the farmers for irrigation of agricultural fields should be strictly banned. Efforts may be made to grow floating rice on the submerged land and around the periphery of the lake, as they do in Cambodia in case of Tonle Sap lake and to produce aquatic crops like *makhana*, *singhara* etc rather than draining out the lake for conventional agriculture. This will be more beneficial.

Watershed Management

There is no serious problem of siltation in the lake at present. However, the situation can further improve if tree cover is increased in the catchment areas. Sustainable agriculture should be practised in the areas surrounding the lake. Use of chemical fertilisers may be discouraged and discontinued as the inflow of the residue of fertilisers to the lake enhances the nitrogen content of water resulting in increased eutrophication and weed growth. The farmer should be encouraged to use bio-fertilisers. Benefits of crop rotation may also be explained to the farmers and incentives for its adoption may be provided.

Research, Monitoring and Training

There is great need of studying the various aspects of the ecosystem of Kawar lake in detail so that rational management approach may be devised. As a first step survey, mapping and classification of the lake resources may be undertaken and their interaction and relationship should be identified. Assessment of inflow, outflow, flood pattern, water quality, sedimentation, ground water recharge, bio-diversity, pollution, anthropogenic pressures and their effects on the lake ecosystem, land and water rights, resource utilisation etc should be undertaken. The ameliorative management activities should be suitably monitored and annual estimation of the avifauna of the lake should be done with a view to determining the profile of resident as well as migratory bird population. Suitable training should be imparted to the people living in the vicinity of the lake so that they understand the importance of the conservation of the lake ecosystem and work for the same.

Development of Eco-tourism

Kawar lake has good potential for being developed as a tourist spot. The lake and the visiting birds, particularly in winter, are the main attraction. *Jaimangala* temple is another attraction which is visited by pilgrims throughout the year. However, due to poor or no facilities available for stay, boarding, boating, bird watching, entertainment, and marketing etc the tourists are not very enthusiastic to visit the lake. If the area is suitably developed to encourage tourism, opportunity of increased employment will be created for the local people. They will then have more income and more interest in the development of the lake.

Legislative and Administrative Measures

There is still a conflict about the legal status of the lake. It is not defined whether it is under Water Resources department, Environment and Forests department, Tourism department or Revenue department. The issue of the water rights of the fishermen and the land rights of the farmers is still not finally resolved. The declaration of *Krishni Vihar* has not yet been done. The declaration of the lake as bird sanctuary has only partially served the purpose for want of effective monitoring system. The fishermen, who stealthily do poaching and trapping of birds, are forced to over-exploit the resources. If some alternative means of livelihood is provided to them, they may readily give it up.

Community Participation

The participation of the local communities in the lake management is an important component for success. The integration of social and ecological dimensions, which are interrelated and interdependent, should be the focus of management strategy. The emphasis should be on the preventive measure rather than curative measure. Training and education of the local people will help them in understanding the ecological importance of the lake and will induce them to undertake only such activities which would reduce the negative impact on the lake. Good work has been done by Chilka Lake Development Authority in community participation for wetland conservation. It is desirable to draw upon their experience and expertise and to set up Kavar Lake Development Authority for holistic management of the lake ensuring community participation.

CONCLUSION

Kavar lake is one of the many large ox-bow lakes existing in the Indo-Gangetic plain. It is highly productive and has very rich bio-diversity. It is an important waterfowl habitat. The main fauna of the lake consists of fish. The local fishermen have fishing rights and the farmers have the rights to cultivate the exposed lake bed. This leads to social conflict. In addition to this, the lake is subjected to many other threats and problems. Holistic management has been suggested which can be successfully implemented with community participation. No stone should be left unturned for making the whole system sustainable.

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