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Sustainable Approach for Conserving and Managing for Urban water bodies

Sarika Bahadure
Assistant Professor
Visvesvaraya National Institute of Technology,
Nagpur, India
E-mail: sarika_wa@yahoo.com

Pulluri Sangeetha
Visvesvaraya National Institute of Technology,
Nagpur, India
E-mail: sangee_pulluri@yahoo.co.in

Abstract

Lakes are the ecology which plays important role in maintaining micro climate balance, fulfilling different direct and indirect uses like fishing, agriculture, ground water recharge. Thus it is vital to conserve and safeguard the lakes. Lakes are under different anthropogenic stresses of unplanned urbanization and industrialization. Mismanagement of natural resources combined with an ever increasing population has been responsible for introducing many objectionable changes to water ecosystems. In recent years, the lakes are being privatized on Public Private Partnership model for conserving and managing which led to the restricted or forbidden access to traditional users who are dependent on lake for livelihood. Traditional users are losing their livelihood opportunity. Also with unaffordable entry fees access to marginalize community is constrained. Lack of ecosystem approach in restoration programs and management plans lead to the decay of many lakes. Thus, lake restoration and management plan should consider all the ecosystem components for the proper sustainable use of natural resources. This paper evaluates differences between lakes managed by public private partnership and government with community participation in terms of uses of lake before and after restoration. This study presents the probable negative impacts of privatization over other which affects the diversity of traditional ecosystem services in urban areas. At the end it tries to put forth the strategies which can be adopted for better restoration are the ecology which plays important role in maintaining micro climate balance, fulfilling different direct and indirect uses like fishing, agriculture, ground water recharge. Thus it is vital to conserve and safeguard the lakes.

Key words: *Urban lakes, Conservation, Management, Public Private Partnership, Community Participation*
JEL Classification: *G 14*

1. Introduction

1.1 Current status

Today one of the problems which Indian cities are facing is water crisis, in terms of quantity and quality. This is due to the decrease in fresh water availability (S. Sengupta and S. Dasgupta, 2012). When we observe the global distribution of water 3% of total water on the earth is fresh water, of which surface water constitutes 0.3%, ground water is 30.1%, icecaps and glaciers are 68.7% and others are 0.9%. Lakes, river and swamps constitute 87%, 2% and 11% of surface water respectively (The Corbett Foundation, 2010).

Lakes are either natural or manmade. Lakes are important part of the ecosystem and play important role in microclimatic control, perform various environmental, social, economical functions. Some of the direct and indirect uses of lakes are supply of water for house hold purposes, recharging ground water, flood control, providing biodiversity, recreational spaces to the societies (Kang, 2013).

1.2 Issues

Unplanned urbanization and climate change is leading to the degradation of lakes. Different threats to the water bodies like encroachment, over exploitation, catchment feeding, pollution, illegal mining activities, eutrophication and absence of administration framework to manage the urban water bodies has resulted in rapid decrease in number of water bodies in Indian cities (Kang, 2013).Water bodies in greater Bangalore reduced in number from 207 in 1973 to 93 in 2007 (Ramachandra T. V. and P. P. Mujumdar, 2009). 3245 hactars of water bodies lost from 1989 to 2001 in Hyderabad (C. Ramachandraiah and S. Prasad, 2006). In 2001 out of 137 lakes listed 65 were reported as built over in Ahmedhabad city. In Delhi it was observed that 21 out of 44 lakes were gone dry and water tables is lowered from year 2001 to 2011 (Ritu Singh and Manu Bhatnagar, 2012).

According to Intergovernmental Panel on Climate Change (IPCC) report, due to population growth the gross per capita water availability in India is projected to decline from about 1,820 m^3/year in 2001 to 1,140 m^3/year in 2050 **(The Corbett Foundation, 2010)**. Loss of water bodies lead to the various economical, socio-cultural, environmental losses like depletion of ground water table, loss of biodiversity, loss of livelihood, flash floods **(Kang, 2013)**.

Thus there is an urgent need for conservation and management of urban water bodies looking at its function and values.

1.3 Management and Conservation of the lakes

Management and Conservation of the lakes can be done in different ways, among them two major methods are: i) by Public Private Partnership model and; ii) by Government or Government along with Community Participation

Public Private Partnership (PPP) is a partnership between public institution and private sector for completing a project that will serve the public. It is commonly used for development, operation and management of urban infrastructure where the public institutions lack capacity. Here 'Privatization' is seen as a resource (Arora, 2013). The lakes are leased out for specified duration to the private companies for developing and maintaining the lakes through PPP model under the specified conditions. Governing authority of lakes invite private companies for biding, conserving, developing and managing under specified *Terms of Reference*. Lake is then leased out to the selected private company to carry out the development and management of lake. Detailed Project Report (DPR) is prepared and finalized by the government consulting the private company requirements. Implementation of the work allotted is carried out and maintained by the private company for specified duration according to the lease.

Without PPP, lakes are developed and maintained by government or as public commons. Here Conservation and management of lakes are carried out by the concerning governing authority (ies) of the lake. DPR is prepared and finalized by the government. Implementation and maintenance is under the government. Government authority may include active participation of community, Non Governmental Organizations (NGO), various institutions and researchers. Their participation can be at different stages like DPR preparation, implementation, maintenance in the conserving and managing process of the lake.

The two major components in the conservation of lake are i) Conservation of the lake water body and ii) Lake front development. Conservation of the lake includes investigation of the lake to know the actual status of the water quality, species availability and diversity and its past importance to take the measure to rejuvenate it. This requires design of engineering and conservation measures like cleaning and maintaining the water body, planting new trees and maintaining structures with historic importance and safeguarding the dependent community on offshore. This may have minor beautification work like jogging track and development of park. Lake front development includes proving facilities to the user like boating, stalls, theme park, joy rides, restaurants, kids play area, jogging, sitting area, etc (IDC, 2009).

Conservation of lake rejuvenates water body, improve water quality, houses different species and provide public facilities. It might not generate enough revenue to make the project financially

viable for a private partner to invest. On the other hand Lake front development consists of revenue generating activities and providing happening urban space.

The Ministry of Environment and Forests (MoEF) has initiated National Lake Conservation Plan (NLCP) with an aim to restore and conserve polluted urban lakes in the country. The major activities include prevention of pollution entering in the lake, cleaning of lake, catchment area treatment, beautification, public awareness and participation.

2. Methodology

This paper compares two lakes (Chilika and Kankaria lake) which are conserved and managed by governments and public commons with two other lakes (Mansagar and Hebbal lakes) which are conserved and managed by PPP model. The study is carried out to understand: i) uses of the lakes; ii) issues of the lake before restoration; iii) conservation process; and iv) post-restoration outcome.

The study helped to understand the consequences of the restoration and management due to change in management model.

2.1 Study areas

Chilika Lake: Chilika Lake is located in Bhubaneswar, Orissa state. It has water spread area varies between 116500 (in monsoon) to 90600 Hectors (in pre-monsoon). It is a natural brackish salt water lagoon in Asia (Rout, 2006) and is designated as a Ramsar site since 1981 (P.K. Naik et al, 2008).

Chilika Development Authority (CDA) with Chief Minister as a Chairperson, act as an umbrella organization for integrating various organization (11 international organization, 4 national ministries, 6 other national organizations, 17 state government organizations, 13 research institutes, 33 NGOs and Community Based Organizations and 5 Community group (Pattnaik, n.d.). They all together play active role in management of the common property resources of Chilika Lake. Legitimate stakeholders, particularly local communities and indigenous people are being strongly encouraged to take an active role in planning and restoration process (Rout, 2006).

Kankaria Lake: It is the biggest lake in city of Ahmadabad, Gujarat. It was created by Sultan Qutabud-din in 1451with water purifying system but now lost with time. It has an area of 25.17 hector. It has an approximate circumference of 4.8 kilometer. It represents historical and cultural value (Wikipedia, 2014). Ahmadabad Municipal Corporation (AMC) backed by Gujarat Government took up the comprehensive lakefront precinct recreational Urban Space in the heart of the city of Ahmadabad (IDC, 2009)**.**

Mansagar Lake: Mansagar Lake also known as Jalmahal is the significant lake with an area of 121.41 hectors in Jaipur, Rajasthan. It is a manmade water body created by damming Darbhawati River near Nahargard Fort in 1610 for irrigation and recreation purpose by Raja Man Singh I. A palace was built in the middle and temple on northwest of lake (Paritos Gupta et al, 2008). The stakeholders involved in restoration and management are Jalmahal Resorts Pvt. Ltd (under PPP), MoEF, Government of Rajasthan (GoR), Jaipur Development Authority (JDA), Jaipur Municipal Corporation (JMC), forest department, irrigation department, Rajasthan Tourism Development and Corporation and Department of Tourism.

Hebbal Lake: Hebbal is the most elevated part of Bangalore with three major valleys and abutting ring road on south. It has an area of 76.87 hectors (Ramachandra T.V. and Ahalya N., n.d.). A single nonprofit society Lake Development Authority (LDA) was set up by the Government of Karnataka for regeneration and preservation of the lakes. They has leased out the lake in 2006 to private company East India hotels Ltd Oberoi group (Fernando, 2008).

This study compares above four restored lakes by and Government with Community participation and PPP model to understand the conservation and management strategy policies in both models.

3. Comparison of privatized and non-privatized lakes

3.1 Chilika Lake

Ecological Use: It is the largest wintering ground for migratory birds (hosts over 160 species of birds) on the Indian sub-continent. The lake supports number of threatened species of plants and animals. It has rich biodiversity with variety of birds, vertebrate, marine, brackish and freshwater species and fisheries due to which it got place in Ramsar Convention for wetland. The lake is of great value in preserving genetic diversity (Wikipedia, 2014) (Rout, 2006).

Economic use: The fishery resources sustain more than 0.2 million fisher–folk and 0.8 million watershed community living in 132 villages on the shore and islands. Apart from fishing 77% of the working population in peripheral villages is engaged in Agriculture which is dependent on Chilika Lake (Pattnaik, n.d.). International tourists and ecotourism contribute to the local economy.

Issues: Increased siltation, degradation of the drainage basin, alteration of fresh water flow and decrease in salinity has resulted in shrinkage of water-spread area, loss of biodiversity and depletion of fishery resources. Tidal influx into the lake affected by the shoal formation and continuous shifting of the mouth of sea adversely affect the natural recruitment of species. Limited occupation opportunities and land holdings led to poverty and migration. Loss of

biodiversity with decline in productivity adversely affected the livelihood of the community that depended on it. The conflict between fishermen and non-fishermen communities for fishing rights in the lake exist. Lack of institutional mechanism to regulate the common resources resulted in unsustainable and unbalanced resource distribution and use (Pattnaik, n.d.).

Conservation Process: CDA adopted ecosystem approach to conserve this wetland by integrating local communities. Community's capacity building was carried out with the help of local NGOs and was made aware about the ecological goods and services provided by the lake systems that contribute to their livelihood. *Dangei Pahad* micro watershed in degraded watershed areas is the success story with community participation. They have learned to use the watershed judiciously, not cutting the tress and planting more trees and conserving the watershed. More than 3,000 villagers including the women, children, are participated in this program.

The problem of tidal influx was resolved by making a straight cut and bringing the mouth closer to the lake by 16 kilometres (Pattnaik, n.d.).

3.2 Kankaria Lake

Ecological Use: It attracts birdlife (Centre of science environment ,Amandeep Kang, 2013).

Economic use: It acts as a Tourist place which attracts the people of all age group not only from India but also from abroad. It acts as a social performance and congregation platform for events like Ras Garbha, Kankaria Carnival and Dog show by Police.

Issues: This Lake is in danger of drying due to siltation and has reduced from 16-17 feet depth to 10-12 feet depth (Ranade, 2008).

Conservation Process: AMC took up the work of de-siltation and cleaning of lake. They also developed Lake front providing facilities like Toy Train, Indoor sports Stadium, Laser show, Jogging Track, Aquarium, Zoo, Park (Nagina wadi), Amusement Park (Balwatika) Butterfly Park, Food Court, Lighting. The lake and garden attract people for walking, relaxing, yoga and running. AMC has decided to charge Rs 10 for entry ticket (IDC, 2009).

3.3 Mansagar lake

Ecological Use: It houses more than 150 species of migratory and resident birds.

Economic use: The lake downstream is used for vegetable cultivation and irrigation. It also acts as a Tourist place due to the proximity to Amer fort and only water body in Jaipur, which attracts the people from world wise and all age group people (IDC, 2009).

Issues: The sewage from the walled city of Jaipur was diverted into the lake and extensive deforestation in the surrounding hills has resulted in rapid siltation and reduced water storage capacity of the lake. The palace in the lake submerge to a depth of three meter or more during the

rainy season. Sole Sewage Treatment Plant (STP) partially treats domestic waste water which is not sufficient. Eutrophication restricts the survival of the macrophytes. All this has strongly affected water quality. Decrease in forestland (flora and fauna) has also resulted in reduction in birds population.

Conservation Process: The conservation project comprise of three major component Mansagar lake, Jalmahal Monument and Lake Precinct. The lake conservation plan for the Mansagar Lake under the NLCP, stressed upon the diversion and treatment of wastewater, desiltation, bioremediation, afforestion and catchment treatment. To maintain water level and improve the quality of water 4 hectors of wetland construction is proposed. Settling tank was constructed to trap the sediments from hills. Existing STP redesigned and renovated to enhance treatment quality. Water quality is regularly monitored against the baseline data gathered by the University of Rajasthan. The dredged sediments were used to create few islands which were planted to promote biodiversity of birds and encourage bird watching. This enhanced the aesthetic and educational value of the lake (Rana, 2008).

Under PPP model, the private stake holder Jalmahal Resorts Pvt. Ltd. (JMRPL) is involved in the restoration and maintenance of Jalmahal monument and lake front development with 40.46 hectors of land, 5.6 hectors of submerged water land and 18.5 hectors of *Gaimumkin Talab* (part of lake). The development includes providing sports facilities, restaurants, craft *bazzar*, restaurants, food courts, public park, gardens, bus stop and parking. The revenue generated will be used for maintenance of the lake.

3.4 Hebbal Lake:

Ecological use: Hebbal Lake is habitat for various local and migratory birds (Krishna, n.d.).

Economic use: It is used for different purposes like domestic water use, livestock water use, pisciculture by fisheries department, agriculture in catchment area and boating.

Issues: Most catchment areas are covered by building and industries. Waste water from the storm water channels caused pollution of lake water. Bathing, washing cloth, idol immersion adds in polluting water. Toxic elements from the agricultural fields in catchment of lake lead to the pollution which damages the ecology and ground water quality of lake. Fishes and birds died due to pollution and dehydration. At several places around the lake ground water has contaminated which made ground water unsuitable for drinking purposes (VIMOS Technocrats and Associates, n.d.) (T.V.Ramachandra and V.G. Ranjani, 2000).

Conservation Process: Department of Forest, Ecology and Environment and Government of Karnataka made effort to rejuvenate Hebbal Lake. Hebbal Lake Park Association (HELPA) was

formed in 2002 for conservation and management of Hebbal Lake. Funding was done by the Indo Norwegian environment program. Lake cleaning, deweeding, desilting (by mechanical means using excavator) is done with the support of experts, forest department (S. Shivanand and D. Gandhi, 2007). Structural measures and surplus flow arrangement is proposed to isolate the lake from sewage to keep it clean. Other recommendation included construction of silt trap, providing sanitary facilities, STP, solid waste collection and disposal arrangement, awareness campaign, environment education and lake front development for recreation (VIMOS Technocrats and Associates, n.d.). Islands with fruit- bearing trees were created for birds in the lake.

4. Outcome after conservation process

4.1 Positive Outcome

Chilika Lake: 57% of government and research input and 43% of NGO and community's involvement has resulted in the success of the conservation and management of the Chilika Lake.

The participatory management of watershed and coastal process resulted in the functional integrity of ecosystem and enhancement of productivity thereby increasing per capita income of local community (fisherman, farmers and other dependent). Tidal influx problem and logging problem was resolved. Flora and fauna species reappeared. Fish and prawn landing increased by eight times which resulted in increased average annual income of community depending on lake by more than US $ 1,000 per family (Pattnaik, n.d.).

Kankaria Lake: Cleaning of lake improved the quality of water inviting various bird species. Lakefront development is conceived as a memorable recreational urban space and has enriching experience. It has become a good tourist place and attracts visitors both local and tourist. Project cost can be recovered from the services provided over a period of time (IDC, 2009). The culture of littering, encroachment, building and heritage abuse in past is replaced by the culture of walkability (public friendliness), public art, festival, sports and recreation (Singh, 2013). Entry fee is relatively low thus affordable for students, low and middle income people.

The restored and developed Kankarial Lake is awarded by HUDCO for 'Best Practices to Improve the Living Environment' in 2012 and AMC has given special award 'Lee Kuan Yew World City Prize 2012' for Kankaria lake front development.

Mansagar Lake: Migratory birds species increased due to the creation of five nesting island. Local fish species is reintroduced. Holding capacity of lake has increase by dredging of lake bed (Kang, 2013). Water quality of the lake is improved. Water balance is maintained by allowing treated sewage to enter into the lake.

Hebbal Lake: After Privatization Lake dredging was done even though earlier dredging was done under INEP. Privatization neglected the restoration and conservation measures and concentrated more on Tourism oriented development via developing Jogging track, boating facilities, food courts and park.

Government restored and managed Chilika and Kankaria Lake does not have major negative outcomes. But negative outcome are observed in Privatized Mansagar and Hebbal Lake.

4.2 Negative outcomes

Mansagar Lake: The absence of single apex authority and involvement of multi stake holders (JDA, JMC, Forest Department, Irrigation Department, Rajasthan Pollution Control Board, Rajasthan Tourism Development and Corporation, Department of Tourism) resulted in poor coordination and integration resulting in the delay in the restoration process (Bal, 2012).

Land reclamation: Government has leased out lake front land with water submerged land to JMRPL under PPP. There was no authority under law which will permit the reclaiming of area of 5.7 hector submergence area given for leasing for 99 years (Bal, 2012). This adversely affects the ecology of lake.

Delineation of lake: West side Highway is alienating the lake. Lake drive road alienated the lake from hilly forests. Since both lake and forest are conserved as protected areas lake drive road is waste of money.

Prohibition of activities will affect the lake: Illegal construction of settling tanks and wall has damaged the lake. JMRPL has done filling and compaction of 40.46 hector from soil of lake damaging the ecology and the structure of the lake. Filling and compaction are not permitted without clearance. The project area is within the 10 km radius of Nahargarh wildlife sanctuary, under the Act of 1972 the project has to obtained clearance from MoEF under provision of Environment Protection Act, but no such approval has been obtained. Lack of proper infrastructure facilities, water supply, sewerage network and maintenance conflicts put lake under threat. Waste water is discharged directly into lake without any treatment (Bal, 2012).

Hebbal Lake: Hebbal Lake is developed in isolation without linking to the other lakes. High entry fees imposed to the lake front development facilities has deprived the marginalized community. Fencing and charging high entry fees for public space against public interest. Various NGO like rain water club, Environmental Support Group, local community, environmentalists are against the privatization of the lake on which many livelihoods depend. PPT adversely affected the rights of local communities who depended on the lake for livelihood uses like fishermen cattle users and dhobis (IDC, 2009) (Dasgupta, 2009). High court has passed interim order to stop

further development under PPP model but the private parties interpreted the order in other way and the conservation activities like deweeding has affected. (Environment, n.d.)

Ecology problems: Commercialization and unsustainable human activities put stress on the ecology of lake like affecting fish and bird species (IDC, 2009). Re-dredging was done unevenly putting treat to ecosystem and structure of the lake (Yeswanth, 2008). Not much improvement is observed in water quality like the dissolved oxygen level is 3.2 mg/l and recommended minimum standards by environmental protection act is 4.0 mg/l (Department of Mines and Geology, 2011)

Violation of land use regulations: Private developer has not taken permission from Bangalore Development Authority (BDA) for introducing commercial use shops, resorts and hotels in the lake precinct (IDC, 2009) indicating profit motive of private holders instead of conserving lake. Proposed construction of 223-room hotel is put to stay with help of NGO and civil society response as it is near bird sanctuary.

5. Discussion

Lake conservation and management should support the ecology, socio-cultural activities and users who have dependency on the lake. But in case of privatized developed and managed Mansagar and Hebbal Lake adverse outcome are more like the ecology is affected, restricted access widened the social gap and the structure of the lake changed. They concentrated more on money making in lake front development instead of conserving or restoring lake. Conservation and management of lakes should not be handed over to the private companies since lakes are public spaces, thus the strategies should consider the uses and users of the lake along with the active participation of community, NGOs and different institutions.

Integrated development: Lake Development should be done considering the lake catchment, community and the use of the lake. In case of Hebbal Lake while in privatizing the lake, LDA of Bangalore did not consider the traditional users who are dependent on the lake for different purposes like fishing and agriculture. The traditional user's public spaces is turned into parks and commercial spaces (food courts, boating, commercial fishing, etc.) with closed access. In case of Chilika Lake the development is based on ecosystem approach which involved local community and thus led to success but privatized Mansagar and Hebbal Lake had negative outcome die to privatization.

Involvement of multi stakeholders in the restoration and development should be based on ecosystem approach including community, people different sectors, NGO in order to safeguard the lake which is public property.

Changes in the use of the lake: The changes in use of the lake affect users dependent on the lake, ecology and catchment area. In case of Chilika Lake the sustainable approach resulted in increased employment opportunities for the local community and improved ecology of the lake. But in the case of privatized Hebbal Lake loss of livelihood of the traditional users has been observed and the ecology of the lake is under threat due to the human activities.

Instead of changing the use of the lake for commercial purposes Hebbal Lake should be declared as a bird sanctuary to attract the bird species and eco- tourist. It is wise to take up a comprehensive study of use of lakes to augment drinking water and recycle waste water through tertiary treatment for reuse instead of concentrating on commercial, recreational activities as in case of Hebbal lake. In case of Mansagar Lake instead of leasing out the lake area to the private companies and damaging the ecology of the lake, the Jaipur government with the help of different organizations can restore and develop it as environment friendly public space.

Unwanted development in privatized lakes: Development of the lake should safeguard the ecosystem at the same time funds should not be wasted for unwanted development. Even though Hebbal lake was restored and rehabilitated under INEP program the lake was leased out to the Oberio Group and repeated dredging of the lake was done. There should be some specified norms regarding the nature of work to be carried out in and around lake to safeguard the same.

Accessibility: Lake is public property and should be accessible to different income people. Kankaria lake is acting as revenue center which attracts people of different age group of people but in case of privatized Hebbal lake the unaffordable fees poses difficulty to the low and middle income people to access them. This widens social inequality. Also profit motive of privatization can be seen. Hebbal lake is already restored under Indo INEP, thus instead of privatizing the lake, HELPA integrating community and NGO can manage and restore the lake.

Loss of livelihood: In case of Chilika lake there is an improvement in the income level of the livelihood users of the lakes but in privatized Hebbal Lake loss of livelihood like fisherman and dhobis can be observed. Community participation at different stages can help the government to work and coordinate in holistic manner for the livelihood of the local.

Ecosystem safety: Conservation and management should not damage the lake ecosystem. But, in case of privatized lakes, violations of rules and regulations have damaged the lake. Commercial activities like food courts should not be within the buffer zone of 30mt from the lake boundary. Lake front development and tourism activities which impose threat to the lake should not be permitted in the lake area, for such development carry out survey to avoid development in fragile areas.

Table 1: Comparison of the four lakes based on the study

	Chilika lake	Kankaria lake	Mansagar lake	Hebbal lake
Hydrological and ecological issues	Yes	Yes	Yes	Yes
Economical issues	Yes	Yes	Yes	Yes
Ecological improvement	Yes	Yes	Improvement done Problem exist	No
Hydrological improvements	Yes	Yes	Yes	Improvement done Problem exist
Accessibility to different income people	Good	Good	Good	Not accessible
Violations of rules and regulations	No	No	Yes	Yes
Ecological problems	No	No	Yes	Yes
Major End beneficiaries	Government and Public	Government and Public	Private Stakeholders	Private Stakeholders.

6. Conclusion

Conservation and management strategies for lake should consider different impacts due to the development instead of concentrating only recreational development. Development strategies should have multi disciplinary inclusive approach. Central and State government organizations, Educational and Research institutes, Community, Citizens and NGOs should participate in conservation and management of lake instead of giving into the hands of private companies as their motto is revenue generation and not safeguarding lake water resource. A Single apex authority for lakes as decision maker should coordinate with all the stakeholders.

Proper implementation and achievement of conservation activities should be with community involvement. They should be made aware about the ecological, hydrological, environmental and socio-cultural importance of the lake. This can be done through various outreach programs and publications. The active participation of the students and community in planning, design, execution, cleaning, measuring water quality, planting trees, bird watching, drawing competition and self help program for lake rejuvenation give the opportunity for practical environmental education. Community Awareness and involvement about conservation activities will also reduce the burden on governing body. Formation of lake development trust or residents trust, involving community and NGO will help in raising funds, maintenance of lake and spreading awareness of about lake conservation activities. This will also make lake a platform for social gathering place.

Involving researchers like ecologist, environmentalist in lake conservation help in safeguarding the ecology and structure of the lake. Cost effective technologies like Eco-technologies can be used instead of conventional treatment techniques.

Preparation of biodiversity plans for city should integrate Lake Ecosystem. Management plan for individual lakes should be prepared based on the broad level policy framework for the lakes. Roles and responsibilities of all stakeholders should be clear for developing the working relationships and smooth functioning of the work assigned. It is more importance to safeguard the lake ecosystem which will help in holding rain water, recharging ground water, treating the wastewater, and maintaining local healthy microclimate instead of converting into commercial and recreational activities. For commercial and recreational facilities proper space should be demarcated which is not environmentally sensitive. No construction buffer zone should be maintain along the lake. More trees should be planted to attract birds which will act as a tourist and serve as an example of ecologically-wise integration of civic interest and biodiversity. This will also help in managing the lake with reasonably low entrance fees.

Thus at the end it could be said that the government involving community and other stakeholder lead to a positive conservation and management of the lake instead of privatization where the private party aims at revenue generation and not safeguarding the lake.

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