

Conservation and management of Phewa Lake ecosystem, Nepal

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This paper deals on current issues of conservation and management of a touristically important and environmentally degraded Lake Phewa Tal of Nepal from an integrated conservation and development perspective. The paper highlights on salient environmental features and management strategies of this multiple use lake. The management objectives focus on the long term sustainable management of a subtropical mountain lake ecosystem of Nepal in a collaborative, institutionally and financial sustained way. The findings are based on a field level investigation on need assessment and stakeholder analysis from multidisciplinary and participatory approach. Major conservation and management issues include: restoration of lake water quality, reduction of sedimentation load, eco-zoning of lake shoreline, conservation of aquatic biodiversity, promotion of eco-tourism and improved institutional capability of lake resource management. Relevant solution measures include: construction of a diversion canal, waste treatment plant, constructed wetland, buffer zoning, conservation of threatened species/habitat and effective monitoring system. Management strategy comprises bio-physical and socio-economic aspects with emphasis on issues like adoption of watershed/ ecosystem approach at policy level, equity in hardware/software development components, integration of income generation in conservation activities, sharing of responsibility/benefits among the local stakeholders, enhanced management capacity development and institutional strengthening for environmentally and socio-economically sustainable development of Lake Phewa form a long term perspective.

Keywords: integrated approach, ecozoning, sustainable utilization, stakeholders

Introduction

Current state of the world's lakes is indeed alarming and people around the world will have to make concerted effort to reverse the trend toward degradation. Management of a lake, which acts as an environmental indicator is very difficult as it requires resolution of important technological, financial and institutional issues and support from both public and the industry, which are generally liable to short term economic gains. New innovative way of lake management include partnership and integrated catchment approach (Nakamura, 1997), holistic perspective and sustainable use of lake resources (Engel, 1987). Phewa Lake which possess immense socio-economic, scientific and cultural values but a threatened ecosystem due to sedimentation, eutrophication and encroachment represent a case of disturbed lake in dire need of management. Further deterioration may cause severe loss of aquatic resources having ecological and economic significances. Major problems of lake management are related to social problems, citizens' involvement and economic-social and cultural aspects (Borre et al., 2001). This demands implementation of integrated management plans to restore and minimize the loss to a certain extent (Bista et al., 2002; IUCN, 1995a).

In this line, a development study on a master plan for conservation of Lake Phewa was conducted with an objective to formulate integrated plan for the environmental conservation of Phewa Lake and improve quality of life of people of its watershed area from participatory and ecosystem approach (JICA/SILT, 2002). The present paper highlights on salient features of the indicated study work.

Description of study area

Phewa Lake, the touristically most important lake of Nepal is a stream fed dam regulated, semi- natural freshwater subtropical mountain lake (maximum depth 24m and mean depth 7.5 m), lying at an altitude of 742m asl, in Pokhara valley (28° 7'-28° 12'N-84° 7'-84° 19'E). It occupies an area of 5.23 km², watershed area of 110km² (Rai et al., 1995). The lake has multiple uses such as hydroelectricity, irrigation, fishery and a boating facility. By land use pattern the lake features contrast in terms of forested with sparse rural settlement on southern side, agricultural land with dense urban areas on northern side, silt trap zone in western side and river channel zone in eastern side of the lakeshore. The watershed of the lake constitute

forest (44%), agricultural land (39%), urban and wetland area (5%), pasture and barren land (5%), lake area (4%) and shrub land (3%)(DSC, 1994).The population and mean annual rainfall of Phewa watershed accounts 0.14 million with annual growth rate of 7.4% and 35,000 mm respectively (CBS,1995). Trophically the lake changed from oligotrophic in '70s, to mesotrophic in '80s, and eutrophic by '90s (Shrestha and Jananuer, 2001). Biodiversity richness accounts for 7 vegetation types in watershed area, 104 bird, 34 mammal, 16 fish, 14 reptile and 6 amphibian species (IUCN,1995a) plus 39 aquatic macrophytes including 23 hydrophytes and 16 helophytes (Shrestha and Janauer, 2001). Number of tourists to Pokhara valley including the Lake Phewa accounted roughly 100,000 in 1995 (Banskota and Sharma, 1998).

Methodology

Field investigation: A multidisciplinary team of experts investigated all important aspect of conservation and management related issues of Lake Phewa at field level including laboratory analysis and engineering survey works during September, 2001.

Stakeholder analysis: Stakeholders' meeting and a public hearing program were organized to document concerned stakeholders' comments/suggestions from participatory approach.

Major conservation and management issues

Seven major threats to lakes of the world include: accelerated eutrophication, invasive species, toxic contamination, over fishing, water diversion, acidification, and climate change. Institutions and institutional arrangements for addressing these issues and for implementing a watershed approach is just beginning to emerge on lakes around the world (Borre at al., 2001). In this context, major environmental threats of Lake Phewa of Nepal, a least developed country, indicated as follows indicate some similarity and differences.

Restoration of lake water quality: Cultural eutrophication is considered major parameter for water quality management in Lake Phewa. Incidence of algal bloom in Lake Phewa by early 1990s, as a result of destruction of ecotone or buffer zone area resulted in anoxic condition and mass fish kills combined with adverse health impact such as skin rash, itching and conjunctivitis to swimmers in murky water of Lake Phewa implies sharp decline in water quality. This directly posed negative impacts on attraction of the local tourism based economy. Virtually irreversible accelerated eutrophication of a lake is similar to "diabetes" in humans (Nakamura, 1997)

Reduction of sediment load: It is estimated that during the period of 1990-'94, annual siltation rate has a range of about 175,000-225,000 m³. At this rate the terminal silt trap portion will be separated from the main lake by next 20-25 years and the lake proper will be "dead" by next 135-175 years, assuming loss of 80% water volume (DSC, 1994). A time series map analysis indicate a decrease in area from 10 km² (1956/57), to 5.5 km² ('76) and 4.4 km² ('98). There has been more than 50% reduction in area within a time frame of 5 decades (JICA/SILT, 2002). Lake Phewa is polluted due to high internal loading of sediments (SAIC, 1992).

Eco-zoning of lake shoreline: The effects of non-point sources such as agricultural run off are found to be greater than those of point sources of pollution such as laundry areas in Lake Phewa (Rana, 1990) As per conservation guideline, 10-30m strip of land along the lake shoreline and next 90m is recommended for buffer zone and controlled development zone with horticultural/agro forestry activities respectively (IUCN, 1995b). In practice, it needs full implementation. Restructuring of the littoral zone provides a balanced approach to lake restoration and multiple uses of the lake, thereby integrating management practices with planning (Engel, 1987).

Conservation of aquatic biodiversity: Uncontrolled growth of alien invasive species such as water hyacinth, and exotic carp fish species have caused loss of aquatic biodiversity especially of wild rice and native fish species. It indicates laxity in management such as control through utilization of invasive species and this in turn poses an adverse impact on the ecosystem health of the lake.

Promotion of ecotourism: Lake Phewa environ, famed as one of the most beautiful place on earth is touristically significant. It represents a hotspot for ecotourism promotion. However development of tourism

has been unplanned and spontaneous. Growing urbanization and unplanned tourism development activities around the lake in absence of inadequate infrastructural facilities have negatively affected the lake's recreational values (Banskota and Sharma, 1998).

Inadequate institutional capability: Institutional inefficiency in terms of inadequate cooperation and coordination among stakeholders has hindered effort on sustainable management of the lake resources. There is no specific authority responsible for the conservation and management of Lake Phewa (Banskota and Sharma, 1998) implying “tragedy of commons”.

Management Strategy framework

The field observation and stakeholders' concern established water pollution and sedimentation as major problems of Lake Phewa. Basic policy for conservation of Lake Phewa includes: extend its life span, maintain its cleanliness and promote it as an attractive tourist destination. To achieve this target, from current polluted status, there exists a need of an integrated and holistic approach along with sharing of responsibility and benefit among the stakeholders. Strategic approach covering bio-physical and socio-economic aspects can be highlighted as followings:

Integrated conservation and development approach: The focus of the study lies on integration of “hard ware” and “soft ware” components exemplified by construction of diversion canal to mitigate problem of water pollution, constructed wetlands to check sediment load, conservation of threatened species and habitats e.g. wild rice and fish spawn site and institutional strengthening. The basics for management of world's lakes includes: watershed approach, intersectional coordination, stakeholders' involvement and effective institutional arrangement for implementation/ monitoring (Borre et al., 2001). Sustenance of economic development projects is not meaningful in absence of active involvement of people (Banskota and Sharma, 1998).

Adoption of Watershed/ ecosystem approach: Lakes which are environmentally sensitive and an integrated part of a watershed lying at lowest level are vulnerable to sedimentation and pollution. This implies conservation of lake need coverage in watershed and ecosystem basis. This emphasize on systemic approach (Jorgensen and Vollenweider, 1989). On account of high sensitivity and importance of the lake area, it has been proposed to declare “Phewa Lake watershed conservation area” (IUCN, 1995b), however, it has not been implemented yet.

Integration of income generation into conservation activity: Local community can be motivated to integrate income generation and nature conservation such as through tea, coffee plantation in erosion prone hilly areas. As economic development governs environmental conservation, promotion of income generating activities holds substantial importance in relation to effectively implementing environmental plans into action (Shrestha, 1999).

Conclusion

Stakeholders were found to be aware and capable of taking environmentally sound decisions such as the selection of cost effective and long term sustainable option of a diversion canal in place of relatively costly and locally less sustainable measure such as a mechanized water purification system. Consensus building on constructed wetlands at mouth portion of major inlet: Harpan stream, to check sediment load from watershed area and to raise tax from Phewa lake visitors as a means of financial sustenance hold high significance. The proposed plans from an integrated, participatory and ecosystem approach were found environmentally and socio-economically sustainable. Effective implementation and monitoring of plans are needed to ensure sustainable conservation and management of this precious great Himalayan inland freshwater resource. This demands confidence building among stakeholders and promotion of institutional efficiency.

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