Integrated Lake Management and The World Bank

The conservation and management of lakes and reservoirs must enter the mainstream of the economic development process through comprehensive water resources management. Actions to improve management of lake resources on a sustained basis are necessary due to the high levels of direct and indirect pressure on lakes and reservoirs from rapid population growth, industrialization, and the growth of irrigated agriculture which are threatening the capacity of lakes and reservoirs to provide their enormous and varied benefits.

Why Are Lakes Important?

Lakes and reservoirs are critical elements of the earth's freshwater hydrological system and must be managed as part of a larger ecosystem rather than as independent units. They contain most of the earth's surface stores of liquid fresh water. Lakes and reservoirs provide water for drinking, irrigation, industrial processes, and power generation. They provide habitats for numerous species of fish, crustaceans, turtles, amphibians, birds, mammals, and water plants, many of which are important sources of protein and income for local inhabitants. Lakes and reservoirs are important for controlling floods, retaining sediments, and recharging groundwater. They are a source of recreation for swimming, boating, fishing, and quiet contemplation. Lakes are also important media for transportation in some regions. Finally, lakes and reservoirs provide, all too often, a major disposal site for domestic sewage, industrial wastewater, and cooling water from power stations.

Lakes and reservoirs as part of integrated water resources management

Compared with rivers, lakes and reservoirs are essentially closed systems, and their natural cycle takes tens or even hundreds of years to flush out contaminants. Because of their vulnerability to degradation, lakes require more careful and complex management than most rivers and streams. The World Bank is supporting measures to protect and manage lakes and reservoirs for the long-term future through its Water Resources Management Policy.

Current Development Trends

Lakes and reservoirs contain over 90 percent of the world's surface water stores of liquid freshwater. Lakes are not evenly distributed, nor are reservoirs. Many lakes and reservoirs are in high-income countries of North America and Western Europe, but their role may be even more significant in the countries of Eastern and Central Europe, and in the developing countries of Asia, Africa, the
Middle East, and Latin America. These countries have a growing need for freshwater resources.

Until recently, population and economic growth have occurred without paying adequate attention to the management of the lake and reservoir resources upon which economic development and human life depend. In many countries both the quality and quantity of freshwater available from lakes and reservoirs have declined significantly over the past 50 years. Lakes and reservoirs are increasingly unable to serve their ecological or economic functions.

Population in developing countries is projected to increase by nearly two thirds over the next 30 years, from 4.3 billion today to 7.1 billion in 2025. It will become increasingly challenging to provide freshwater to drink, to grow food, and to run factories and power plants to meet the needs of these people. It is imperative that we take action now to prevent the further degradation and depletion of lakes and reservoirs upon which so many will depend.

Challenges in Managing Lakes and Reservoirs

- **Water pollution.** Pollutants threatening lakes and reservoirs come from point and non-point sources, including sewage from municipalities, industries and mines, and runoff from farms and cities. Nutrients and organic matter from these sources accelerate eutrophication — a process which enhances plant growth, depletes dissolved oxygen and which may kill aquatic life and change ecosystems. Heavy metals, toxins, and chemicals contaminate sediments and bioaccumulate throughout the food-chain exposing humans to toxins which may cause diseases, cancer, or birth defects.

- **Water withdrawals, diversions and lake reclamation.** Water withdrawals from lakes and reservoirs, water diversions from upstream dams, and lake reclamation for agriculture and aquaculture may significantly deplete the size of the waterbodies, destroying habitat for plants and animals and sometimes causing high levels of salinization.

- **Disturbances in watersheds.** Logging, land conversion, and other disturbances in watersheds may lead to siltation and sedimentation of lakes and reservoirs, and block the rivers and streams that feed them. This can diminish the flood-control capacity of lakes and reservoirs, shorten their lifetimes, destroy aquatic habitats, and reduce the productivity of their ecosystems.

- **Introduction of exotic species.** Inappropriate fish farming and the introduction of exotic species may lead to loss of biodiversity or to a change in the ecosystem of the lake.

- **Overfishing.** Increasing human populations and the introduction of new fishing practices may lead to unsustainable fish harvesting -- and even the collapse of the fisheries.

**Policies and Actions for Mainstreaming Management — World Bank Approach and Experience**

Mainstreaming the management of lakes and reservoirs into the development process requires taking, on a sustained basis, a series of complementary measures, as follows:

**Policies, Strategies, Plans**

- **Water resources planning:** A comprehensive approach. Managing lakes and reservoirs so that they can provide their varied benefits sustainably requires a comprehensive approach involving all stakeholders and covering all activities affecting the water resources throughout the watershed. To work effectively, management plans must be developed at
the community-level, involve the participation of all the groups who benefit directly and indirectly from the waterbodies, and have clear and transparent rules for resolving conflicts. Wherever possible, property rights should be granted to resource users, who are then made responsible for their management.

- **Tools for better decision-making.** The use of analytical tools and techniques for assessing the net benefits of projects can help ensure that resources for projects are invested in the best possible way. Some useful tools include benefit-cost analysis, environmental and social impact assessment, and national environmental action plans.

- **Improving the allocation of water resources.** Currently, enormous quantities of water are wasted through inefficient irrigation systems or through poorly monitored and maintained urban water delivery systems. Charging users for water to reflect its economic value would help ensure that water is not wasted. Farmers and urban dwellers who pay appropriately for their water are much more likely to introduce water-saving technologies and practices than those who do not.

- **Pollution prevention and abatement.** Reducing pollution effectively requires controlling both point and non-point source pollution. Many countries have successfully reduced point and non-point source pollution using policies combining regulations, economic instruments, public education, and enforcement measures.

**Applied Research, Innovation, and Dissemination**

- **Applied research.** Much more information is needed to evaluate conditions in lakes and reservoirs in developing countries, and to understand how these are changing over time. Applied research efforts should focus on collecting basic data on water and environmental quality, hydrology, and hydrogeology, and understanding the inter-relationships between lakes and reservoirs and the larger freshwater systems of which they are a part.

- **Innovation.** Long-term management of lakes and reservoirs will require innovative, low-cost technical, financial, institutional, and policy approaches that reduce pollution, encourage water conservation, and improve the management of aquatic ecosystems and resources. Promising technologies include spray irrigation systems that use wastewater to improve soils for raising crops, technologies which allow industries and municipalities to reduce, reuse, or recycle process waters, and the use of artificial wetlands to treat municipal and industrial wastewaters.

- **Dissemination.** Finally, it is important that information on successful practices and proven technologies is widely disseminated. For example, the Consultative Group on International Agricultural Research (CGIAR) is working to disseminate information on sustainable farming practices -- such as terracing, contouring, crop rotation, ground-cover maintenance, and mulching -- that are effective in reducing land erosion and the runoff of sediments, silt, and pollutants to lakes and reservoirs.

**Next Steps**

The World Bank plans to undertake the following measures to address the critical issue of lake and reservoir management:

- **Global Water Partnership.** At the Stockholm Water Symposium in August 1995, the United Nations Development Programme (UNDP) and the World Bank announced the formation of the Global
Water Partnership (GWP) which will support the comprehensive management of our fragile water resources. The GWP will be used as a vehicle to mainstream the management of lakes and reservoirs into the development process.

- **Water Resources Management Policy.** The World Bank plans to develop supplementary policy guidance concerning the management of lakes and reservoirs as an element of its overall Water Resources Management Policy which was issued in 1993. This document will identify measures which need be taken to integrate lake and reservoir management issues effectively into strategic and project planning.

- **Strategic Action Plans.** The World Bank, subject to the availability of support from the Global Environment Facility (GEF) and other sources, will support the cooperative preparation and implementation of programs and projects to enhance the management of lakes and reservoirs. Current activities for Lake Victoria, Lake Ohrid, Lake Sevan, and the Aral Sea would be used as models for future activities.

- **Borrower Training.** The World Bank, with the support of its Economic Development Institute, will incorporate policy, management and technical concerns related to lake and reservoir management more fully into its training programs for integrated river basin management and integrated coastal zone management. This process would support the development of local capacity to address these issues in the design and implementation of programs and projects.

- **Support for Preventive and Restorative Measures.** The World Bank is prepared, at the request of its borrowers, to finance lending operations for preventive and restorative measures that enhance the management of lakes and reservoirs, either as free standing projects or as components of projects. The World Bank will continue to assure that all proposed projects are subject to environmental review consistent with its own procedures.

- **Lakes Management Initiative.** To assure a consolidated and well coordinated approach to managing lakes and reservoirs, the World Bank - through its Vice Presidency for Environmentally Sustainable Development - will support a Lakes Management Initiative. The objective of this initiative, managed by an interdisciplinary team of specialists from our Environment, Agriculture, and Infrastructure Departments, would be to support a Bank-wide exchange of knowledge and experience in the management of lakes and reservoirs which would be reflected in policies, best practices, programs, and projects.

Suggested Reading:


This Dissemination Note is based on a presentation by Alex McCalla, AGR's Director, at the 6th International Conference on the Conservation and Management of Lakes, Kasumigaura, Japan, October 23-27, 1995. The paper was prepared with the assistance of a team from the Environment Department and Agriculture and Natural Resources Department, comprising Wendy Ayres, Awa Busia, Ariel Dinar, Rafik Hirji, Stephen Lintner and Robert Robelus.