

Integrated Lake Basin Management

**Informational Requirements
for a Lake Basin Management
Programme**



- *In its various forms (vapor, liquid, ice), water is a fundamental component in the complex linkages between our planet's biotic and abiotic components, being the essential medium for life on our planet*
- *The world's freshwater resources, however, are under increasing pressure because of (1) increasing population growth; (2) increasing agricultural production to meet human food needs; (3) urbanization; (4) increasing economic activity to enhance human well-being; and (5) globalization of trade*

- *The Millennium Ecosystem Assessment and Global Environment Outlook indicate the Earth's freshwater, coastal and marine ecosystems continue to decline -- human activities are a critical causative factor and, in turn, also are being impacted by the environmental and socioeconomic consequences of these activities*

■ *Our planet's freshwater resources:*

- (1) *Finite* - *There is a fixed quantity ("All the water on Earth is all the water there is");*
- (2) *Sensitive* - *Water is easily polluted (its condition reflects human activities in its surrounding drainage basin);*
- (3) *Irreplaceable* - *Water has no substitute for its many uses (humans cannot 'make' water)*

- *Virtually all freshwater problems can be categorized as being problems of (1) quantity, (2) quality, or (3) both*
- *Quantity issues involve shortages or excesses. Shortages results from :(1) Natural phenomenon of drought, and (2) Anthropogenic effects of human over-abstraction of freshwater to meet agricultural, industrial or drinking water needs. Excesses result from excessive precipitation or snowmelt*

- *Quality issues are a function of pollutant loads. Major freshwater pollutants comprise some combination of: (1) microbes; (2) nutrients (particularly phosphorus and nitrogen); (3) heavy metals; (4) synthetic organic chemicals; (5) oxygen-consuming materials; and (6) sediments. Highly saline water is a pollutant in some situations*

- *On global scale, major differences regarding water quality concerns lie in:*
 - (1) *Perspectives of individuals and sectors affected by pollution (i.e., what is specific problem(s) and how serious is it?);*
 - (2) *Range of available options for dealing with problems (i.e., what can be done about it and how much will it cost?)*
- *The former focuses on assessing the condition of the water resources, while the latter focuses on water governance and financial issues.*

- *Whatever the basic perception, fundamental issue to be considered is how humans can ensure the sustainable use of freshwater resources to meet human health and economic needs, while also protecting important ecosystems.*

- *Integrated Water Resources Management (IWRM):*

".....A process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"

...Global Water Partnership (2000)

- *IWRM concept continued to evolve and expand over past decade, including:*

(1) Integrated River Management (IRM);

(2) Integrated River Basin Management (IRBM);

(3) Integrated Coastal Area and River Management (ICARM)

- *Recently, concept of IWRM applied to lake systems:*

"Integrated Lake Basin Management"

(ILBM)

Lakes as Freshwater Resources:

- *Parts of larger aquatic systems that can include rivers, wetlands and groundwater;*
- *At any given instant, lakes contain more than 90% of all liquid freshwater on Earth's surface;*
- *From landscape perspective, lakes = two closely interrelated, yet distinct, parts (waterbody + surrounding surface area from which water drains into it)*

Both waterbody and basin must be taken into account in lake management activities -- former cannot exist without the latter.

Unique Resources Values (cont'd)

- Significant repositories of natural and human history (ancient urban centers often arose on or near lakeshores);
- Development of lifestyles of some indigenous cultures based on lakes (Lake Titicaca (Bolivia, Peru); Lake Chapala (Mexico); Lake Manasarowar (Tibet, China) considered sacred sites:
- Lakes with large water volumes can moderate local climate by reducing range of atmospheric temperatures fluctuations;
- Intrinsic beauty and aesthetics

Unique Resources Values

- *Lakes subject to the widest range of human uses (→ also greatest potential for water use conflicts);*
- *Storehouses for large quantities of water (shortages, excesses);*
- *Sources of food and recreational possibilities for humans;*
- *Home to amazing range of aquatic biodiversity; also resting and feeding habitats for migratory birds;*

Resource Values of Lakes

More potential uses (values) than other water systems:

- (1) Direct Values - *drinking, irrigation & industrial; transportation; hydropower production; fishing & aquaculture; recreation; breeding grounds for migratory waterfowl;*
- (2) Indirect Values - *buffering extreme water events (floods, droughts); pollutant sinks;*

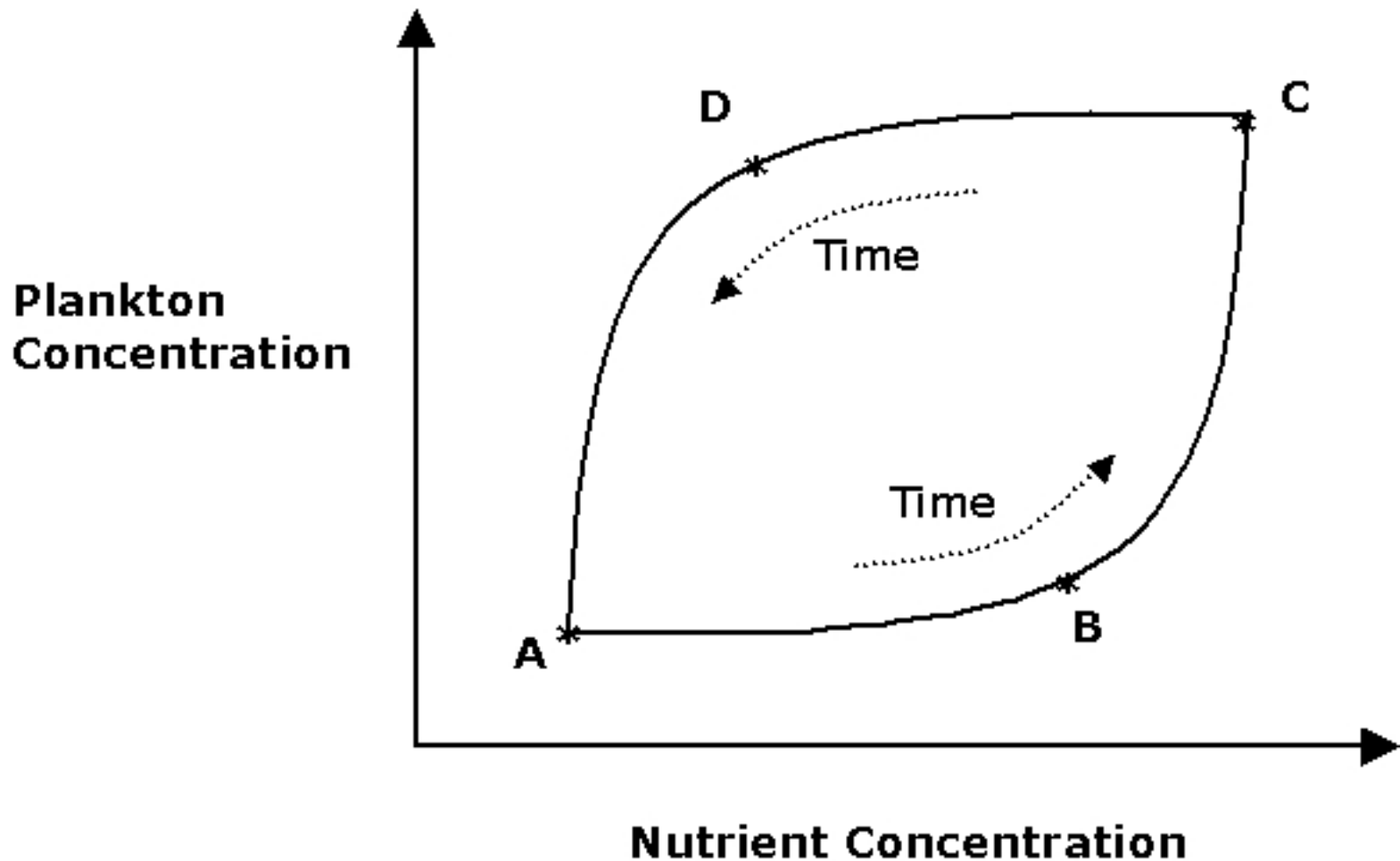
Resource Values of Lakes

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- (3) Non-use values - *aesthetics (beauty, mental relaxation; "grandeur of nature); religious/spiritual significance; "...knowing that it's there."*

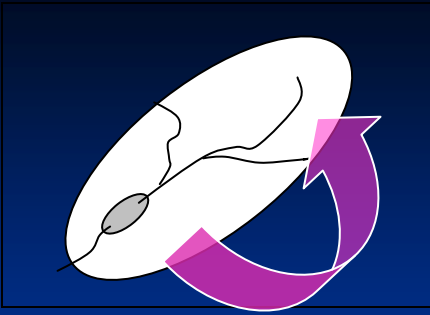
Unique Characteristics of Lakes

- (1) Integrating nature – Mixing of water and pollutant inputs from multiple sources; barometer of human activities in surrounding drainage basin;
- (2) Long water retention time – inflows change from 'lotic' to 'lentic' system → buffer against negative impacts of pollution AND positive impacts of remedial activities;
- (3) Complex response dynamics – Non-linear responses to perturbations ('hysteresis')

Hysteresis and the Long-term Response of Some Lakes



Management Implications of Lake Characteristics



- *Integrating nature:*
 - *“memory” of human activities in basin*
 - *managed across jurisdictions*
- *Long water retention time:*
 - *mix of control instruments*
 - *long term management commitment*
 - *monitoring*
 - *reliable funding*
- *Complex dynamics:*
 - *role of science*
 - *linking problems to causes*

Information Needs

Principle 4 of World Lake Vision:

“Policy development and decision making for lake management should be based on sound science and the best available information.”

.....I LEC (2003)

Information Needs

Multidisciplinary information and data needs include:

(1) Biophysical Characterization:

Physical, chemical & biological factors;
water uses; water availability;
physiography & geology of drainage basin;
flora; fauna; etc.

→ Fundamental information on quantity
and condition of water resources;
where found

Information Needs - (cont'd)

(2) Governance Characterization:

Institutions; policy; finances; cultural mores; sociology; politics; etc.

→ *Fundamental information on how human use the water resources*

- **Coupling Scientific Information & Lake Basin Management**

- *Desirable characteristics associated with scientific information, include:*

- (1) Reliable understanding;*

- (2) Inclusion of monitoring;*

- (3) Communication with decisionmakers;*

- (4) Accessibility of knowledge to lake basin management stakeholders*

- (5) Enhancing Capacity for Acquiring Scientific Knowledge & Data*

Use of Scientific Information in Lake Basin Management

- *Scientific information used in three main ways to enlighten lake basin management:*
 - (1) Show the limits of the resource;*
 - (2) Enlighten hard-to-see connections;*
 - (3) Provide novel or innovative solutions (including the use of models)*

Sharing Scientific Information

- *Facilitating involvement of lake stakeholders in management efforts:*
 - (1) *All relevant stakeholders should be involved;*
 - (2) *Stakeholders must be allowed sufficient time to develop capacity to become familiar with relevant issues;*

Sharing Scientific Information (cont'd)

- (3) Existing representative structures (e.g., local governments, NGOs, traditional organizations) should be used to maximum extent in disseminating relevant information and data;*
- (4) Roles of stakeholders should be clearly defined;*
- (5) Stakeholders should have access to sufficient resources to become effectively engaged in lake management process.*

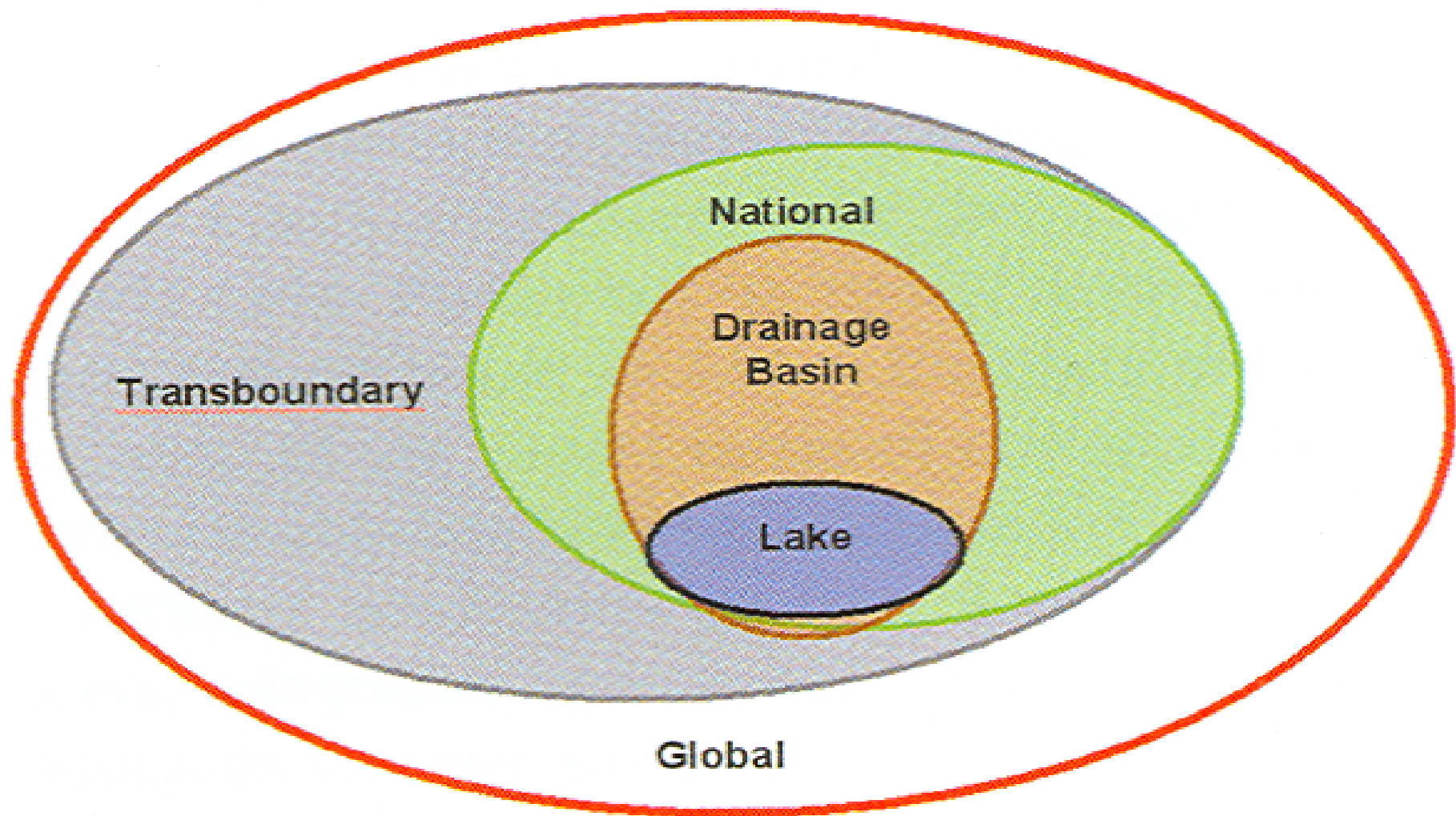


Figure 1. Diagrammatic representation of the interconnectedness of the origin and nature of threats facing lakes.

WORLD LAKE VISION

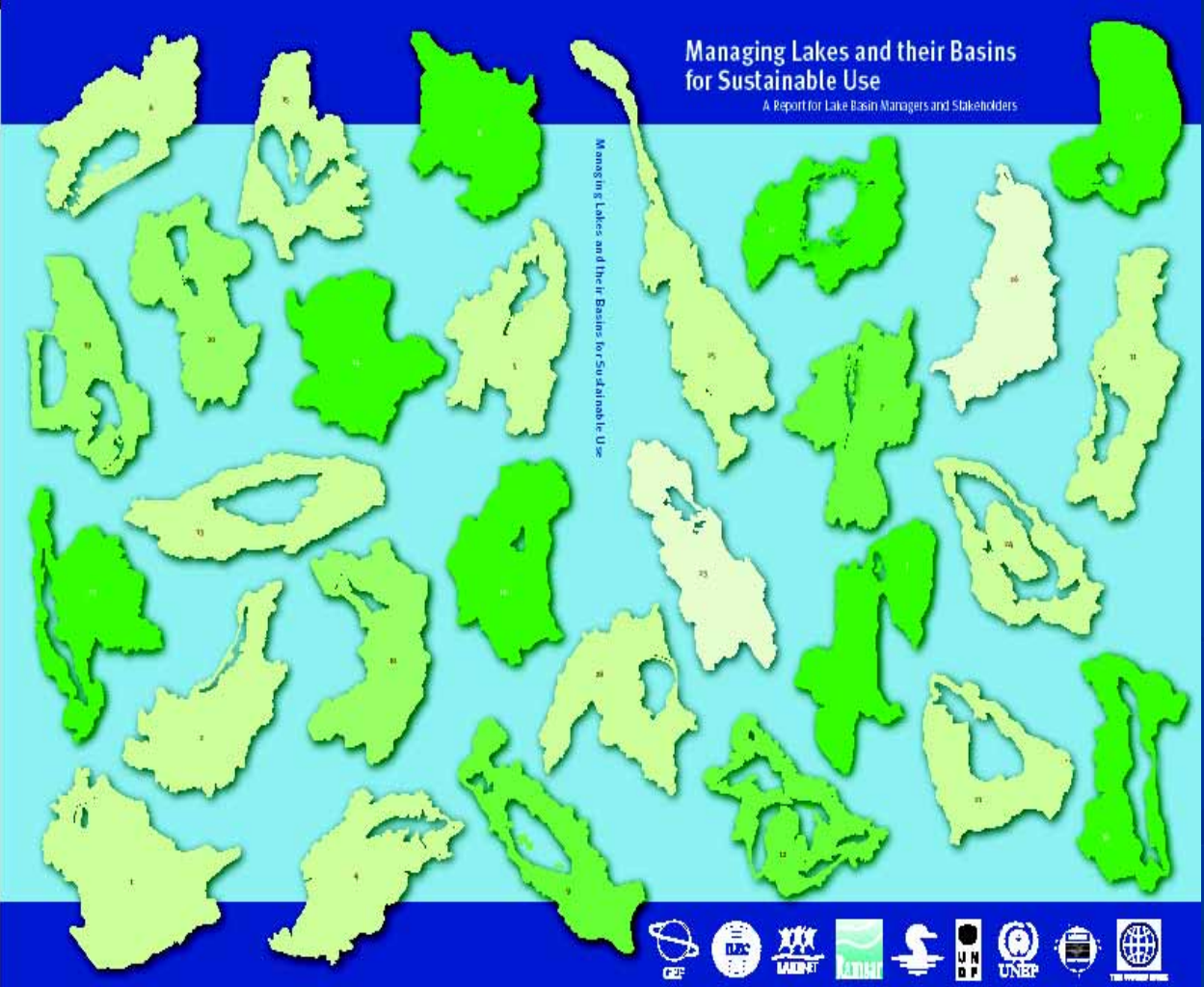
A CALL TO ACTION



World Lake Vision Committee



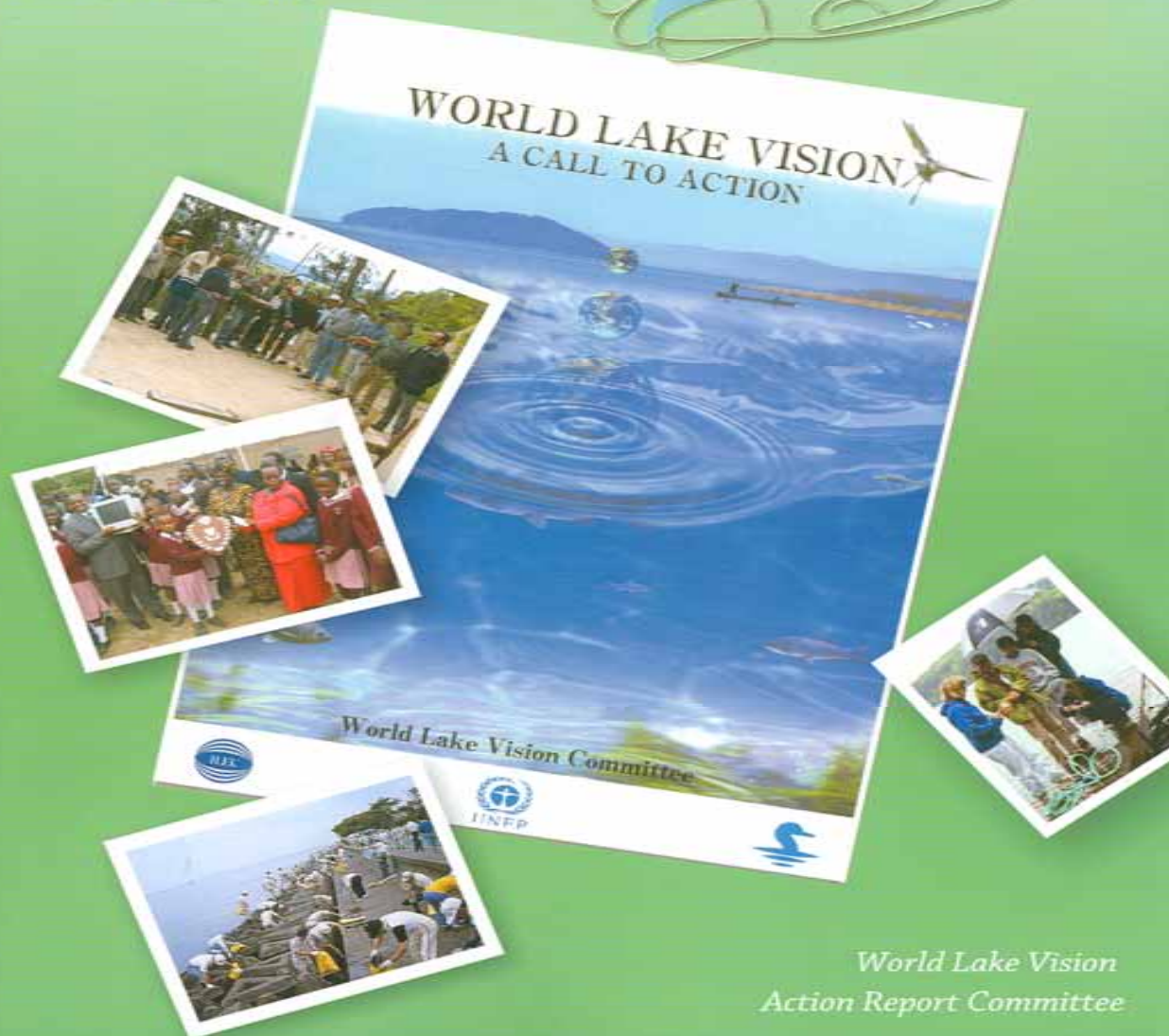
A Global Review of Lake Basin Management



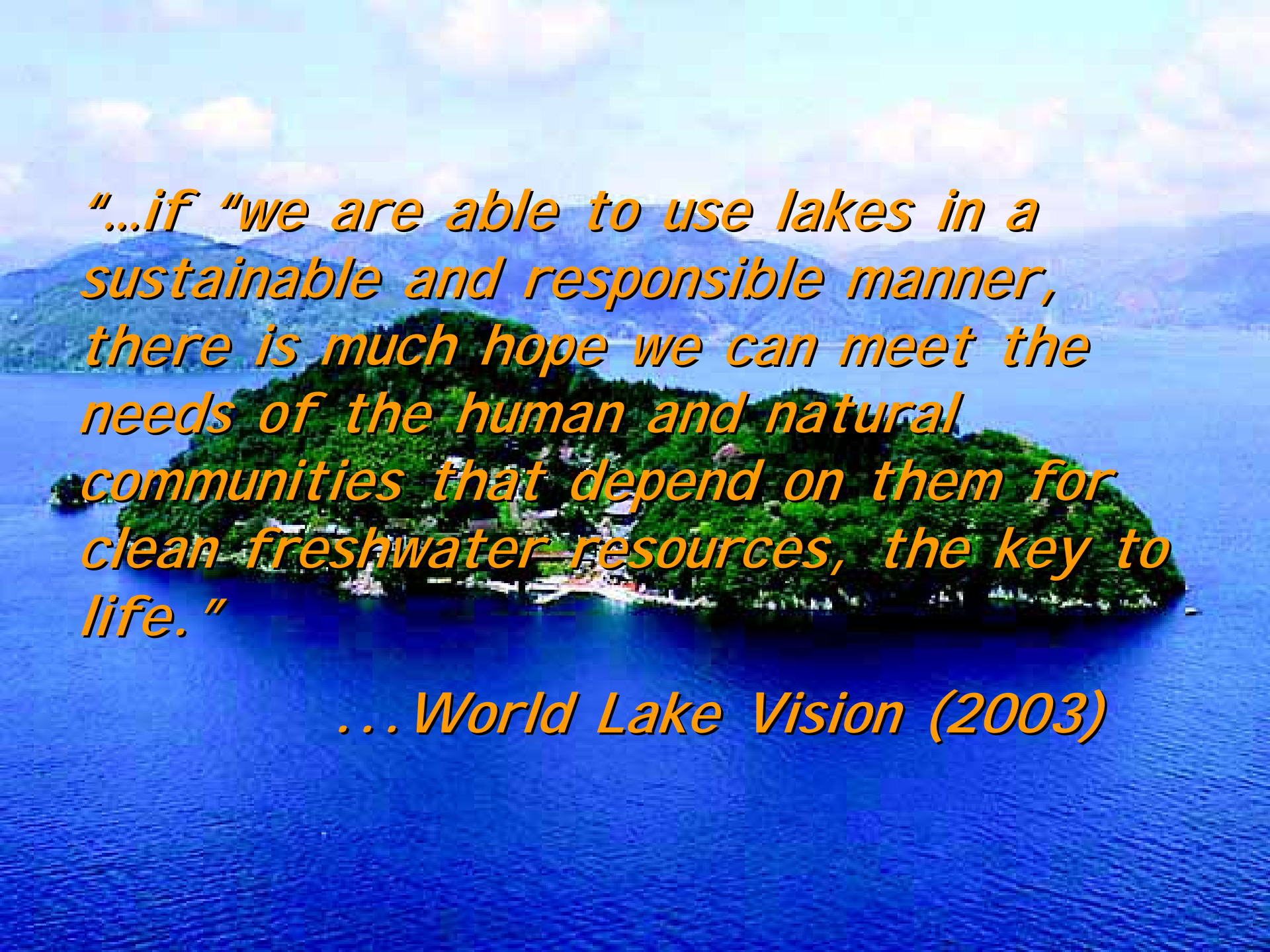
World Lake Vision

Action Report

*Implementing the World Lake Vision
for the Sustainable Use of
Lakes and Reservoirs*



*World Lake Vision
Action Report Committee*

An aerial photograph of a small, lush green island in the middle of a large, deep blue lake. The island is covered in dense green trees and has a few small buildings and a dock visible. In the background, there are rolling blue mountains under a sky with light, wispy clouds. The overall scene is serene and natural.

"...if "we are able to use lakes in a sustainable and responsible manner, there is much hope we can meet the needs of the human and natural communities that depend on them for clean freshwater resources, the key to life."

...World Lake Vision (2003)