Development of ILBM Platform Process

Evolving Guidelines through Participatory Improvement 2nd Edition

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Request

This document is meant to be an evolving document for improvement through application to actual cases of lake basin management challenges faced globally. The identified possible needs for improvement, together with the lessons learned and the experience gained through actual applications, may be kindly communicated to infoilec@ilec.or.jp.

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Evolving Guidelines through Participatory Improvement

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Preamble: Purpose of This Document

Background

What is “lake basin management,” and how is it supposed to be carried out? This simple question is not easy to answer. Our overall record in realizing successful lake basin management has not been very impressive over past years. Why is this so, despite so many years of global experiences with management plans of one kind or another being developed and implemented for many of our lakes? Among many possible reasons, one is our inadequate understanding of the relationship between the process of development and implementation of a management plan, and the governance improvement needs that must accompany this process.

Planning and governance are complementary activities. Unless there is a plan, the resource development and conservation activities can become haphazard, and the use of lake basin resources unsustainable. The same is true regarding governance. Unless there is a long-term and sustained effort for improving the overall basin governance, i.e., institutions, policies, stakeholder participation, information, technology, and finances, the implementation of individual plans and programs can become haphazard, fragmentary and disarrayed, and the basin environment would remain fragile, making the sustainable use of the resources ever more difficult to achieve. In the planning of lake basin management, it is often assumed that the overall basin governance is intact, and that it is simply a matter of carrying out component plans and programs to fit the overall objective of basin management. In fact, this assumption would not hold true for most developing countries and, under limited circumstances, would not hold true even in many developed countries.

What Is Integrated Lake Basin Management (ILBM)?

Integrated Lake Basin Management (ILBM) is an approach for achieving sustainable management of lakes and reservoirs through gradual, continuous and holistic improvement of basin governance, including sustained efforts for integration of institutional responsibilities, policy directions, stakeholder participation, scientific and traditional knowledge, technological possibilities, and funding prospects and constraints. It has been conceptualized on the basis of the premise that achievement in managing lakes, reservoirs and their basins is facing a serious global challenge. ILBM also takes the position that the problems facing individual lakes cannot be properly addressed unless the fundamental issue of sustainable resource development, use and conservation facing the lakes is address globally, and with strong, long-term political commitment. The ILBM Process also is designed for lake basin stakeholders collectively to fill the gaps between what has already been achieved, and what remains to be achieved realistically in continuing governance improvements over time.

What Is the ILBM Platform and How Does It Help Lake Basin Management?

The main purpose of this document is to inform and guide the process for improving lake basin governance, i.e., development and implementation of policies, programs, activities and actions to be undertaken, with the broadest possible representation of the basin community, and fullest possible accountability and responsibility. To address this overriding goal, this document provides a conceptual framework of ILBM and the associated processes to support its implementation. It also proposes the development of ILBM ‘Platforms,’ a virtual stage for collective stakeholder actions for improving the basin governance through ILBM, as a strategic means of facilitating the gradual and continuous improvement of basin governance over a long time period. The extension of the scope of application, from a basic ILBM framework to a cyclic process framework, is proposed in relation to the conventional planning and implementation processes. The proposed conceptual framework, possible application schemes, and some experience and lessons learned over the past decade, are summarized in relation to the issues and challenges facing some selected cases in developing countries. The need for mainstreaming the concept on a global experience is also discussed.

Chapter Structure

The chapter structure consists of: Lakes as Lentic Waters: Distinctions, Features, and Management

Implications (**Chapter 1**), Planning vs. Governance: A Crucial Relationship for Sustainable Basin Management (**Chapters 2**), ILBM Platform Development: Seeking to Strengthen the Six Pillars of Governance (**Chapter 3**), Frameworks for Interpreting the ILBM Outcomes (**Chapter 4**), Knowledge Base and Data Base Systems (**Chapter 5**), and Summary and Way Forward (**Chapter 6**). It is emphasized that this document is not meant as a prescription to operationalize the static concept of the ILBM Process, but rather to serve as an evolving document to be revised and refined as its readers and practitioners collectively gain experience with ILBM, particularly in regard to the development and use of the ILBM Platform, which represents the hub of collective basin stakeholder actions to make contributions toward sustainable use of lake basin resources, individually as well as globally.

Box 1. Lake Basins, a Major Freshwater System on the Globe

Comprising more than 90% of the readily-available liquid freshwater on the surface of our planet, lakes and reservoirs are the key components of global water resource systems. They are managed for various purposes. Drinking-water supply lakes, for example, are managed for clean, safe water. Fishery lakes are managed to maximize the harvesting of abundant and healthy fish. Scenic lakes are managed for aesthetic reasons for visiting tourists. Polluted lakes are managed to restore their water quality and to rehabilitate the ecosystem. Most lakes, however, are subjected to multiple management objectives intertwined with complex, and sometimes conflicting, needs and approaches, often with inadequate management resources. The managed lakes usually have a management plan, but the integration of objectives, needs and approaches for successful management are not as easy as one would expect from an ideal plan drawn on paper. Further, the management challenges in many cases stem from the complicated situation evolved over the course of history of the lake and its surroundings, with various interventions already having resulted in an unsustainable management regime.

The track record of sustainable management of lake basins over the past several decades, however, has not been very impressive globally, particularly in developing countries. Together with other standing bodies of inland waters such as reservoirs, wetlands, ponds, lagoons and the like, most of them being connected to rivers and other flow paths upstream, downstream and underground, lakes have been suffering from the deteriorating trend of water quality and ecosystem integrity. As a result the overall value of their very existence, not only as sources of resource values for human use, but also the intrinsic values such as scenic attraction, religious and cultural affiliation, and diverse aquatic and terrestrial life forms, have been ubiquitously diminishing.

Figure B1. Everyone Lives in the Basin of Lakes or Other Impounded Water Bodies, and ILBM Helps Them Live Happily

Although much of the situation is due to the lack of management plans and/or the inadequacies in implementation capacity of these plans, they are not the only major reasons. Yes, without plans and programs, and without the necessary human and financial resources mobilized, effective lake basin management will not be possible. However, even with plans and programs, and with the necessary human and financial resources, lake basin management won't succeed without the foundation to support such pursuits; namely, the gradual improvement of overall governance of the basin and beyond.

1. Lakes as Lentic Waters: Distinctions, Features and Management Implications

This Chapter gives a background on the global need for, approaches to, and achievement in, the management of the basins (including the riparian environments) of lakes and other standing bodies of water such as reservoirs, ponds, wetlands and estuaries, collectively designated as "lentic waters." The need for management will be reviewed, and the fundamental reasons for the difficulties in sustainable management will be discussed. It will also discuss the unique features of lentic waters, as compared to those of flowing (lotic) waters such as rivers, and of the concept of "Ecosystem Service," as a basis for sustainable management.

1-1 Lentic-Lotic Basin Systems in the Hydrostatic-Hydrodynamic Context: Management Implications

Lakes and reservoirs are broadly considered as "standing" or "static" water systems or, using a hydrologic term, they are designated "hydrostatic" systems. In contrast, "moving" waters, such as rivers, can be regarded as "hydrodynamic" systems.

Similar expressions exist in the ecology literature as well. The descriptive terms are "lentic" and "lotic" systems. The meaning of "lentic" is basically the same as for hydrostatic, and the meaning of "lotic" is the same as for hydrodynamic. However, the lentic and lotic expressions have the additional connotation of their imbedded ecological functions. That is, the term "lentic" also connotes the ecological properties unique to a standing body of water, while the term "lotic" also connotes the ecological properties unique to a moving water system. It is noted that lentic waters can be either fresh or saline/brackish.

Thus, natural basin water systems, such as lake-river systems, pond-stream systems, wetland-spring systems, and even constructed, but naturalized, dam-river systems are hydrostatic-hydrodynamic systems, as well as being lentic-lotic systems, because of their historically-fostered ecosystem functions. On the other hand, a water supply storage tank of treated water, with inflowing and outflowing conveyance pipelines, would be regarded only as a hydrostatic-hydrodynamic system, and only marginally as a lentic-lotic system because of its suppressed natural ecosystem functions.

The term "lentic" connotes the ecological properties unique to a standing body of water, while the term "lotic" connotes the ecological properties characterizing moving water system.

Figure B2 illustrates this important relationship. The natural lake-river systems, pond-stream systems, and wetland-feeder spring systems are strongly lentic-lotic in character. The pond-channel systems constructed in past times, becoming naturalized after many decades and centuries, may be regarded as moderately lentic-lotic in character. On the other hand, the artificially constructed storage tank-conveyance pipeline and detention ponds-discharge channel systems cannot be characterized as lentic-lotic systems. Most basin systems constitute a complex combination of these three types of lentic-lotic systems. The flow regime changes as flow control measures are introduced, and, consequently, the management implications also differ depending on the flow regime. Management of a basin that consists mostly of a strongly lentic-lotic regime, for example, requires a different management approach than that for a basin consisting primarily of a weakly lentic-lotic regime. Thus, the basin governance characterizing the management approach for the latter would have to duly adjust to address this difference, as will be discussed in succeeding chapters.

The term "lakes" is used in this document to mean "lentic waters" and the term "lake basins" is used to mean "lake-river basins" or more broadly "lentic-lotic basins".

In addition, most water systems have properties that lie somewhere between being totally lentic (totally hydrostatic) and totally lotic (totally hydrodynamic). The water in some parts of a river may become stagnant or non-flowing and be regarded as being lentic (hydrostatic), for example, while some portion of the water in a lake may move very rapidly at some times, thereby being regarded as lotic (hydrodynamic).

Box 2. Lentic-Lotic Basin Systems in the Hydrostatic-Hydrodynamic Context: Environment: A Conceptual Framework for Management

A basin water system generally consists of a mosaic of many smaller hydrostatic (standing-water) basins and hydrodynamic (moving-water) basins. In the completely natural setting, the hydrostatic system is synonymous to a lentic system and the hydrodynamic system is synonymous to a lotic system, as the terms lentic and lotic imply the geo-historically formed ecosystem significance associated with standing and moving waters. In the completely artificial setting, the system would only be a hydrostatic-hydrodynamic system. The artificial systems constructed many decades and centuries ago in the natural setting could be regarded as weakly lentic-lotic, as compared to the totally natural systems regarded as strongly lentic-lotic.

It is also to be noted that most water systems typically have properties that lie somewhere between being totally lentic (totally hydrostatic) and totally lotic (totally hydrodynamic). The water in some parts of a river may become stagnant or non-flowing and be regarded as being lentic (hydrodynamic), for example, while some portion of the water in a lake may move very quickly, thereby being regarded as being lotic (hydrodynamic). Because a lake basin represents a complex combination of both lentic and lotic water systems, the term "lakes" will be used in this document to mean "lentic waters," and the term "lake basins" will be used to mean "lake-river basins" or more broadly "lentic-lotic basins." The lentic water can be either fresh or saline/brackish.

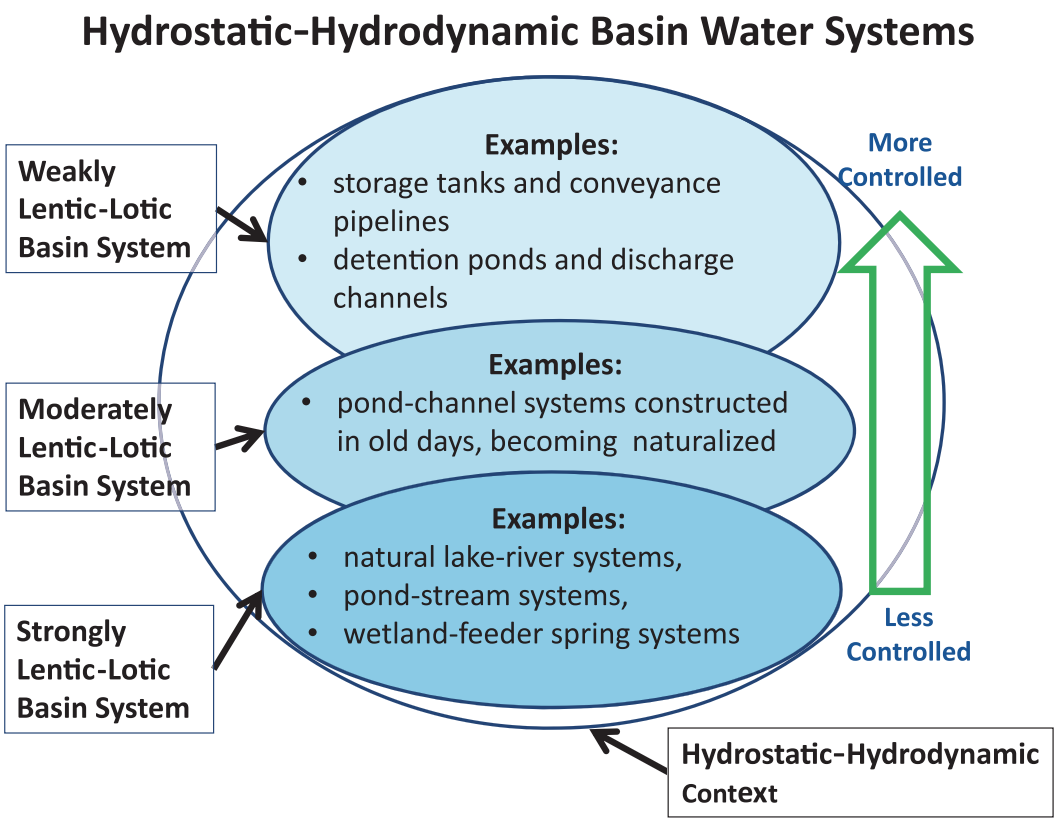


Figure B2. Degree of Control of Lentic-Lotic Basin Systems in the Hydrostatic-Hydrodynamic Context

1-2 Lake Basin Typology with a Focus on Lentic-Lotic Linkages

A detailed discussion on this subject is presented in **Annex 1.** A summary is presented below.

Although each and every lake basin is comprised of a unique combination of characteristics, it is helpful to group lake basins into types to assist those engaging in ILBM Platform development to find similar cases from which to learn. The focus of this document, however, is on lentic-lotic linkages and here we present a typology based on that concept. It makes use of five simple questions that can serve to elucidate, from a decision making perspective, which lake basins are similar to others from a lentic-lotic point of view.

The five themes are: Lenticity (how much of a basin's water is in lentic form?), Hydrological Position (how upstream or downstream is a lake within its broader drainage basin?), Connections (what are the major types of connections between a lake and other water bodies?), Control of Outlet (to what degree is the outlet of a lake controlled?), and Diversions (are there significant diversions of water in or out of the basin?).

Lenticity

The term "lenticity" was coined in one of the recently-prepared report on the development of assessment methodology for transboundary lake basins (ILEC, 2011) to describe how much water in a given basin is in lentic vs. lotic form. Systems with a greater percentage of water in lentic form have slower response times to stress. This also generally implies a higher buffer capacity. On the other hand, they respond relatively slowly to positive interventions. Lenticity can be calculated by considering the total amount of volume in lakes in a given lake basin and comparing that with the annual runoff generated within the drainage area. (See **Box 3** for examples.)

Hydrological Position

ILEC (2011) notes that the farther downstream a lake basin is relative to its broader drainage basin, the more likely it is to receive upstream pressures. Additionally, it is more likely to be seen as 'important' from the broader drainage basin perspective. One way of quantifying this "hydrological position" is to compare the amount of runoff generated in the lake's portion of the drainage basin upstream of the lake, compared with the total amount generated in the whole drainage basin. This includes not only the lake's upstream but also the downstream area of the lake's outlet all the way to the ocean.

Connections to Other Types of Water Body

Connections between waterbody types have received increased attention in recent years. ILEC (2011) explicitly studies connections among aquifers, lakes, rivers, large marine ecosystems and the open ocean.

Groundwater connections: The importance of inflowing and outflowing groundwater connections to a lake's water quantity and quality is among the most important issue.

Large Marine Ecosystem (LME) connections: Closing of a lagoon's connection with the sea due to sedimentation from the lake basin can lead to a marked decline in the ecological status of the lagoon. A significant amount of water and pollution may be entering from and discharging out into the marine system.

River connections: Probably the most pervasive connection is between a lake and its inflowing and outflowing rivers. The flood water carried into the lake from the upstream rivers may totally dictate the lake water level during the wet and the dry seasons. In many cases, the lake water provided to the downstream use can not only be local importance, it may be national and international importance.

Lake connections: In some cases, a given lake's water balance can be strongly controlled by the outflows from an upstream lake.

Atmospheric connections: All lakes, except perennially frozen ones, have some connection to the atmosphere though direct precipitation on their surfaces and through evaporation. In some cases, these connections can be the main drivers of change for a lake. For lakes lacking a surface or subsurface

outflow, evaporation can dominate the water balance.

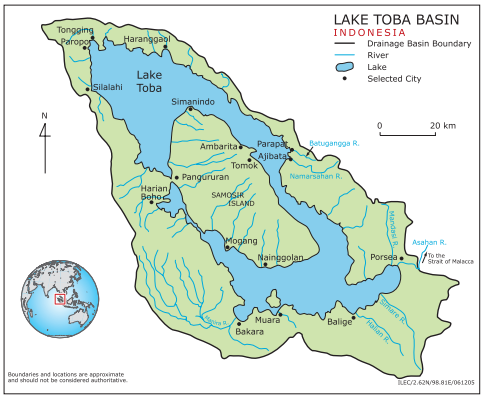
Control of Outlet

The degree to which a lake's outlet is controlled can have significant impacts on the lake's ecosystem. One of the main motivations in controlling a lake's outflow is to reduce the lotic nature of the downstream river in order to increase the ease with which hydropower can be generated.

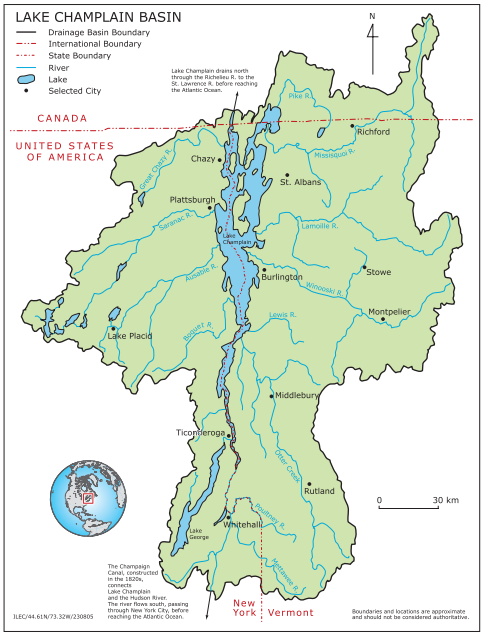
Diversions

The diversion of water into or out of a lake basin can have significant effects on water quality and quantity. Diversion out of a basin can have serious effects on the water balance, especially in closed lake basins dominated by evaporation.

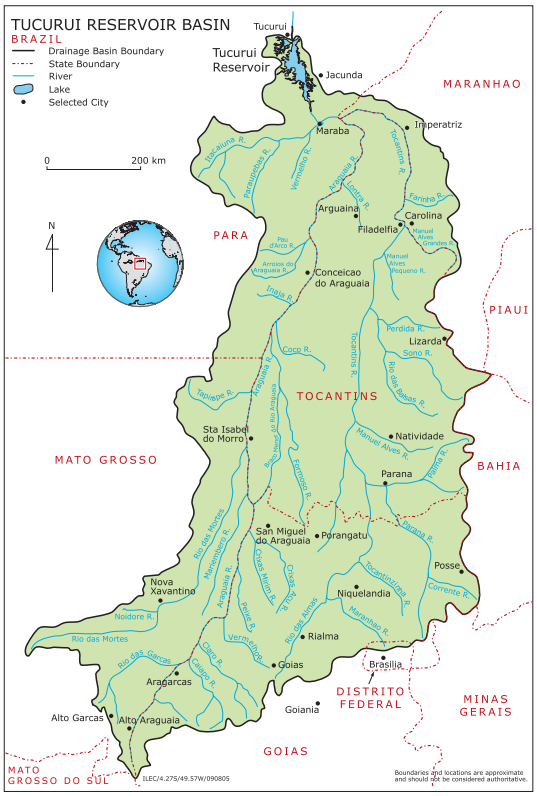
Box 3. An Example of Lake Basin Typology: Lenticity



(a) High Lenticity: Lake Toba Basin



(b) Moderate Lenticity: Lake Champlain Basin



(c) Low Lenticity: Tucurui Reservoir Basin

Figure B3. Examples of Lenticity (reproduced from **Figure A1-1 a-c** in **Annex 1.**)

1-3 Vulnerable and Fragile: Features and Implications of Lentic Waters

The occurrence and management of lake basin problems is a function of three distinguishing characteristics of lentic-lotic basin systems, including: (1) *an integrating nature*; (2) *long water residence time;* and (3) *complex response dynamics.*

Integrating Nature[i]: *<Stresses come from many directions and transcend across the entire water system>*

Because of their location at the hub (the terminus in the case of being situated downstream; the source in the case of being situated upstream) of a drainage basin, lakes and reservoirs are the flow-regime integrators within the entire river-lake basin complex. On the one hand, for example, they may suffer from the degrading pollution inputs received via rivers and other inflowing channels from sources throughout their surrounding drainage basin, as well as beyond (via long-term atmospheric deposition). On the other hand, they may adversely affect the downstream beneficiaries by trapping and not releasing valuable nutrient-rich sediments. These integration effects transcend over the entire lake and riparian land interfaces, thereby causing both the lake resources and the problems associated with them to form a complex web of cause-effect relationships and propagate throughout the lake, and even through the connected inflowing and outflowing water courses to other parts of the basin.

The management implication of the integrating nature is that a broad range of management policies and programs need to be introduced and implemented for as many source of the problems as possible across the entire lake basin system. This is particularly important for transboundary lakes. Thus, cooperation between the countries sharing a transboundary lake basin is essential for effective lake basin management.

Long Retention Time: *<Problems remain for a long time, and finding solutions also takes a long time>*

The water residence time refers to the average time that water spends in a lake. Large lakes are typically characterized by large water volumes and resulting long retention times, giving them a buffer capacity in that they are able to absorb large inputs of water, as well as the pollutants and sediment loads carried in this water, sometimes without exhibiting immediate negative impacts. This incremental response to pollutant inputs can make it difficult to notice degradation problems until they have become serious lakewide problems. Long water retention times also allow suspended materials in the water column, including pollutants, to settle to the bottom of the lake, thereby ensuring the role of lakes as a sink for many materials. A long water retention time also ensures that, even when remedial programs are implemented to restore a degraded lake, it can take a very long time - if ever - for a lake to recover. It also leads to lags in ecosystem responses that are poorly matched to the human management time-scale.

The management implications of long retention time include that, because the problems can build up and become noticed slowly, and it takes long time also to solve such problems, the institutions involved in lake basin management need to be prepared to engage in sustained actions, with long term funding commitments.

The implications of lake ecosystem vulnerability being affected for a long time necessitate management with a precautionary approach.

Complex Response Dynamics: *<The ecosystem behavior is often unpredictable and uncontrollable>*

In contrast to lotic water systems, lakes do not necessarily respond to perturbations or pollution in a linear fashion. This is due in large part to their stagnancy of impounded water mass held over long time, which allows time delays in response to external disturbances. The result can be a non-linear response (hysteresis) to increasing pollutant loads. For example, a lake can receive a large nutrient load

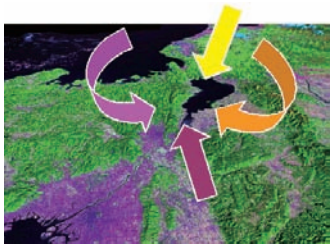
without exhibiting significant degradation until the nutrient concentration reaches a critical level that triggers a fundamental shift from its existing trophic state to a more eutrophic condition, characterized by detrimental algal blooms. The lake can then exhibit rapid degradation after this critical level is reached. This same buffering capacity also hinders achievement of the positive goals of water quality restoration programs. Even after pollutant loads have been reduced, for example, a lake will not necessarily exhibit a positive response to such remediation efforts until after the lake has flushed or otherwise neutralized its previous high content of nutrients, which may take a considerable period of time. Further, experience also suggests that only a certain degree of recovery maybe possible, and that the original good condition may never be achieved.

The management implications of complex response dynamics include that lake basin problems must be anticipated as far in advance as possible, through monitoring, developing indicators and analytical studies. Scientific studies to better understand the complex processes and their implications, and also to help develop solutions to the resulting problems.

Box 4. Three Features of Lentic Waters, a Lake Biwa -Yodo River Case

1. **Integrating Nature** (Everything comes together) → Issues are mostly inseparable.

The environmental and ecological stresses come from the atmosphere, the watershed lands, and along the downstream Yodo River, with a total water-user poputation of some 14 million in Shiga, Kyoto, Osaka and Kobe areas.



GIS credit: Keisuke Sato, Ritsumeikan University, Japan

2. **Long Retention Time** (Problems remain long, and finding solutions also takes long time) → Changes are gradual and often invisible.

The inflowing water togeter with contaminants stay inside for years and decades before being flown out. Most of the non-biodegradable settled materials stay much longer and undergo biophysical and chemical chenges. The maximum depth is 104 m and the mean residence time of the lake water is estimated at some 15 years.

Photo credit: Etsuji Hamabata, University of Shiga Prefecture, Japan

3. **Complex Response Dynamics** (Everything affects everything else in water) → Often unpredictable and uncontrollable.

The physical, chemical and biological interactions are intertwined in many complex ways and are always undergoing changes, making it difficult to predict and control. The gigantic vortex called a gyre is one of the phenomena which are normally invisible but became visible on a hot summer day when some silt was carried into the lake from one of the major inflowing rivers.

Photo credit and courtesy: Asahi Newspaper for Lake Biwa Research Institute, Japan

1-4 Ecosystem Services: A Useful Conceptual Framework

The overall degrading trend of the world's lakes[ii] suggests that, regardless of the form of ownership, their management leaves much to be desired. The Millennium Ecosystem Assessment (Millennium Ecosystem Assessment. 2005) notes that ecosystems provide a range of benefits, in the form of life-supporting services to humanity, services that nature provides essentially free-of-charge, although not strictly without costs. Virtually all ecosystems provide services essential for human health and economic well-being. The four classes of ecosystem service components are:

1) ***Resources Provision Services*** – These represent the products people obtain from ecosystems, including water supplies; fish; crop irrigation; wood and fiber; fuel; hydropower generation;
2) ***Regulating Services*** – These refer to the benefits people obtain from the regulation of ecosystem processes, including flood and drought mitigation; self-purification capacity; health provision; navigation routes; climate mediation; aquatic habitats; diverse food-chains; fertile lands; coastal ecotone buffer capacity;
3) ***Cultural Services*** – These refer to the non-material benefits people obtain from ecosystems, including aesthetic and scenic values; religious sites and spiritual values; historic sites; educational resources;
4) ***Supporting Services*** – These refer to the services necessary for the production of all other ecosystem services, including heat energy; geological formation; nutrient cycling; primary production; physical formation.

Their relationship is shown schematically in **Figure 1.**

The challenge is for humans to gradually attain a balance between the ***resource provision services*** and the ***regulating services*** of the overall *ecosystem services*[iii], which requires a much longer timeframe and much broader spatial implications than the conventional idea of lake basin management. Consistent with the Millennium Ecosystem Assessment, ecosystem services represent the benefits people obtain from ecosystems.[iv]

In defining these ecosystem services in this manner, it is noted that resource provision services are typically valued in monetary terms. The other three classes of services, however, are more difficult to value in this manner. As a result, degradation of the latter services often is neglected in management efforts. Increasing use of lake resources can have profound negative impacts on the environmental status of lake systems.

The progress of degradation within a lake and its basin often takes place on a wider, deeper scale than may readily be apparent. Of particular interest within the context of lake basin management is that increasing human use of lake-specific ecosystem provision services can result in degraded ecosystem regulating services. Even more important, however, is that increasing loss of regulating services, in turn, can also result in decreasing provision services, as well as the loss of cultural and support services. This reality highlights the need to transform unsustainable resource development to sustainable resource use.

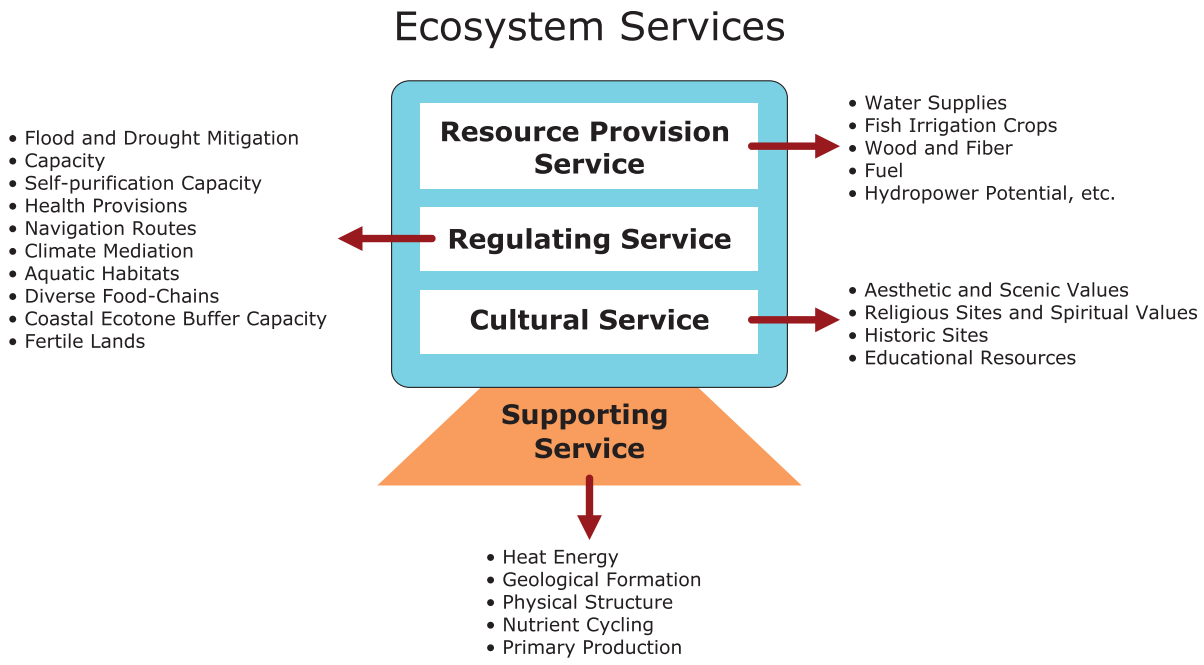


Figure 1. Four Classes of Ecosystem Services

<Case Example 1: Ecosystem Service of Lake Lanao, an Ancient Lake under Stress>

As one of the fifteen or so ancient lakes[v] in the world, Lake Lanao in the Philippines contains about 18 endemic species of cyprinid-flock fish, while also providing water supply, fisheries, bathing and other livelihood uses of water, and a means of transportation, to the resident population, consisting mainly of the Maranao ethnic group. Their cultural heritage and socioeconomic and ecological values of are closely attributed to the lake's *Regulating and Cultural Services*. Further, the lake water draining into the Agus River is subsequently impounded by seven dams that generate sufficient electricity to meet about 70% of the entire Mindanao power requirements. The artificially-controlled lake water levels for hydropower generation have hindered the artisanal fisheries and shoreline agriculture activities. The environmental and ecological state of the lake also has deteriorated because of the soil erosion caused by villagers transmigrated to the upper and steeper parts of the watershed. The poverty-stricken population also suffers from political and military conflicts, stemming in part from ethnic and religious differences. Because of the rigorous stakeholder participation promoted by the local NGOs, however, use of the ILBM Platform has proven positive, contributing now to establishment of a Protected Area Management Board (PAMB)[vi] in the region, possibly a closely-affiliated conceptual framework to facilitate the ILBM Platform Process.

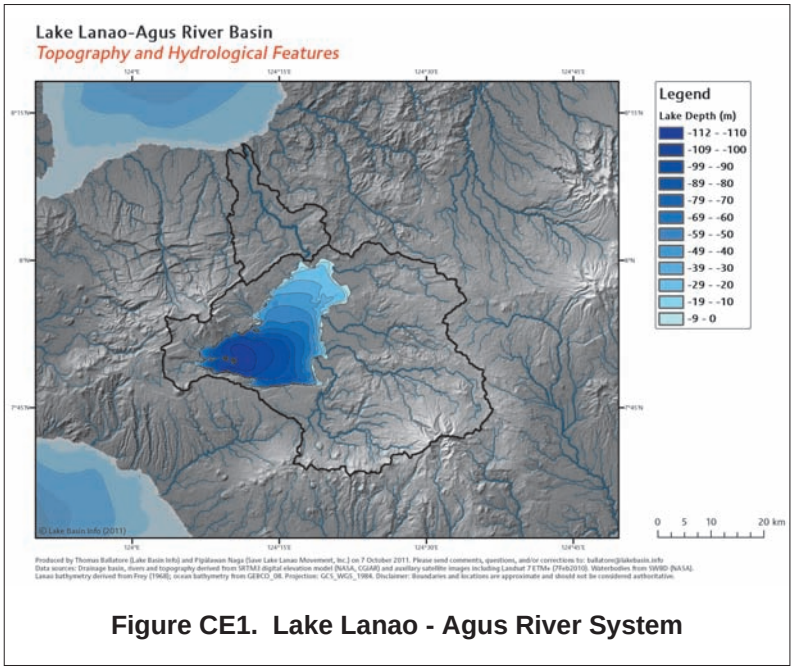


Figure CE1. Lake Lanao - Agus River System

1-5 Resource Use Features and Their Management Implications

1) Resource Use Features

The difficulties associated with sustainable use of lake resources, particularly for lakes under strenuous pressures of congested use, are sometimes discussed in the context of "Common-Pool Resources"[vii] feature of lakes (see **Box 5** for a discussion of its theoretical framework). The discussion usually proceeds in such a way that, if the prospective users are allowed to engage in the extractive activities of the finite and easily-degradable lake resources without any control, the resources tend to be easily diminished in a short period of time, perhaps never to be restored. This "Tragedies of the Commons"[viii] type of situation is sometimes found in highly congested urban and peri-urban settings in some developing countries. The actual cases of lake basin management, however, usually defy generic application of this concept. Elinor Ostrom, as referenced by Moore (2010), for example, made the observation that the Common-Pool Resources could be successfully managed as long as it was clear who gets what; good conflict resolution methods exist; the people keep the resource in sufficiently good condition to enjoy appropriate benefits; that monitoring and punishing offenders is done by the users; and the users are allowed to participate in setting and modifying those rules.[ix] Thus, the ownership, the stipulated responsibilities, and the knowledge about the state of environment, are the key factors for addressing lake basin management for sustainable use, which can be discussed for different cases.

Broadly speaking, lake resources may be owned by national, regional or local governments, by communal groups, or by private individuals and organizations. If a lake is a government-owned property, the required management rule would involve governmental policies, rules and regulations, and responsible actions by citizens. If a lake is a communal property, the management rule would involve traditional community rules for quotas, moderation in extractable uses, and a sharing of the sense of collective conservation. If a lake is a private property, the management rule would involve rules for meeting the desired optimal use.[x] When these lake resources are not owned by anyone, they are used as open access resources.[xi]

2) Management Needs, Reasons and Purposes, and Perspectives

The extent and nature of management needs could be very different, depending on, for example, whether the causes pertain to **i)** *the lake itself or its basin*, and whether or not the management need pertains to **ii)** *a single resource or to multiple resources* for the same lake. They could depend also on how **iii)** *the causal-chain of degradation phenomena* is developed. For example, it may originate from **iii-1)** *inside the lake (physical, biological,* chemical phenomena and interactions), from the **iii-2)** *immediate riparian land-water interface* (shoreline configuration, ecosystem properties, anthropogenic activities, etc.), from the **iii-4)** *riparian water system linkages* (upstream, downstream, from groundwater, etc.), or from the **iii-5)** *non-riparian water system linkages* (far upstream, far downstream, outside the basin through the atmosphere and other transportation sources, etc.)

A range of management reasons and purposes may also be described also in a variety of ways, and they are generally complexly intertwined. For example, **a)** developing resource values (e.g., fisheries and water resources development) and **b)** enhancing resource values (e.g., tourism and recreational facilities ; fishery market facilities), are strongly motivating reasons and purposes. If the resource use become too congested, then **c)** decongesting resource use (e.g., regulating water extraction and fish harvest) may become quite important. A further level is, the overall availability of resources may far exceed the overall demand, leading to the need for **d)** resolving resource use conflicts (legal, institutional and technological interventions), for **e)** reducing environmental stress (e.g., pollution control; control of invasive species), and **f)** rehabilitating and restoring riparian habitats. Further, the management need for **g)** protecting resource value damages from extreme events such as floods and droughts. Management intervention through **h)** taking precautionary adaptation and

mitigation measures (global warming; ubiquitously dispersed chemical contamination) is also becoming an important management purpose. The range of specific reasons and purposes culminate to the need for **i)** improving overall ecosystem health, as implied in the Ecosystem Service framework introduced in the previous section, the most encompassing reason for, and purpose of, lake basin management.

Management perspectives are another important concept. They differ in regard to 1) space, 2) time, and 3) perception. The spatial perspective was already introduced in section **Section 1-2** (**Lake Basin Typology**), where relationships among physical configurations, linkage structure, riparian land-water interface, linkages to other water systems were discussed. *The temporal perspective* relates both to the geo-historical implications of the formation and alteration of physical, chemical and biological presence of lakes, and their relationships with their basins, and to the history of human-nature interaction over centuries, if not tens of centuries. *The perceptional perspective* relates to the way the lake basin society formed their values in relation to the resources provided by the lakes. This perspective is particularly important in terms of the cultural history of the riparian communities in evolving traditional management rules.

In summary, the challenges facing the sustainable use of lake basin resources are broad in spectrum, complexly intertwined in nature, and quite encompassing in terms of fulfilling lake basin management needs over temporal, spatial, and perceptional scopes. It is not just a question of developing a single management plan and expecting it to be implemented by the prospective beneficiaries of managed resources. In fact, the ownership, not only of the lakes as a resource base, but also of the causes of resource value degradation, is important. The management responsibilities transpiring out of the ownership must be shared and fulfilled by the remotest of the causal chains of resource value degradation. The possible modes of transaction for fulfillment of the responsibilities will have to be clearly understood by all, as there are challenges encompassing the issue domains of institution, policies and politics, participation, technologies, knowledge and information and financial resources. These factors are discussed in the next chapter.

Box 5. On the "Common-Pool Resources" Aspect of Lake Basin Management

In economics, a Common-Pool Resources (CPR), also called a Common Property Resources, is a type of good consisting of a natural or human-made resource system whose size or characteristics makes it costly, but not impossible, to exclude potential beneficiaries from obtaining benefits from its use. The characteristics of common-pool resources may be described using a table as illustrated below. In the table, "Rival" means that one person's use of a resource subtracts from the amount available to other users. For example, someone catching fish reduces the amount someone else can catch - at least over the short term. For "Non-rival" goods, one person's use does not affect another's use. That is, one person's enjoyment of the climate-moderating or aesthetic benefits of a lake does not diminish another person's enjoyment. "Excludable" implies that there would be some cost to incur in controlling someone's access to a resource. "Non-excludable" implies that cost for restricting access would be too high. That is, it is difficult to prevent people from accessing the resource. This framework is used essentially to tell that the "Non-excludable" but "Rival" resources, such fish resources in lakes, are common-pool resources that tend to be overused in the absence of management rules. Some uses (flood control) are public goods.

		Excludability	
		Excludable	Non-excludable
Rivalry	Rival	Private Good	Common-Pool Resources
	Non-rival	Club good※	Public good

※A club good defines a resource system whose benefits are owned or utilized by a restricted group of beneficiaries (e.g., recreational facilities in a members-only lakeshore resort facility), while a private good describes benefits owned or utilized by an individual beneficiary (e.g.,a privately-owned boat).

2. Planning vs. Governance: A Crucial Relationship for Sustainable Basin Management

This Chapter discusses how the management needs of lake basin resources are met, particularly in relation to the perceived limitations in the conventional concept of planning and implementation. It emphasizes the need for "basin governance improvement" to be succinctly incorporated in the general process of planning, without which it would not be possible to successfully implement plans and programs for sustainable use of lake basin resources.

2-1 Meeting Management Needs: Scopes and Approaches in Planning

The possible reasons for, and purposes of, lake basin management discussed in **Section 1-5** would necessitate development of suitable frameworks for planning, with the goal of fulfilling the respective requirements. For example, **a)** developing resource values would be required for the sectoral agencies in charge of water supplies and fisheries. The **b)** enhancing resource values would be required, for example, for promoting tourism and recreational facilities. The need will soon arise for plans to **c)** decongesting resource use in such a way that undue pressures would be alleviated, for example, by reducing the number of fish catches through both statutory and non-statutory means. In the case of **d)** resolving resource use conflicts, introduced plans may involve compensatory payments or creation of a new resource base to ease the resource use competition. Most well-known plans in lake basin management are those for **e)** reducing environmental stress, particularly in relation to the quality of lake water. The plans usually stipulates structural means (e.g., construction of sewerage systems), as well as nonstructural means (e.g., enhancement of regulatory activities such as compliance monitoring of the quality of discharged effluents). However, there is a whole range of measured stress reductions, depending on the kind of stresses produced, and for what reasons. Removal of noxious sediments form the lake bottom, rehabilitating the lake bottom for restoring the shellfish habitat, enhancement of agricultural Best Management Practices (BMPs), local eco-labeling, etc., may be all categorized under environmental stress reduction. A rather debatable plan for stress reduction is bypassing pollution-loaded river water away from the lake to downstream or other destinations. This may simply result in relocation of the environmental stress to another location, other than actually addressing the basic causes.

There are other types of plans that play important roles in lake basin management, such as those for **f)** rehabilitating and restoring riparian habitats, as well as those for **g)** protecting resource value damages from extreme events. The former is becoming more and more common in many developed countries, as well as in some developed countries, with innovative technologies being developed and the benefits of introducing such technologies outweighing their costs. The plan to delineate reed-bed protection zones for maintaining and enhancing ecosystem integrity, for example, probably falls in both categories. Planning for **h)** taking precautionary adaptation and mitigation measures is rare, other than for often-heated debates as to whether or not to allow siting of facilities that may have potentially irreversible adverse impacts on the ecosystem properties of the lake (e.g., dams; resort complexes). Overall, the plans mentioned above are all related to addressing **i)** improving overall ecosystem health.

The plans developed for the various reasons and purposes, however, may not necessarily produce the desired outcomes. The resource development and resource conservations plans individually introduced, for example, could typically result in a conflicting outcome. The temporal and spatial scopes of plans can prove inconsistent with the way the lake ecosystem behaves, despite significant financial, technological and manpower investments. Improved lake water quality could prove to be very erratic whithin a short planning horizon. Above all, although the plans being developed and implemented by the responsible bodies with different mandates (e.g., multiple resource development agencies vs. regulatory and coordinating agency) are likely to be implemented in coordination, there is no standard approach that would always work well in such cases. In summary, there is a need for more than only planning and implementation to ensure that

inconsistencies among individual reasons and purposes will gradually be harmonized. The individual plans would complement each other over time, and the overall outcome of these plans would be consistent with sustainable development, use and conservation of lake basin resources. This suggested approach defines "Integrated Lake Basin Management," a concept to be described in the following chapters.

Box 6. Lake Basin Management: Evolving Global Experience

It is important to note the way in which the typology of lake basin management plans that were discussed in the main text of **Section 2-1** are applicable to the evolving global experiences in lake basin management, both in developed and developing countries. For example, among the plans to **a)** developing resource values; **b)** enhancing resource values; **c)** decongesting resource use; **d)** resolving resource use conflicts; **e)** reducing environmental stress; **f)** rehabilitating and restoring riparian habitats; **g)** protecting resource value damages from extreme events; **h)** taking precautionary adaptation and mitigation measures; and **i)** improving overall ecosystem health, the plans characterized by **a)** through **d)** above are extremely important issues in many developing countries, particularly those in South East Asia, South Asia, Central Asia, Middle East, Central-Latin-South America, and Africa. Many developed countries, particularly those in Europe, North America, and East Asia and Oceania, have already past this stage, and are stressing the importance of moving forward to develop various policy frameworks directed to requiring plans that are characterized by the above items **f)** through **i)**. Although the plan to **e)** reduce environmental stresses is a common challenge for both, it exhibits different contexts. In many developing countries, it is a matter of livelihoods, (i.e., the kind of environmental stresses affecting them include direct health hazards, loss of staple animal proteins, and diminishing food sources due to serious biodiversity loss). On the other hand, in most developing countries, it has more to do with a need to enhance amenity values, such as recreational and aesthetic values.

It is not to say that there are no exceptions to the above simplistic dichotomy. In fact, many countries falling within the above definition of developing countries have a significant number of lake basin cases that have been brought under the above plans for **h)** and **i)**. In fact, some of the most important global assets are lake basins in the above-noted developing country regions. In the same vein, many of the developed countries currently have the legacy of still doing poorly in plans addressing above-noted items **a)** through **d)**. Rather, they have had an era of their livelihoods being directly dependent on such lentic-lotic freshwater resources only up to the time that modern technologies allowed them to live in the world dictated by large-scale pumps and concrete conduits. The loss of the lentic-lotic environment, in lieu of the strictly hydrostatic-hydrodynamic environment, creates a lingering feeling that some of the resource values lost in the process cannot readily be restored and regained.

The above milieu of planning needs and experiences attests to the importance of looking at lake basin management, not as an issue of individual lakes *per se,* but rather as a central issue in water management on the global level that is intertwined in a complex manner in the linkage mechanisms of basin typology, of different forms of lentic-lotic and hydrostatic-hydrodynamic water systems with land and atmosphere interactions, of the historically-transformed pursuits for resource values, and of the management issues that have evolved through human-nature interactions across continents, and over the course of centuries, if not tens of centuries.

2-2 Governance Improvement as a Prerequisite for Planning

<Meaning of Governance[xii]> "Governance" is a concept that recognizes the importance of government's actions (in its diverse levels and components) while recognizing also the importance of linking such actions to be tied to other groups and sectors that interact within the same space, across "public-private-civil interaction networks along the local/global axis". Such condition increases the legitimacy and efficiency of the undertaken actions, reducing in an important way the social costs of public policies implementation. The rapid spreading of the term since the 1990s seems to reflect an increasing awareness of a paradigm-shift in power relationships. There has been a perception of insufficiency of the classic concept of "government" to describe the transformations that have been taking place in the context of globalization. Governance is a notion that searches for (instead of imposing) a model to describe a complex systemic transformation, which takes place at different levels (from local to the global) and in different sectors (public, private and civil), as noted by Juarez (2010). A more specific definition of governance as related to water management is provided in **Box 7.**

<Close Relationship between Planning and Governance> Though useful as it is, the existing literature on planning for lake basin management touches little on the broader subject area of governance. Perhaps not so conspicuously noticeable in cases described in such literature, development of a management plan and its implementation has a great deal to do with "governance" being intact and continually strengthened as new challenges arise. This close and complementary relationship between planning and governance is particularly important in the case of lake basin management for sustainable use, because 1) it involves a large number of stakeholders with multiple sector interests, complicating the implementation of the plans and programs, and 2) it requires the people's understanding and proactive involvement across the entire basin over long time, requiring government agencies to play a suitable facilitating role, as well as implementing individual plans and programs.

<Range of Planning Bodies and Activities> In the case of resource extraction and use, plans and programs are developed by the respective sector agencies in charge or the stakeholder groups in control. As for resource conservation, including pollution control, and ecosystem maintenance and restoration, the plans and programs are developed generally by the coordinating agency for environmental protection or the concerned bodies having influence on the sustainability of resource use, such as village environmental committee supported by relevant NGOs. There are exceptional cases where a single apex body with the statutory authority is established for the entire lake basin. Under such a case, the body would be in charge both of resource development and conservation, with varying degrees of authority and power to dictate on sectoral interests.

<Range of Governance Issues> Implementation of such plans and programs would involve a range of governance issues including institutional performance, policy and program harmonization, community participation and involvement, scientific information and data, reliable technical capacity, and secure financial backing, all for achieving the desired goal. It is clearly easy to stipulate, but difficult to ensure, that such concerns are satisfactorily addressed in the process of implementation of plans and programs, particularly in developing countries. Simply put, while planning lake basin management is one thing, implementing it is totally another, with the latter closely linked to the overall governance capacity of the basin stakeholders.

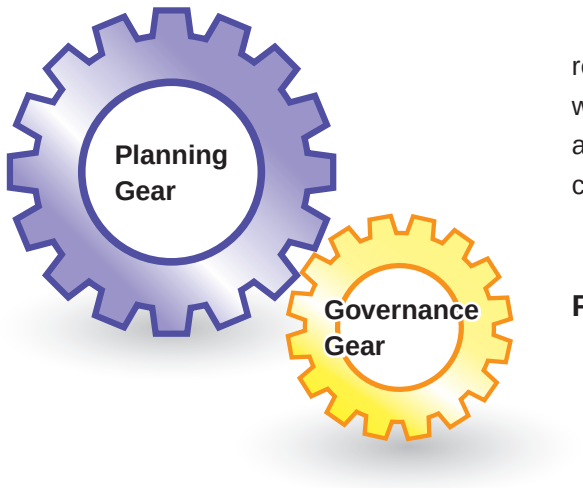
<An Example of Governance - Planning Relationships> Managing sewerage facilities and enforcing regulatory measures, for example, has a great deal to do with institutional strength, financial arrangements, and fulfillment of societal responsibilities by the general public. If financing of construction of a sewerage system with installation of necessary equipment in developing countries must depend heavily on external sources of fund, then the issue of financial sustainability would be a dictating factor influencing the success or failure of the plan prescribed through the planning procedure. Stringent implementation of regulatory measures against the polluting industries, not yet so impressive in many

developing countries, will also become a dictating factor. Further, when industrial interests are protected, and individual citizens are too preoccupied with their daily subsistence efforts, they may not have the time and financial means to fulfill their responsibilities in terms of taking voluntary actions to reduce pollution from around their households, or to make full payment for sewerage services fees.

Thus, simple application of the planning framework based primarily on the developed-country experience should be taken more as a direction than as a model to provide the prescriptions. Emphasis should be placed also on how strengthening of the basin governance is incorporated into the planning process so that its plans and programs are successfully implementable.

Box 7. What Is "Governance" and Why Is It So Important in Lake Basin Management?

"Governance" is defined in many different ways. A typical definition refers it to be "the interaction of laws and other norms, institutions, and processes through which a society exercises powers and responsibilities to make and implement decisions [affecting lakes and their basin resources as well as their users] and to hold decision makers and implementers accountable" (Moore, 2010). The use of the concept of "Governance" is important in working toward sustainable management of lakes and their basins, mainly because lake basin management is neither a project nor a project nor a program. It is a governance challenge. For example, resolution of resource use congestion, competition and conflicts does not come about simply because a lake basin management plan to ease the resource use is introduced and implemented. In the first place, arriving at a generally agreeable plan for all stakeholders is a phenomenally difficult task, usually taking a long time to develop a compromise plan. Further, regardless of how good the plan is, and how well designed the implementation scheme may be, a sentiment of dissatisfaction about the compromise often persists, and the plan will be subject to a continuing process of resolution, the dynamics of which is dictated by the spatial (basin and beyond), temporal (historical past and foreseeable future to work toward sustainability) and perceptional (who won and who lost, and by how much) governance frameworks that will have to evolve via stakeholder actions in order to be able to absorb any continuing heat of dissatisfaction regarding what has not been compromised.



Lake basin management with plans and programs for resource development, use and conservation, therefore, would not be sustainable without being supported by appropriate governance framework that would also continually pursue improvement.

Figure B7. Planning and Governance Must Be Properly Geared Together for Sustainable Basin Management

2-3 "Six Pillars of Governance": What Are They, What Pillars Need Strengthening, and How?

For individual lake basins, the adequacies and inadequacies of lake basin management may be determined by reviewing and assessing the existing activities and practices, with such typical review questions as:

- ***Is there a focal-point institution in charge?*** Are the capacity building and training program effective? It is still targeted on priority skills? Is it inclusive and open to cooperating agencies, community groups, etc.? What mid-course corrections are needed?

- ***Is there a management plan with realistic scope for its implementation?*** Do we have an adequate management plan, or should it be updated? Are the relevant priorities and phasing clear? Are the resources sufficient? Have we established the necessary coalitions to enable the required actions to be implemented? Is the coordination adequate? Have either technology options or costs changed, and are such changes reflected in the management plan?

- ***Are effective mechanisms in place for participatory implementation?*** Does the plan and its implementation include all stakeholders? What has been the change in awareness and understanding of the problems and their linkages to stakeholder activities? What is the perception of program stakeholders?

- ***Is there a common and shared knowledge about the management challenges?*** Is a monitoring system in place that would enable one to measure changes in key indicators? Is the data base sufficient? What are the remaining key gaps? Are information management tools adequate to be deployed effectively?

- ***Is there strong political will to support sustainable management?*** Is sustaining and building the political will and commitment appropriately placed as part of the management. program? How well is it working? What can we do more of, what should we do less of, and what can we do better?

Based on the comprehensive surveys of the state of world's lakes conducted over the past decade[xiii], the range of such questions have been categorized into six thematic domains, including (1) ***Institutions*** to manage the lake and its basin for the benefit of all lake basin resource users; (2) ***Policies*** to govern people's use of lake resources, and their impacts on lakes; (3) ***Involvement of People*** to facilitate all aspects of lake basin management; (4) ***Technological Possibilities and Limitations*** that are often quite dictating in regard to long-term decisions; (5) ***Knowledge and Information*** of traditional, as well as modern scientific nature, forming the basis for informed decisions; and (6) ***Sustainable Finance*** to support implementation of all of the above activities. These six major topics are the essential governance ingredients that collectively form the management regime for an integrated approach in lake basin management - we refer to them as the Six Pillars of Governance in ILBM (**Figure 2**).

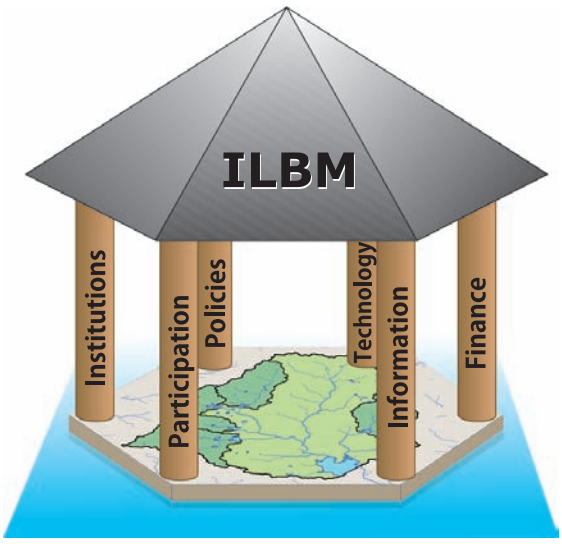


Figure 2. ILBM Governance Pillars, Founded on a Lake Basin Ecosystem Service Base Supporting the Integration Goal

Box 8. Six Pillars of Governance for ILBM to Be Strengthened and Integrated

Institutions: Developing Effective Organizations

When the human population and industrial activity around a lake is minimal, informal and traditional institutions are usually sufficient to manage any problems that might arise. However, with development, the need for more formal government institutions and research groups can arise. When the state and national government policies become more important, local traditional societal measures often lose much of their function.

Policies: Broad Directions and Specific Rules

In most cases, development policies promoting fishing, agriculture, industry, etc., are the initial management focus, with lake environment preservation measures later becoming more important. When environmental degradation seriously impacts resource development and/or when people's interests in protecting biodiversity, ecosystems, scenery, and historical and cultural heritage becomes stronger, appropriate societal rules (direct regulation, economic incentives, etc.) become necessary.

Participation: Expanding the Circle of Involvement

When fishing and agricultural activities are done on a small scale in each village, direct participation of the population is possible. When the activities and sources of problems go beyond the local scale, the possibilities for direct public participation can be lost, necessitating establishment of a regional mechanism. Thus, it is important to have a shared means and/or place for the basin society as a whole to address conflicts.

Technology: Possibilities and Limitations

There is a potentially large role for technical interventions in development and protection of lake resources. Interventions such as sewerage development, which are often used in developed countries to address water quality problems, face the problem of not having a sufficiently large stakeholder base in developing countries to pay for the increased utility.

Information: Pursuing the Sources of Knowledge and Wisdom

There are few lakes for which continuous, or even periodic, diagnosis and surveys of the lake environment are carried out. Indigenous knowledge (e.g., where the important fish egg laying sites are located), along with scientific study and investigation, play a key role in lake basin management. Dissemination of research findings often accelerates social responses.

Finance: Seeking for Sustainable Sources at Appropriate Levels

Although management measures require funding, the funding level often is not uniform, and its distribution must be a societal decision. The allocation of funds depends on how various questions are being answered: how the values of the lake are being enjoyed and by whom; who bears what burden; and how can public resources be secured? Financing, policy making and the methods of participation obviously all affect each other.

Strengthening and Integrating the Six Pillars of Governance

As depicted in **Figure 2**, the Six Pillars constitute the 'roof' of ILBM Governance. Over time, the pillars must be strengthened, and their respective functions must complement each other in an integrated way across sectoral, institutional and professional boundaries. Fundamentally, the use of Six Pillars of Governance is to address the necessary process of strengthening, and integrating the thematic governance issue domains (institutions; policies; participation; information; technology; finance). While the notion of strengthening the individual pillars is rather straightforward, the concept of integration is rather abstract. The subject is discussed in more detail in **Chapter 4**.

2-4 "Lake Brief": A Unifying Thread between Planning and Governance Improvement

By answering the review questions on Six Pillars of Governance for individual lake basins, the adequacies and inadequacies of the existing activities and practices for lake basin management will become clearer. This can be carried out systematically using a collective action report called the "Lake Brief." The elements and outline of a lake brief are described below, supplemented with a general process for systematically developing appropriate questions for corrective actions. An overall outline of the Lake Brief is shown in **Box 9**. A brief description of each of the Sections produces the following information:

I. Introduction

This section should describe the socio-economic context (people; livelihoods; economic characteristics; types of institutions; laws and policies; political structure; etc.) of the region, country, or basin in which the lake is located. It should summarize the overall importance of the lake and its drainage basin, from the perspective of its significance as a natural habitat, and its social, economic, institutional, political, cultural and/or recreational importance to the human population in the region, and its global importance, if any. (Use "Lake Questionnaire" items 10, 11, 14 and 15, in **Annex 2** [or, Annex A of Lake Brief, as shown in **Box 9**].)

II. Description of the Lake

II-1 Overview

This section should provide information on the biophysical features of the lake, including basic physical characteristics (lake surface and drainage areas; lake depth and volume; water residence time; etc). It also should describe the drainage basin characteristics (upstream and downstream tributaries in a lake drainage basin), including the basin landscape and land use patterns. The Brief also should summarize the environmental state of the lake in regard to its drainage basin. The human and environmental benefits derived from the lake/reservoir and its drainage area also should be identified and discussed.

II-2 State of the Lake

This section should include, with as much scientific findings and data as available, a description of the past and present state of the lake's water environment, including water quantity and quality, aquatic biota (flora and fauna), and the state of its ecosystem health. Any regionally- or globally-important aspects of the lake's environment also should be identified. (Use "Lake Questionnaire" items 1-9 in **Annex 2** [or, Annex A of Lake Brief, as shown in **Box 9**].)

III. Management of the Lake and Its Basin

Management of a lake and its basin may be depicted by answering the types of questions listed in **Box 10**. They are related to Lake Questionnaire items 9-16 in **Annex 2** [or, Annex A of Lake Brief, as shown in **Box 9**], which may be developed specifically for individual lake basins.

IV. Major Impact Stories

The Impact Stories represent the narratives of human interventions, whether successful or not, that were introduced to attempt to deal with management challenges faced by the lake and/or its basin. The stories are best told simply and concisely, with particular emphasis on the context of their development and their results. The Impact Stories may include successes and failures of engineering interventions, the introduction of economic instruments, engagement of political leaders and civil society, policy frameworks that enhance cross-sectoral coordination, and institutions that address specific needs in resource development, use and conservation, management interventions to deal with transboundary issues, etc. Although the Impact Stories associated with a lake do not have to be exhaustive or interrelated, they should be presented in such a way that facilitates better understanding of the governance issues to be described.

Box 9. General Outline of a Lake Brief

The general structure of a Lake Brief is as follows:

I. Introduction
II. Description of the Lake (supplemented by Annex A below)
III. Management of the Lake and Its Basin
IV. Major "Impact Stories" of the Lake
V. Major Lake Basin Governance Issues (supplemented by Annex B below)
VI. Key Challenges to Lake Governance (supplemented by Annex B below)
VII. References

Annex A. Lake Questionnaire (Checklist of data and information on biophysical and managerial issues facing the lake basin; reproduced as **Annex 2** of this document.)

Annex B. Six Pillars of Governance (Check list flowchart of the governance issues facing the lake basin; reproduced as **Annex 3** of this document.)

Box 10. Typical Examples of "Major Impact Stories"

A well-known Impact Story is the so-called the Soap Movement started by housewives in the Lake Biwa basin in the late-1970s, which ultimately resulted in the development of phosphate-free detergents by the detergent industry, and enactment of an eutrophication ordinance that subsequently served as a model for the national lake water quality control law. Another well-known case is Lake Laguna (Laguna de Bay) in the Philippines, including such examples as "co-managed investments for watershed management with carbon finance benefits" and its "Environmental User Fee System," and its "Public Disclosure Program" for controlling the polluting industries. By collectively reviewing the accomplishments and challenges associated with such Impact Stories, almost all aspects of the six Governance Pillar issues to be included in Section V may be reviewed relatively easily. The results of the analysis will form a basis of detailed descriptions of the governance challenges to be discussed in Section VI.

Box 11. Example Questions for "Management of the Lake and Its Basin"

- What do we know about the current management status of the lake and its basin?
- What are the major resource values of the lake and its basin? How are they used/exploited economically? Who benefits and who loses in the use/exploitation activities?
- What are major socio-economic and political implications of the lake and its basin to the basin population, particularly with respect to development, use and conservation of its resources?
- What are the resource use conflicts, and how are they managed? Are they managed well?
- What are the current problems/issues regarding the lake and/or its basin, and how are they being managed?
- What do the basin inhabitants, including fishermen, consider the overall environmental and ecosystem status of the lake to be?
- Are their perceptions consistent with scientific findings?
- What is (are) the apparent and not-so apparent root cause(s) of the identified problems?
- Who or what suffers from the impacts of these problems/issues, and how?

V. Major Lake Basin Governance Issues

Management of a lake and its basin may be depicted by answering the types of questions listed in **Box 12.**

VI. Key Lake Basin Governance Challenges

The key lake basin governance challenges are more comprehensively listed in the flow diagrams in **Annex 3** [or, Annex B of Lake Brief, as shown in **Box 9**] of this document for each of the Six Pillars of Governance in lake basin management.

VII. References

Identify useful supplemental reading materials on the lake, its drainage basin, and the region in which it is located, that complements or augments the various topics discussed in the Lake Brief.

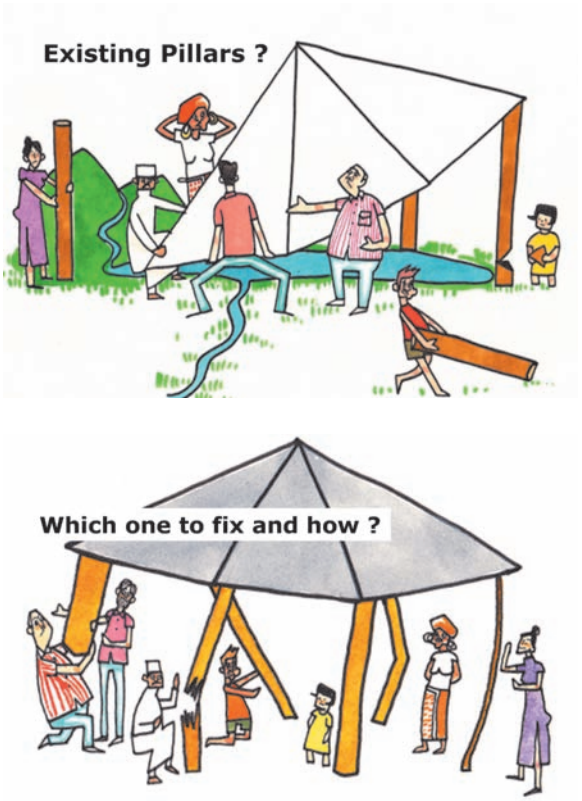


Figure 3. The ILBM Platform Can Facilitate Rebuilding and Improving of the Existing Governance Pillars

In many cases, as depicted conceptually in **Figure 3**, the ILBM Process may have to be initiated on the basis of the existing weak governance structure, or on the remnants of past failed attempts at forced improvement of governance by external forces, such as technical and financial assistance to address certain parts of the lake basin management needs.

How a Lake Brief is prepared will depend on the individual case. If information on Sections II through VI above is already available, drafting a Lake Brief with the above structure may be possible from the outset. In general, however, preparation of a Lake Brief is typically undertaken easily in stages, starting with the Impact Stories (under Section IV) and developing the remaining sections around it (see **Figure 4**). the Impact Stories typically characterize the way a lake basin is currently managed, often providing useful insights into the existing features of the lake basin governance. The above approach is especially useful when preparation of a Lake Brief is done collectively by more than one author. That is, individual Impact Stories may be prepared by various local stakeholder groups. The prepared Impact Stories should provide many useful insights on the Six Pillars of Governance, which could then be used to develop Sections V and VI.

Box 12. Major Lake Basin Governance Issues (Section V): Key Questions

Management of a lake and its basin may be depicted by answering the following types of questions:

- Who (individuals, groups, institutions) are the key players in developing and implementing the actions/programs needed to be undertaken to address the identified lake basin problem(s)? **[Institutions]**
- What is the existing legal and policy basis for lake basin management and what plans and policies have been introduced to manage the lake and its drainage basin, and how well have the associated problems been addressed? **[Policies]**
- What role do the general public and NGOs have in managing the lake and its basin? **[Stakeholder Participation]**
- How much do we know about the state of the lake basin? What data and information need to be generated and shared for developing management plans and implementing them as required? **[Knowledge and Information]**
- What are the major control measures introduced (to address domestic, industrial and other pollution loads; urban and agricultural runoff; water flows and withdrawal; commercial fishing; wetlands and riparian zones; etc.)? **[Technology]**
- What are the major financial mechanisms used to facilitate the control measures (user fees; taxes; fish levies; zoning charges; tradable permit systems; etc.) ? **[Sustainable Finance]**

These questions are more comprehensively listed in the left-hand boxes of the flow diagrams in **Annex 3**, for each of these governance issue domains.

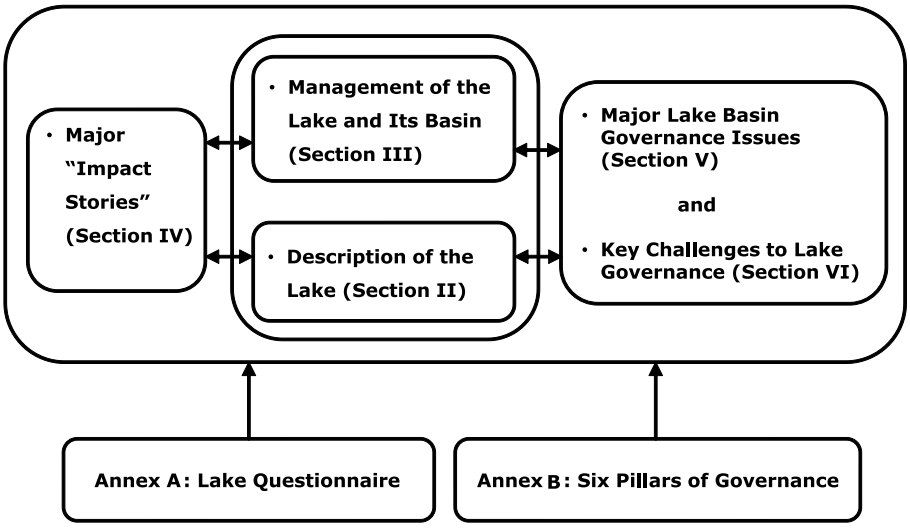


Figure 4. General Structure of a Lake Brief

2-5 Sources of of Information on Lake Basin Governance Improvement

The sources of information specifically related to lake basin governance may be relatively sparse. Nevertheless, a comprehensive coverage of the lessons learned and experiences gained through lake basin management over past decades, is provided in the publication, "Managing Lakes and Their Basins for Sustainable Use: A Report of Lake Basin Managers and Stakeholders" (ILEC, 2005; see **Box 13**). This publication was prepared by ILEC as the final output of the "Lake Basin Management Initiative." The document consists of eleven chapters, divided into three major sections as follows:

Section I -- Understanding the Resource (1: Learning from Others: Drawing Lessons about Lake Basin Management; 2: Biophysical Characteristics of Lakes; 3: Human Use of Lakes: Values, Problems, and Responses)

Section II -- Meeting the Governance Challenge (4: Institutions for Lake Basin Management: Developing Organizations for Action; 5: Identifying Effective Actions: National and Local Policies; 6: Involving People and Stakeholders: An Essential Element of Effective Lake Basin Management; 7: Responding with Technology: Opportunities and Limitations; 8: Informing the Process: the Role of Science, and 9: Mobilizing Sustainable Financing: Local, National and External Funds)

Section III -- Synthesis (10: Planning for Sustainable Lake Basin Management; and 11: Toward the Future).

Section II, consisting of six chapters, is currently a comprehensive source of information broadly covering the governance issues facing lake basin management around the world.

The above document has been transformed into a training module set, and is available in an electronic form (see **Figure 5 and Box 13, item 1**). The outline of this training module set is essentially the same as that of the above-noted publication. It also consists of three sections containing eleven chapters, with Section II corresponding to modules on Institutions, Policies, People (Participation), Technology, Information, and Finance. Each module is provided with a report (i.e., an overview of the respective chapters of the above publication) and a PowerPoint presentation. Each chapter is provided with additional information sources, similarly in the form of a report with associated PowerPoint presentations prepared by international experts to compliment the wide knowledge base generated during the project, as well as through their experiences. The module is also provided with a set of review questions for the online users. ILEC has developed a training course based on this resource material, with the help of the Japan International Cooperation Agency (JICA), presented once a year in Kusatsu, Shiga, Japan.

Another important source of information is ILEC's journal, *"Lakes & Reservoirs: Research & Management"* published first in 1995. Among the recent articles, for example, ILBM and the lake basin governance issues were highlighted in detail with regard to Kariba Reservoir (Magadza, 2006; Nyikahadzoi, 2009), Lake Chivero (Magadza, 2003), Laguna de Bay (Santos-Borja and Nepomuceno, 2006), Fisheries in Africa (Ogutu-Ohwayo and Balirwa. 2001), and Lake Chini (2010).

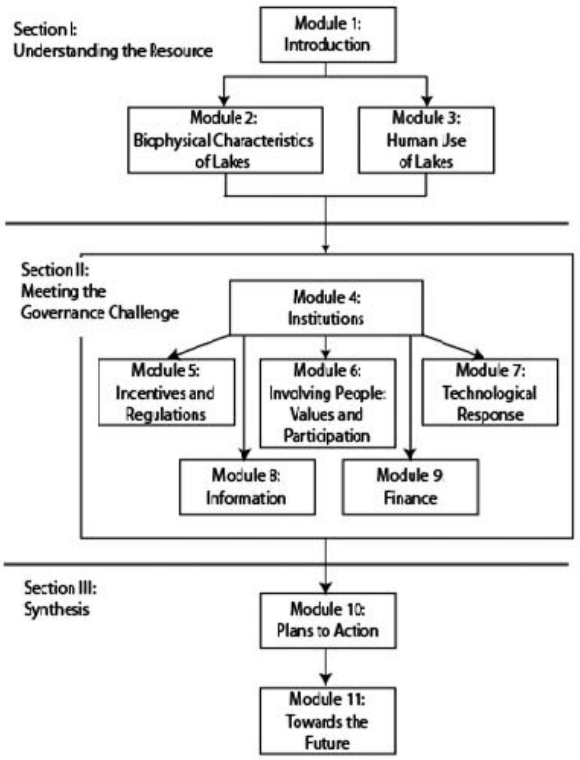


Figure 5. Structure of the ILBM Training Module

Box 13. ILBM Resource Materials Available from ILEC

The followings are resource materials on the concept of ILBM and its application to lake basin management challenges around the world, all of which can be downloaded from the ILEC website.

1) The self-learning training module for the general contents of this document is available as “ILBM Training Materials” on the website: (http://wldb.ilec.or.jp/ILBMTrainingMaterials/index.html).

2) The broad conceptual framework of ILBM, including the lessons and the experience leaned from twenty eight case studies around the world undertaken between 2003 and 2005 by ILEC, in cooperation with the World Bank, and with financial support from the GEF (Global Environment Fund), was published in the document, “Managing Lakes and their Basins for Sustainable Use,” which can be downloaded from the website: (http://www.ilec.or.jp/en/pubs/p2/lbmi).

3) An abridged version of the above document, “Managing Lakes and their Basins for Sustainable Use,” entitled, “How Can We Stop Degradation of the World’s Lake Environments?” can be downloaded from the website: (http://www.ilec.or.jp/en/pubs/p2/ilbm-manual).

4) A complementary leaflet of the of the above document, “Managing Lakes and their Basins for Sustainable Use,” is downloaded from the website: (http://www.ilec.or.jp/en/pubs/p2/ilbm-leaflet).

5) The updated edition of “Guidelines for Lake Brief Preparation,” can be downloaded from the website: (http://www.ilec.or.jp/en/pubs/p2/lake_brief).

6) A ‘primer’ for this document, entitled “Primer: Development of ILBM Platform Process – Evolving Guidelines through Participatory Improvement,” can be downloaded from the website: (http://www.ilec.or.jp/en/pubs/p2/primer-ilbm-platform-process).

The descriptions 2) through 6) above correspond to these documents illustrated from left to right.

“Lakes and Reservoirs: Research and Management” is a peer-reviewed journal published by ILEC. It aims to promote environmentally sound management of natural and artificial lakes,consistent with sustainable development policies,and publishes international research on the management and conservation of lakes and reservoirs. The journal could be subscribed through the publisher’s website: (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1440-1770).

3. ILBM Platform Development: Seeking to Strengthen the Six Pillars of Governance

3-1 What Is an ILBM Platform?

An ILBM Platform is a virtual stage for collective stakeholder actions for improving the basin governance through ILBM. A Lake Brief specifically prepared for this lake basin will be used to guide this process. **Figure 6** illustrates the activity flow diagram of the above process as a set of stepwise activities guided by the main themes of a Lake Brief.

1) The first step is for all the Platform members to acknowledge ***the state of lake basin management****, as part of the Lake Brief development process (corresponding to Sections II and III of the Lake Brief Structure presented in* ***Section 2-4****);*
2) The second step is for all the Platform members to identify and ***analyze the issues, needs, and challenges regarding the Six Pillars of Governance*** *(corresponding to Sections IV and V of the Lake Brief Structure presented in* ***Section 2-4****); and*
3) The third step is for all the Platform members to ***integrate the ways and means to meet the governance challenges and implement actions*** *(the experience and lessons learned globally on the subject are compiled and made available in the form of a report and on websites[xiv]).*

The platform structure may vary from one case to another. It may be developed afresh, or evolved from the existing structures such as associations, committees or agency units. As long as it allows for a broad range of stakeholder groups to contribute to improving the overall basin governance, the structural forms can suit the given basin situation. The establishment of a platform could be required and supported legally. There are forms of platform similar in concept to that of ILBM commonly found in the lake basin management statutory provisions in some developed countries[xv], but such statutory-based platforms are rarely found in developing countries. Even without any statutory basis, however, ILBM Platforms could be developed and evolved for various basin governance challenges including, for example, the case of overexploitation of limited common-pool resources in lake basin communities.

Once the Platform is formed, the existing lake basin management information could be compiled and analyzed as needed and as possible, by a small expert group formed to undertake the platform supporting activities. If feasible, the collected and analyzed data and information by such a group could be transformed into inventories of data and

Box 14. Identified Merits of an ILBM Platform Process

An ILBM project focal point made the following observations on the merit of the ILBM Platform Process using a Lake Brief:

1) **Non-prescriptive design**: The non-prescriptive and flexible narratives of the Lake Brief allow the basin community's values, in terms of socio-cultural and historic backgrounds, to be properly reflected in the ILBM Platform Process.
2) **Updating of information**: The periodic revision of Lake Briefs also helps update the issues and prepares basin stakeholders to meet new challenges.
3) **Joint preparation**: The joint preparation of a Lake Brief helps clarify specific needs, challenges and approaches for productively addressing the important lake basin governance issues.
4) **Wide range of issues without prejudice**: The Lake Brief design and ILBM Platform concepts can accommodate a wide range of views from stakeholder groups and individuals without undue prejudice or prerogatives.
5) **Fostering of the common vision**: ILBM Platform provides a basis for sharing a common vision and for resolving differences in ideals.

information and made available through a database and a knowledgebase. The team may then be able to share the results with a much broader circle of stakeholder organizations, as a means of deciding on their respective roles and responsibilities for pursuing the concerted actions. A schematic illustration of the Platform Process is shown in **Figure 7**.

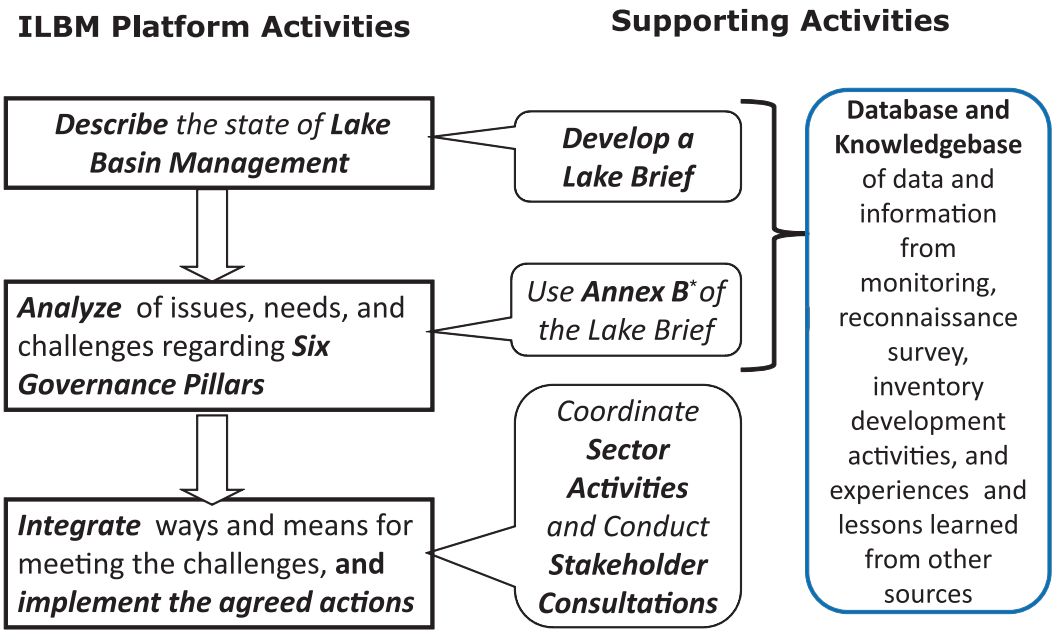


Figure 6. Activity Flow of a ILBM Platform Process

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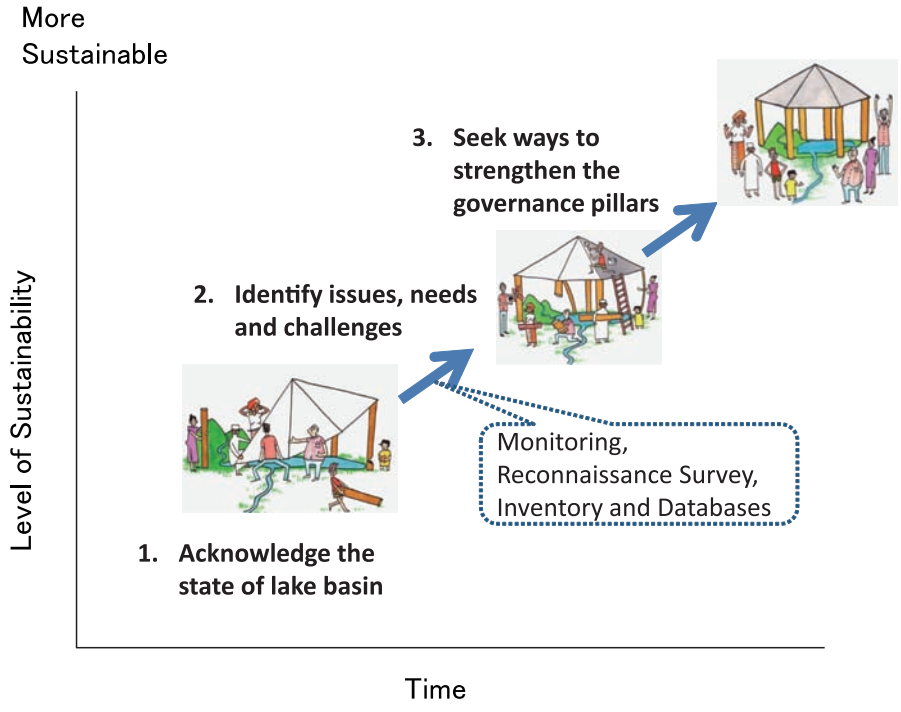

Figure 7. Schematic Illustration of a Basic ILBM Platform Process

3-2 The ILBM Platform May Evolve to Become a Cyclic Process

How each of the case study lake basins will be able to improve its governance toward sustainability depends on a number of factors. For some lake basins, the conventional approach in planning, without explicit reference to the concept of ILBM, may be just adequate for addressing their sustainable management. But the experience and lessons learned from the ILBM cases compiled over the years imply two things quite clearly. Firstly, lake basin management is not a project, but a long-term governance improvement process. Therefore, it must evolve over many years and decades toward sustainable resource development, use and conservation. Secondly, even without calling it ILBM, the process adopted in successful lake basin management cases entails gradual, but continuous, improvement of lake basin governance.

Thus, while the Basic Platform Process described in **Section 4-1** gives a general idea on the use of a Lake Brief to drive the lake-basin governance improvement process, it does not illustrate well the way through which on-the-ground improvements in governance may be achieved incrementally over a long period of time. The Process must be molded into a cyclic process to achieve that goal, as shown in **Figure 8.** The Process consists of: (1) Describing the state of lake basin; (2) Identifying and analyzing the issues, needs and challenges; (3) Integrating ways and means to improve the governance pillars and then (4) Assessing the improvement in the governance pillars, repeated cyclically toward a satisfactory level of sustainability in future. This Cyclic Process resembles what is called the PDCA cycle[xvi] of planning (see **Annex 4** for discussion on PDCA cycle).

A conceptual illustration of the above Cyclic ILBM Platform Process is shown in **Figure 9**. Note that the "Envisioned Future State of Governance," is quite difficult to prescribe in reality at the outset. It may so happen that the target state of improved basin governance would only become clear over time through the cyclic process itself, rather than at the outset. It is because the "governance targets" are usually not so easily definable in quantitative and prescriptive terms, unlike the ordinary "planning targets". In other words, the objective of governance improvement is not the "output" of the cyclic process, but rather the "outcome" of the process that supports implementation of individual plans and programs for lake basin management (see also **Annex 4** for discussion on the feature of PDCA cycle for governance improvement). The above observation leads to the important notion of "*fostering a common vision*" rather than "*developing a common vision*" in governance improvement, in the case of the ILBM Platform Process.

A lake basin management case, even without explicit reference to ILBM, may still be considered an ILBM case in an implicit way. A successfully managed lake basin always achieves its long-term objectives through gradual, continuous improvements in lake basin governance.

One additional aspect of the Cyclic ILBM Platform Process is assessment of the incremental improvements of basin governance. As shown in **Figures 8** and **9**, strengthening the governance pillars would require assessment of its incremental improvement at appropriate *"increment of time period,"* using some kind of "indicators of improvement." The details of these considerations are discussed in the following section.

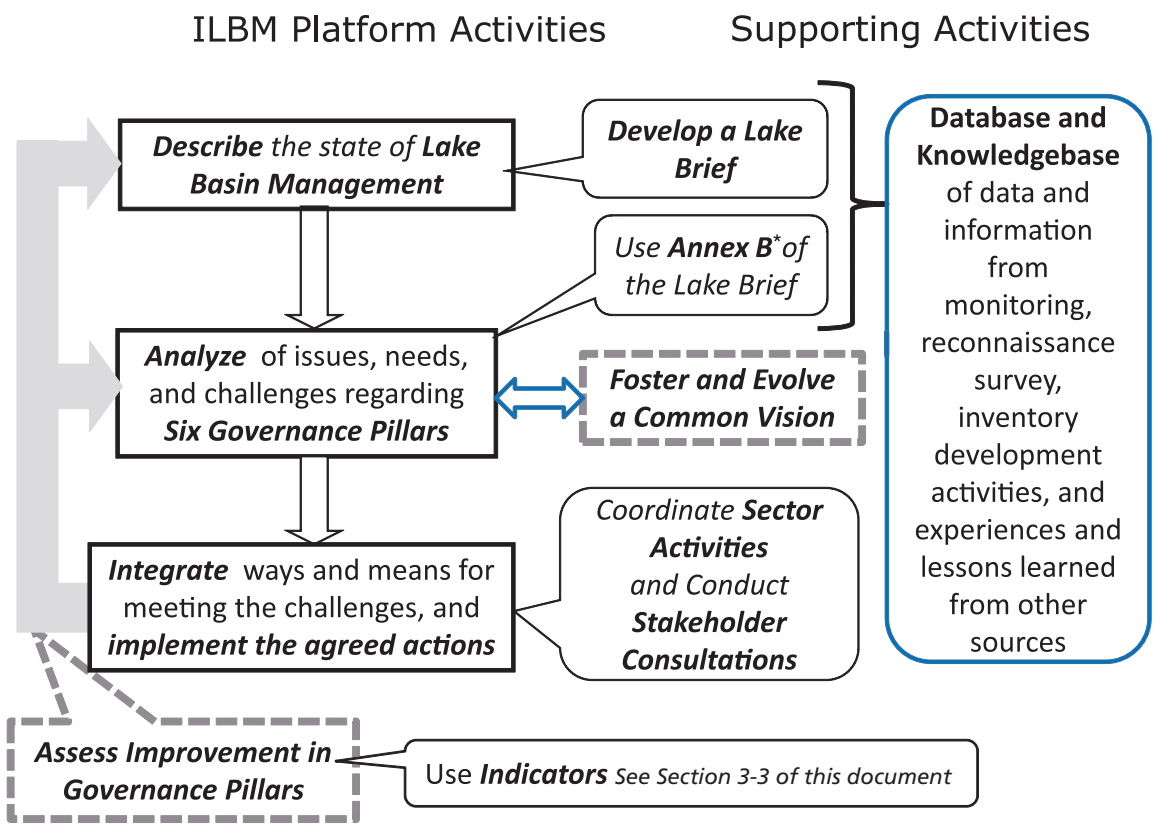

Figure 8. Activity Flow of a Cyclic ILBM Platform

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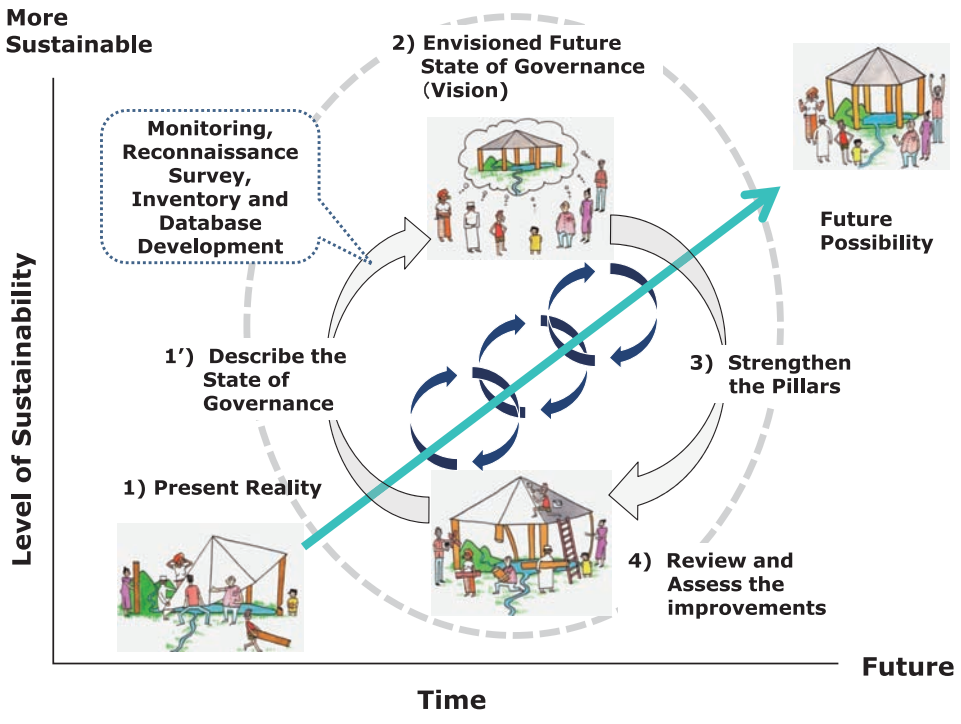


Figure 9. Schematic Illustration of a Cyclic ILBM Platform Process

3-3 Assessing Governance Improvement Over Time

As briefly touched on in the previous section, there are two important considerations for assessing incremental improvements in lake basin governance; namely, ***a) time intervals for review and assessment;*** and ***b) assessment methodologies and indicators***.

a) Time intervals for review and assessment

The time interval for review and assessment of governance improvement depends on the specific items of the Six Pillars of Governance about which the assessment is to be made, and what indicator(s) is/are to be used for the assessment. Take the efficacy of laws and regulations already enacted and in force, for example, under the 'Policy' Pillar. Once enacted and in force, the time intervals for revision of such laws and regulations would generally be on the order of at least several years. The case of financial mobilization for an ongoing sectoral plan under the 'Finance' Pillar provides a contrast. The expenditure amount could change annually, if not every half or quarter year.

The time interval can also differ for the same item being assessed, depending on the availability of data and information. If the assessment can be conducted on the basis of already-existing data and information, the effort required would be relatively light, requiring only a short time interval for assessments. On the other hand, if the assessment involves acquisition of new data and information generated through commissioned studies that require funding, institutional commitments, and capable human resources, the time increment could be much longer, perhaps on the order of years. This fact is important in the case, for example, of assessing lake water quality under the 'Information and Knowledge' Pillar. If monitoring of lake surface water is regularly conducted at certain sampling points, and data are readily available, a time interval period longer than the monitoring interval would then be meaningful. On the other hand, the state of the lake bottom ecosystem, for example, would probably not be part of a regular sampling program, and its analysis may require special sampling and laboratory analysis techniques involving a sspecialized team of researchers or practitioners.

b) Assessment methodologies and indicators [xvii]

Broadly, one would be interested in two kinds of changes resulting from achievement through the cyclic process of long-term efforts involving management interventions for environmental sustainability. The first is the change in the reduction in stress to the lake basin environments (i.e., output, or checking of the necessary condition for lake basin management to proceed), while the second is the change in the state of the lake environment itself (i.e., outcome, or checking whether or not the sufficient conditions for lake basin management have been met to move forward).

The reduced stress to the lake basin (output) will require observations regarding "on-the-ground action occurred," as well as "on-the-ground institutional and political progress" that make the action possible. The former can be achieved either by reducing or removing the stress, while the latter can be achieved by instituting or enhancing the conditionality for the on-the-ground actions to take place. The indicators that would reveal how much on-the-ground action has occurred are called the "***stress reduction indicators***" [xviii], while the indicators that reveal how much on-the-ground institutional and political progress has occurred, or how much improvement has been made to the enabling environment for pursuit of stress reduction, are termed "***enabling process indicators***."

Examples of ***stress reduction indicators*** would include such measures as:

- Increased reed bed area resulting from de-siltation operations;
- Reduced industrial pollution loading because of more stringent enforcement;
- Reduced excess water withdrawals;
- Reduced agrochemical application per cropland area;
- Reduced silt and sediment carried into the lake;
- Areal extent recovered from decreased infestation by invasive species of fauna and flora; and
- Reduced areal extent of illegal occupancy resettled outside of the riparian land.

Typical ***enabling process indicators*** may include such measures as:

- Realization of stakeholder involvement in preparation and creation of a management plan;
- Enactment of regulations on the mesh size of nets in order to reduce the quantity of inadvertently harvested juvenile fish; and
- Legal and institutional reforms for harmonization of various environmental management plans.

On the other hand, determining the degree of improvement in the actual state of the lake environment (outcome) will require observations on the positive benefits realized by "stress reduction" and the associated "enabling process." This determination will require examination of the extent of the actual change for the better on the basis of various measurement approaches, as well as inferences, estimations and judgments of the actual state of the lake environment. Accordingly, in addition to the above two indicators, we need a third set of indicators that will collectively reveal the state of the lake in question. This latter set is known as "***environmental status indicators***."

Typical ***environmental status indicators*** may include:

- Decreases in the nutrient concentrations;
- Improvement in the state of ecosystem health, as reflected in an increased biodiversity index; and
- Utilizing questionnaire surveys, and determining the extent to which communities and stakeholders benefitted from the changes in environmental conditions.

It is noted that the values and information associated with "stress reduction indicators" and the "enabling process indicators," which can be regarded as the necessary-condition indicators, are easier to obtain, as well as being rather straightforward as measures of progress toward improved lake basin governance. In contrast, some of the "environmental status indicator" values are not easy to obtain, and are much less straightforward to interpret, compared to the other two types of indicators. The difficulty in obtaining the values of the latter is for the same reason as in the case of the assessment of the state of ecosystem at the lake bottom, as mentioned in the earlier discussion on the time interval. Their analysis may require special sampling and laboratory analysis techniques from research efforts, rather than monitoring. This less straightforward interpretation stems from the fact that an improved or degraded "environmental status indicator" value at a particular instance does not necessarily mean the overall state of the lake basin environment is actually improving or degrading (that is, the sufficient condition may or may not have been met). The indicator values have to be interpreted on a much more long-term basis, and sometimes with the help of auxiliary tools of analysis and interpretation such as sophisticated and specialized instrumentation and mathematical modeling tools.

The sequential nature of the indicators is also important. For example, if eutrophication of a lake is to be controlled by a sewerage system, construction of treatment and reticulation systems may become necessary. One of the first processes required is knowledge of the state of water quality, as well as the state of ecosystem integrity of the lake (environmental state), while developing a plan for enhancing the enforcement (enabling process), and for constructing a wastewater treatment system (enabling process). Identifying and obtaining the necessary financing from various sources will need to be explored and realized (stress reduction). The households and business operations would then need to expend their own funds to connect to the system (stress reduction). If there is no legal requirement for their connection to the system, enactment of a bylaw as an enabling process would be necessary (enabling process). The need for the installation of a nutrient removal capability, or tertiary treatment capacity, may then become an issue, with needed mobilization of additional funding (stress reduction). The reduction of nutrient discharges to the lake may be assessed by checking the record of the number of household connections (stress reduction), while the actual state of the lake water quality must be monitored and assessed (environmental state).

3-4 Governance Linkages Within and Byond the Lake Basin

There is another important reason that the ILBM Platform may need to become cyclic in nature. It relates to the interactions among the ILBM Platforms through the horizontal and vertical linkages of governance. First, the horizontal linkage becomes an issue in relation to the involvement of multiple sectors (e.g., drinking water supply; fisheries; tourism) within a particular lake basin, each functioning on the basis of its own governance framework best suited for its management. For the overall sustainability of lake basin resources, these different frameworks must be somehow interlinked. This interlinkage will not occur automatically. The linkage may be gradually formed as the sectoral management plans are implemented, with the Cyclic ILBM Platform facilitating the interlinkage. An illustrative image of this situation is presented in **Figure 10**. The same applies for a particular sector (e.g., drinking water supply) within the same lake basin that needs a common sector policy and implementation under the closely-shared geographical, socio-cultural, economic setting within the basin, even if the jurisdictional responsibilities may be independent of each other. In other words, all lake basin ILBM Platforms within a given river/lake basin must be explicitly or implicitly interlinked. The illustrative image is presented in **Figure 11**.

In regard to the vertical linkage, the micro-, meso-, and macro-scale basin governance elements are linked through the hierarchical nature of political decision-making and/or government bureaucracy rules. More specifically, the river/lake basin management challenges in policy, institution, laws and regulations, etc., at the national level affect the state (district), as well as the lake-basin levels, and vice-versa. The illustrative image of this process is presented in **Figure 12**.

While strengthening of the ILBM Pillars can be accelerated with conscious efforts to harmonize the horizontal and vertical linkages of governance, the harmonization will be accelerated through a cyclic process; namely, a gradual and repeated process of adjustment and adaptation. This is an important reason for the need to develop "Cyclic" ILBM Platforms appropriately suited to the lake basin situation being addressed. The concept of horizontal and vertical linkages of basin governance would become crucially important in regard to international transboundary cases (although intra-national transboundary cases can be just as crucial).

The assessment required for the horizontal linkage of governance will involve harmonization, as well as cross-fertilization, of the common governance challenges among a number of elements, including: (1) the lake basins within a larger lake/river basin; (2) the chain of lake basins along a river basin; (3) the lake basins within the same jurisdictional boundary; (4) any of the above three elements combined, etc., as shown in **Figure 11**. The assessment required for the vertical linkage of governance could be undertaken through the levels, for example, of: (1) the Federal/Central government; (2) the State/Province/District government(s); and (3) the local lake basin, either downward (from central to local) or upward (from local to central). In addition, the vertical and horizontal linkages of governance pertaining to the international transboundary lake basin cases will require a special consideration.

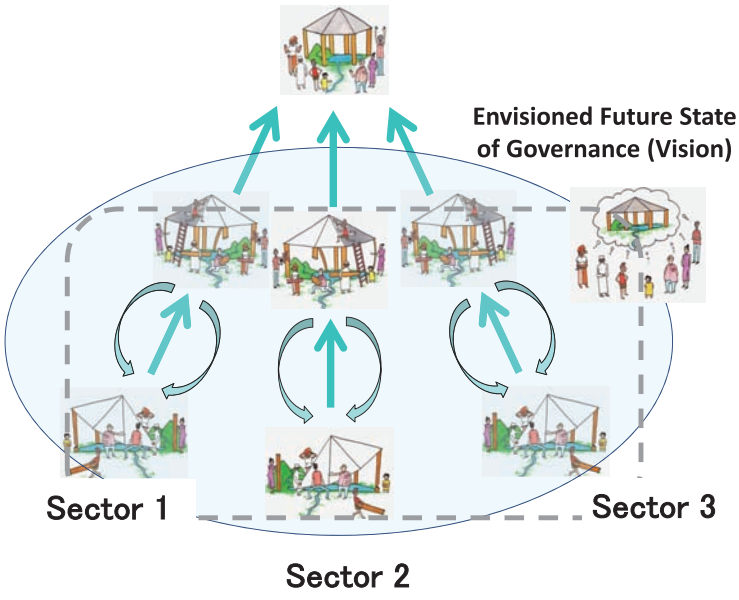


Figure 10. Horizontally-Linked Sectoral ILBM Platforms Within the Same Lake Basin

Figure 11. Horizontal Linkage Must Exist Among the Micro-Scale Basins Within a Meso-Scale Basin

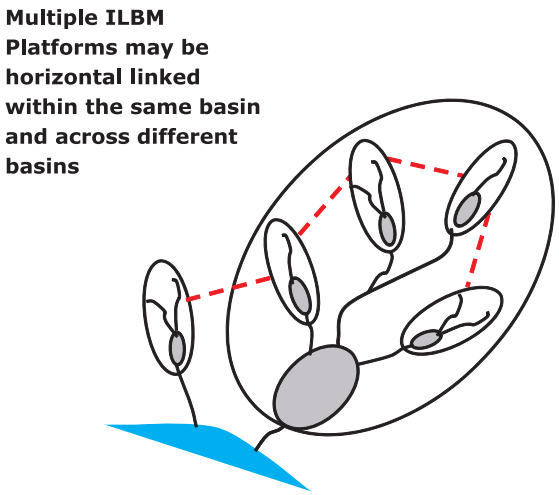
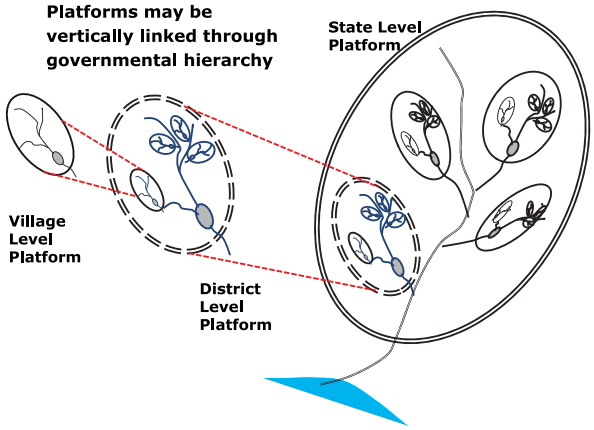


Figure 12. Vertical Linkages of Lake Basin Governance



<Case Example 2: Governance Linkage of a Lentic-Lotic Basin System in Malaysia

A governance linkage involving lentic-lotic linkage is illustrated with the case of Lake Chini (Tasek Chini) in Malaysia[xix], in relation to the Pahang River (Sungai Phang). The behavior of Lake Chini, which ranges in size from about 202 ha (dry season) to 300 ha, is strongly influenced by the hydrology of four feeder river systems (Sungai Perupok to the west, Sungai Melai to the south, and Sungai Datang and Sungai Gumum to the northeast). The main water source to the lake, however, is the Chini River, which is connected to the Pahang River, the longest (450 km) and largest (27,000 km^2) in Peninsular Malaysia, with almost one million population residing in this region. Thus, the Pahang River controls not only the hydrodynamics of the lake, but also the environmental and ecosystem properties of the lake during the flood season. The intrusion of heavily sediment-laden and nutrient-rich water originates from the Cameron Highland resort and tea plantation region at the uppermost region of the watershed, as well as from the rubber and palm oil plantations located alongside the river. The challenge facing Lake Chini is to interface the ILBM Platform with the Pahang River IWRM/IRBM plan, for which there is already a proposed institutional framework[xx], and with the proposed master plan of the UNESCO Biosphere Reserve Program, the first in Malaysia[xxi]. Gradual evolution of the ILBM Platform in this case is able to best address the lentic-lotic linkages of the Pahang River and Lake Chini basin systems.

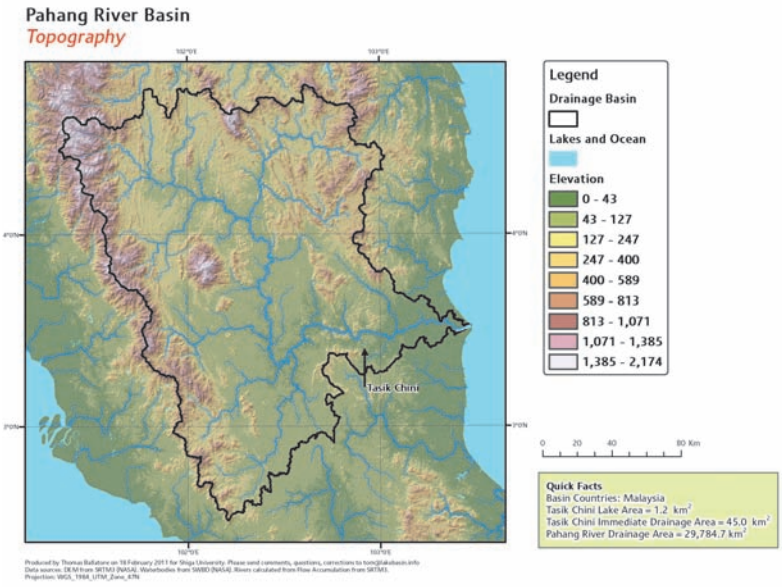


Figure CE2. Pahan River IWRM and Lake Chini ILBM Must Be Complementary

4. Frameworks for Interpreting the ILBM Outcomes

This chapter presents an overview of the application results of ILBM Platform Process, including the stage of Platform Process achieved (ranging from only preparing a Lake Brief, to developing a Basic ILBM Platform Process, all the way to developing a Cyclic Platform Process), the temporal scope of application (either prospective or retrospective), the hierarchical levels and linkages (national, state and local), and the external conditions under which the ILBM application cases were implemented. The categorized results were also interpreted with regard to the range of management purposes/reasons, and to the types of management plans (Vision Plans, Action Plans, Intervention Plans, and Comprehensive Plans) as related to the degree of the ILBM Process usefully pursued.

4-1 Application Cases and Their Typology

The number of ILBM application cases is slowly but steadily growing in different regions of the world, each being at different stages of Platform development. The time required for a Platform Process to evolve from one stage to the next, i.e., from 1) preparation of a Lake Brief, to 2) development of a Basic Platform Process, and finally to 3) development of a Cyclic Platform Process depends partly on the adequacy of the existing human and financial resources, as summarized in **Table 1**.

Many of the application cases have so far been produced as part of research and applied study projects, while others have been produced as part of follow-up activities of bilateral and multilateral technical cooperation programs. In the case of Malaysia, Nepal and the Philippines, for example, the ILBM activities have been undertaken in collaboration with key national government agencies seeking to explore appropriate and suitable national program frameworks for promoting lake basin management, rather than just lake water quantity or quality management. In India and Mexico, local governments and major governmental and nongovernmental organizations and institutions dedicated to lake basin management have facilitated the implementation of ILBM projects for overcoming the difficulties associated with existing fragmentary programs. In Africa, where lake basin management programs tend to be more structural intervention projects than basin governance improvement, the concept of ILBM has been introduced to instill basin stakeholders at large with a greater sense of ownership of the problems, as well as their solution approaches, i.e., meeting of the basin governance challenges. The expectation here is that ILBM may accelerate interfacing of the governmental, nongovernmental and community/citizen initiatives, and that it may enhance the proactive roles of the stakeholders at large in harmony with the governmental initiatives.

The time it takes for ILBM Platform Process to mature will vary from case to case. Where awareness of the need for improving basin governance is high, the ILBM concept may be accepted and appreciated soon after being introduced. Even in cases where awareness is initially low, the basin community may soon become aware of the advantage of the ILBM approach in dealing with complex management challenges not having easily been met in the past solely with government-led structural-intervention type projects. The general observation on the basis of these cases reveals the Lake Briefs, even provisionally-completed, serve as very useful guides for addressing the immediate and long-term lake basin governance improvement needs, and also provide an opportunity for the basin stakeholders at large to engage in an incremental process of improvement. A brief description of each major application case included in **Table 1** is given in **Annex 6** (Past and Ongoing ILBM-Related Projects).

	Summary of ILBM Application Cases: 2008-2012				
	Lake/River Basin Name	**ILBM Process Reached[1]**	**Temporal Scope[2]**	**Government Involvement[3]**	**External Support[4]**
1. African Region	Chivero Nakuru Nyanza Gulf	MP(WS-LB) MP(WS-LB-BP/CP) WS-LB-BP	Retro-Pro Retro-Pro Pro	Nat/State/***Loc*** Nat/State/***Loc*** Nat/State/***Loc***	ILEC/MEnv-J ILEC/MEnv-J ILEC/MEnv-J
2. India	Bhopal	MP	Retro	***Nat/State***/Loc	JICA
	Chilika Ujjiani Reservoir Ahar River Pushkar	MP (WS-LB) WS-LB-BP WS-LB-BP LB	Retro Retro-Pro Pro Retro	***Nat/State/Loc*** Nat/***State/Loc*** Nat/State/***Loc*** ***Nat***/State/***Loc***	IAAB, in collaboration with SU-ILEC/MEdu-J
3. Japan	Biwa Saroma Shinji-Nakaumi	CP (FS) CP (FS) CP (FS)	Retro Retro Retro	***Nat/State/Loc*** ***Nat/State/Loc*** ***Nat/State/Loc***	Under NLWQP Under LLWQP Under NLWQP
4. Malaysia	Bukit Merah Putrajaya Chini Others	MP(WS-LB) MP(WS-LB) WS-LB-BP WS-LB	Retro-Pro Retro-Pro Retro-Pro	***Nat/State***/Loc ***Nat/State***/Loc ***Nat/State***/Loc	NAHRIM in collaboration with SU/ILEC/MEdu-J
5. Mexico	Chapala Lerma River basin micro-watersheds	WS-LB-BP WS-CP	Retro-Pro Pro	***Nat/State/Loc*** Nat/***State/Loc***	Corazón de La Tierra, in collaboration with, SU/ILEC/MEdu-J
6. Nepal	Begnas Phewa Rupa Others	LB MP(LB) LB-BP LB	Retro Retro Retro-Pro Retro	***Nat***/State/***Loc*** ***Nat***/State/***Loc*** ***Nat***/State/***Loc***	Nepalese government organizations, in collaboration with SU/ILEC/MEdu-J
7. Philippines	Laguna Lanao Rinconada Seven Lakes Taal	MP(LB) LB WS SEM SEM	Retro Retro	***Nat/State/Loc*** Nat/***State/Loc*** ***Nat***/State/***Loc*** Nat/State/***Loc*** Nat/State/***Loc***	LLDA, in collaboration with SU/ILEC/MEdu-J
8. Russia	Ilmen Ladoga Chudsko -Pskovskoe(Peipsi)	LB LB LB	Review Review Review	***Nat***/State/Loc ***Nat***/State/Loc ***Nat***/State/Loc	Russian Academy of Science, in collaboration with SU/ILEC/MEdu-J
9. USA	Upper Potomac River Southern Wisconsin Lakes	Independent Study Independent Study	Pro Retro	Nat/State/***Loc*** Nat/State/***Loc***	TSU SWRPC

1. **BP**: Basic Process in progress; **CP**: Cyclic Process in progress; **FS**: Because the lakes are under a statutory framework similar to the ILBM concept, only field studies have been conducted under the ILBM research projects; **LB**: Lake Brief has been prepared; **MP**: The existing management program is forming a basis for ILBM; **SEM**: An introductory ILBM seminar has been conducted; **WS**: Short-term ILBM workshops have been conducted;
2. **Pro**: Emphasis placed on prospective assessment of upcoming challenges, using the ILBM framework; **Retro**: Emphasis placed on retrospective assessment, using the ILBM framework;
   Review: Emphasis placed on retrospective natural science assessment, using Annex A of Lake Brief.
3. **Loc**: Strongly related to the local program framework; **Nat**: to the National program framework; **State**: to the state program framework; the major program frameworks are identified in italic bold characters.
4. **IAAB**: Indian Association of Aquatic Biologists; **ILEC**: International Lake Environment Committee Foundation, Japan; **LLDA**: Laguna Lake Development Authority; **LLWQP**: Local Lake Water Quality Conservation Plan, Hokkaido, Japan; **MEdu**: Ministry of Education, Sports, Culture and Science, Japan; **MEnv**: Ministry of Environment, Japan; **NAHRIM**: National Hydraulic Research Institute of Malaysia; **NLWQP**: National Lake Water Quality Conservation Plan, Japan; **SU**: Shiga University, Japan; **SWRPC**: Southeastern Wisconsin Regional Planning Commission, USA; **TSU**: Texas State University, USA

Table 1. Typological Categorization of ILBM Application Cases for the Period 2008-2012

The following briefly describes some features of the lake basin cases identified in **Table 1**:

- African Region:
  - Lake Chivero (Zimbabwe): Being a major source of water supply for the city of Harare, the capital of Zimbabwe, sustainable improvement of the seriously-degraded lake water quality will not be achievable without gradual improvement of its basin governance, such as with the ILBM Platform Process, combined with enhancement of socio-political and economic conditions of the country;
  - Lake Nakuru (Kenya): An ILBM Process (Kenya Lake System in the Great Rift Valley) is being adopted for this focal lake in a World Heritage Site. The ILBM concept is promoted to help harmonize the implementation of multiple management plans under multiple sector/stakeholder engagements;
  - Nyanza Gulf of Lake Victoria (Kenya): Although this region is a major target region of past and ongoing GEF-World Bank projects for Lake Victoria, the prospect for sustainable resource development and use of this lake basin still seems elusive. The ongoing efforts by the local stakeholder groups to evolve the ILBM Platform Process should be appropriately interfaced with the probable exit strategy of such externally supported intervention projects.

- India:
  - Lake Bhopal: As part of the post-project assessment of the JICA-assisted plan for the conservation and management of the lake, the ILBM framework was introduced as a potentially useful tool for assessing the basin governance improvement, compared to the conventionally-accepted assessment frameworks developed for evaluating the viability of technical collaboration projects;
  - Ujiani Reservoir: This reservoir is well known for "Jala Dhindi," a citizen-initiated "water pilgrimage" activity for saving this reservoir system, which is facing serious water quality degradation. The activity has grown over the years to a mass movement involving various citizen groups, medical and education professionals, religious sectors, students, media, etc. The preparation of a Lake Brief is anticipated to help basin stakeholders to articulate various governance improvement initiatives;
  - Ahar River and its flood plains: Once-being a highly degraded river flowing through Udaipur, the so-called 'City of Lakes,' the introduction of the ILBM concept has triggered an assortment of citizen-initiated actions, including an eco-technological approach called "the green bridge" for the restoration of degraded rivers. It is an example of innovation under the "Technology Pillar" of ILBM Platform Process, now being promoted elsewhere in India;
  - Lake Pushkar: This well-known pilgrimage lake has been facing a serious water level decline for multiple reasons, including neglect, causing an uproar among the basin population, which is heavily dependent on the lake for spiritual, social and economic values. It also is suffering from serious water pollution. The ILBM concept is now regarded as being instrumental in mobilizing support among all basin stakeholders to meet the long-term challenges toward its restoration;
  - Other lake/river basins with ongoing ILBM-related activities include Lake Hussinsagar, and a river in the Thane District of Maharashtra State, where the ILBM concept has been helping to address child-malnutrition alleviation challenges.

- Japan:
  - Various ILBM-related field visits and studies of basin governance have been undertaken for designated and non-designated lakes, under the Special Measures for the Preservation of Lake Water Quality (commonly referred to as the "Lake Law") of Japan.

- Malaysia:
  - Lake Briefs have been prepared for about 30 lakes under its Strategic Plan for Lake and Reservoir Management, being coordinated by the National Hydraulic Research Institute of Malaysia (NAHRIM), with a wide range of management plans attributable to the Lake

Briefs.

- Mexico:
  - Significant progress in ILBM Platform development has been made over a period of several years, for both the Lake Chapala and Lerma River basin micro-watershed regions, particularly in regard to the stakeholder initiative through horizontal (through regional networks), as well as vertical (through the national, state, and local linkages), collaboration for accelerating the ILBM Platform Process.

- Nepal:
  - A draft National Lake Conservation Plan (NLCP) has been developed, based largely on the ILBM framework, as implemented by the National Lake Conservation and Development Committee, Ministry of Culture, Tourism and Civil Aviation, with about 20 priority lake basins having been identified as priority ILBM targets for intensive field studies for their governance improvement.

- The Philippines:
  - Laguna Lake: As one of the most extensively studied lakes, with a range of innovative policy tools and approaches applied through various national and international projects, the lake has utilized and will continue to enrich the ILBM concept. In the meantime, the continuously-updated Lake Brief also is serving a very useful purpose for the improvement of its basin governance;
  - Lake Lanao: Despite its unique existence as an ancient lake with many indigenous species of flora and fauna, the lake is facing serious environmental and ecological degradation due largely to water level fluctuations attributable to hydropower generation, and causing the Maranao community to face serious declines in their livelihood quality and quantity. The ongoing efforts will hopefully facilitate significant change for their betterment in the not-too-distant future.

- Russia:
  - A Lake Brief has been prepared for three lakes in the northwestern part of Russia by the National Institute of Limnology, Saint Petersburg. Preliminary efforts also have undertaken to prepare a Lake Brief for the Caspian and Aral Seas.

- USA:
  - The results of Independent studies undertaken to test the applicability and usefulness of the ILBM framework were presented in November 2012 at the International Symposium of the North American Lake Management Society (NALMS).

4-2 Typical Forms of Plans and Their Implications in the ILBM Platform Process

In discussing the role of the ILBM Platform in the planning process, four general categories of plans for lake basin management are described below; namely, Vision Plans, Short-term Action Plans, Intervention Plans, and Comprehensive Plans. The presumption in the following discussion is that Vision and Action Plans can be statutory or non-statutory. In contrast, most Intervention and Comprehensive Plans are statutory in nature. Use of the previously-noted "output-oriented" indicators is relevant in evaluating the status of the various plans, which are characterized as follows:

1) Characterization of Vision Plans

- The goal of a Vision Plan is usually to bring water stakeholders together to develop a common, or at least compatible, agenda for sustainable lake management, as well as to foster a sense of ownership about the future of the lake basin in question;
- Vision Plans usually consist of a menu of strategies and opportunities directed toward the relatively long-term future;
- The degree of formality associated with Vision Plans can range from being very informal (voluntarily at the village level) to being very formal (national or international level, with some institutional and financial commitments);
- The level of institutional commitment, and the required financial and manpower resources, are likely to be rather moderate, compared to the level associated with implementation of other types of plans.

2) Characterization of Action Plans

- Action Plans are generally short-term, although there are cases whereby a sequence of short-term action plans can constitute a long-term action plan. They are not necessarily sectoral in character;
- An Action Plan is a series of steps or activities to achieve a specific goal, whose major elements include: (1) identifying a specific goal to be achieved; (2) identifying specific tasks or steps directed at what needs to be done; (3) identifying responsibilities and assignments, thereby indicating who will undertake what specific tasks; (4) identifying the time horizon, in order to determine when the identified tasks are to be done, and what goals achieved; (5) producing a time line and planning milestones, including a schedule of work and measures of the progress being made; and (6) identifying available resource possibilities, including identifying what specific funds available for specific activities;
- There are action plans consisting of local actions, initiatives and commitments with little or no financial resources. They also must be coupled with local actions, initiatives and commitments.

3) Characterization of Intervention Plans

- An intervention is a specific activity (or set of related activities) intended to achieve a set of objectives in a particular setting, using a common strategy for output delivery. An intervention has distinct process and outcome objectives, and a protocol outlining the implementation steps;
- Intervention plans for resource development and conservation/remediation purposes are generally developed and implemented by public sector agencies. They tend to have strong sectoral orientation with financial and manpower commitments because they often involve physical facilities;
- Typical intervention plans can range from resource development interventions, such as installation of intake facilities for large-scale water abstraction for riparian paddy field irrigation, to development of a fish cage system along the reservoir shoreline for licensed commercial operations, etc., to environmental conservation and ecological restoration interventions such as dredging of sediments from the lake bottom to improve deteriorating water quality, or construction of a sediment trap along the inflowing channels to the lake for improving fish habitat, etc.

4) Characterization of Comprehensive Plans

- Unlike a Vision Statement, implementing a lake basin management plan requires prescribing details of the long-term structural and non-structural actions to be undertaken. The long-term goals must be addressed by a range of relevant organizations;

- Since implementation of the plan may be longer than the timeframe for usual budgetary considerations, the agencies responsible for carrying out the plan may, or may not, have the needed level of financial and manpower resources;
- For the plan to be viable, it must usually be scaled down to meet budgetary constraints, and subsequently revised over time;
- A comprehensive plan is often developed on the basis of holistic considerations for achieving sustainability objectives to effect changes in the environmental status indicators. It also assumes long-term institutional and financial commitments.

Conceptually, the ILBM Platform Process may be applied to all four forms of plans, although in different ways among the cases. There are cases whereby the preparation of a Lake Brief alone was sufficiently useful, without development of a Platform Process, or wherein the platform development may essentially remain at the basic process level, or even where the platform development may evolve to a full-fledged Cyclic Process. **Figure 13** provides a general typology of the application cases describing the initial pre-ILBM management condition; namely: *(a) those having Little or No Management Plans; (b) those having Independent Sector-Specific Management Plans (i.e., sectoral plans for fisheries, water supplies, pollution control, etc., are undertaken completely independently); or (c) those having Cross-Sector Management Plans* (i.e., sectoral plans are undertaken in some coordination, for example, through water quality monitoring, and under a given statutory framework). In regard to the post-ILBM adaptation of one or more of the four plan types (i.e., Vision Plan, Action Plan, Intervention Plan, Comprehensive Plan), the following general observations are relevant:

Vision Plans and Action Plans Generally Entail a Basic-Platform Process

- ILBM Platforms can be "Basic" in nature, because a plan must usually reflect explicit, as well as implicit, community values. Once developed, the Platform can remain intact through the planning period, thereby not requiring the plan itself to evolve;
- Periodic activities to remind the public at large about the spirit of the vision, however, is a very important role to be played by the Platform.

Intervention Plans Entail a Basic Platform Process and Subsequently a Cyclic Platform Process

- Intervention plans developed and implemented by sectoral agencies usually require specialized technical inputs from experts in the field. Although an advisory body consisting of such experts may play the role of an ILBM Platform, they do not qualify for this role because of rather narrow representation, and a likely lack of transparency to the general public;
- Most intervention projects are directed toward achieving a rather sharply-focused output, accompanied by rather rigorous financial and institutional (including manpower) resource commitments and completion timeframe, often with rather-limited local actions. The Cyclic Platform may not function well in such cases, compared to the Action Plan cases;
- The more congested the resource use becomes, however, the more the use can be coordinated, indicating the Platform working in a "cyclic" manner can prove quite effective in adjusting to emerging needs, as well as to mid-course corrections and adjustments.

Comprehensive Plans Generally Entail a Cyclic ILBM Platform Process

- A comprehensive plan for lake basin management generally includes many citizen-group Action Plans and many sector-agency Intervention Plans. Integration of these two types of Plans is likely to be achieved through a Cyclic ILBM Platform Process;
- A comprehensive plan with a long planning horizon would generally be associated with a number of sector conflicts and slow waning of stakeholder commitments, necessitating inclusion of a Cyclic ILBM Platform Process into the Plan.

Overall, the planning must be accompanied by a system for measuring the extent of governance improvements, with the ILBM Platform Process supporting it in one way or another.

4-3 Management Reasons/Purposes Associated with Governance Pillars

As previously discussed in **Sections 1-5**, **2-1**, and in **Box 6**, the management reasons/purposes for lake basin management can vary widely, ranging from **a)** developing resource values; **b)** enhancing resource values; **c)** decongesting resource use; **d)** resolving resource use conflicts; **e)** reducing environmental stress; **f)** rehabilitating and restoring riparian habitats; **g)** protecting resource value damages from extreme events; and **h)** taking precautionary adaptation and mitigation measures; all the way to **i)** improving overall ecosystem health. It is important to recognize that lake basins are usually managed for multiple reasons/purposes, and that these different reasons/purposes may or may not be adequately inter-harmonized. It also is important to note that a particular lake basin can undergo a gradual shift in focus from one reason/purpose to another, with their inter-phasing more likely to occur in the reasons/purposes direction from **a)** to **i)**, than in the direction from **i)** to **a)**. For a lake basin to be effectively managed for sustainable use of its life-supporting ecosystem services, it is clear that lake basin stakeholders must strive continuously for a greater level of inter-harmonization and inter-phasing of these reasons/purposes.

To achieve a greater level of inter-harmonization and inter-phasing, these different management reasons/purposes, **a)** to **i)** as noted above, must be associated with the corresponding level of each of the Six Pillars of Governance. As further clarification, the Six Pillars of Governance are expressed in more specific terms in **Figure 14**; namely, institutional orientation regarding ecosystem services; policy orientation in government; a participatory approach in management, an information and knowledge focus, technology considerations, and financial resource inputs. The gradients associated with each of these Six Pillars of Governance may now be conceptually associated with the management reasons/purposes. The institutional orientation, for example, would range from a more “singular structure” to a more “plural structure,” the policy orientation in government would range from a more “short-term output” to a more “long-term outcome;” and the financial resource orientation would range from more toward “economic benefit” to more toward “ecosystem benefit,” etc., in relation to each of the management reasons/purposes, **a)** to **i)**. This is an important conceptual presentation of ILBM, implying lake basin stakeholders must recognize that their own association with the individual Pillar issues is always relative, and responsive to the management reasons/purposes of which they may not be immediately engaged, but of which they should be fully aware. It also implies that basin stakeholders must achieve a greater level of inter-harmonization and inter-phasing of management reasons/purposes in order to reach some agreeable mix of these governance qualities. This is a driving force of the ILBM Platform Process, facilitating stakeholders being able to bring themselves together to meet the collective governance challenges slowly and gradually over time.

The above observation implies that ILBM has the flexibility to address the subtle implications of governance challenges, such as resource use conflicts and assessment of management planning alternatives. Regarding the former (i.e., resolving use conflicts), the conflicting stakeholder groups may find it easier to resolve their conflicts through the ILBM Process, than through direct interactions. An example is the Lerma River - Lake Chapala - Santiago River Complex in Mexico, as presented in **Annex 5** (A Practical Approach in ILBM Pillar Assessment: An Example), which describes an iterative process for bridging the gap between stakeholder ideas about meeting governance challenges. As for the latter (i.e., assessment of planning alternatives), Saunders (2012) presents an interesting application of the ILBM framework, using the modified approach highlighted in the above example in addressing management issues in sub-watersheds in the interstate Potomac River Basin in the USA.

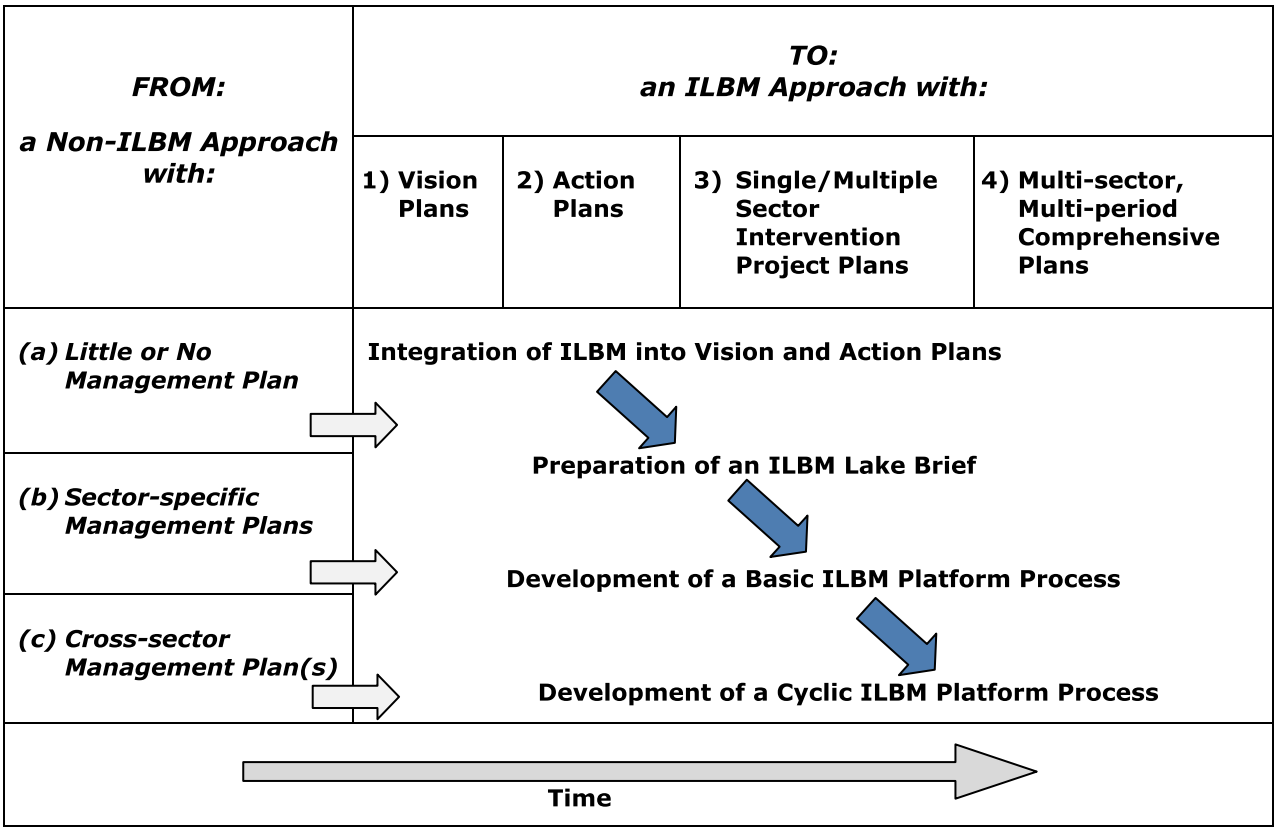
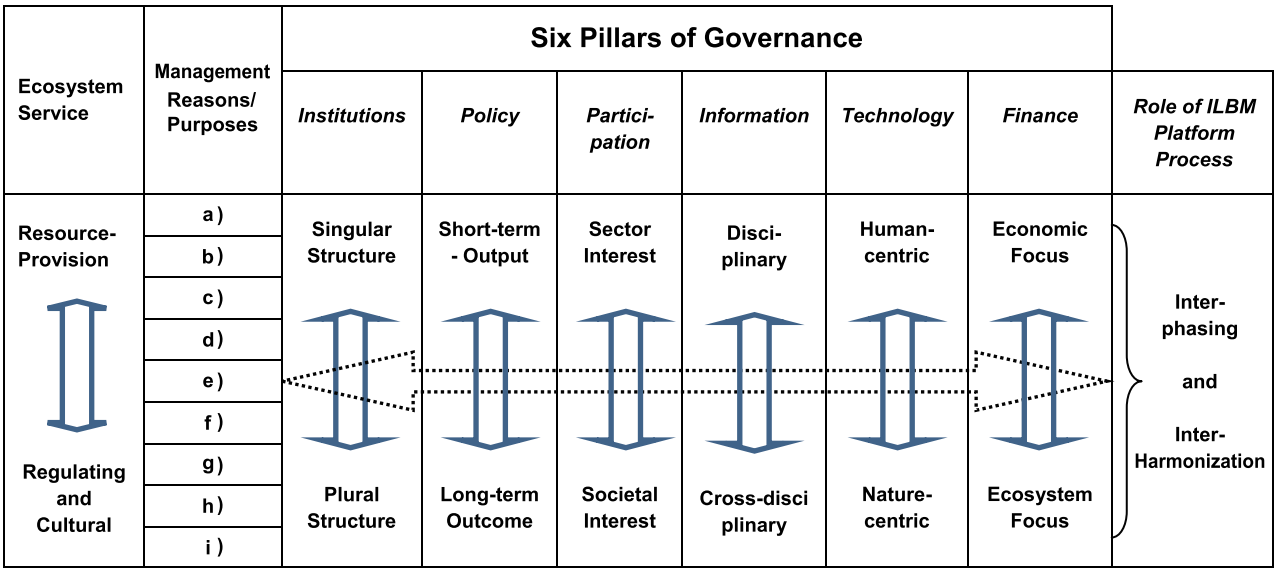


Figure 13. Transformation from a Non-ILBM Approach to an ILBM Approach in Planning



a) developing resource values
b) enhancing resource values
c) decongesting resource use
d) resolving resource use conflicts
e) reducing environmental stress
f) rehabilitating and restoring riparian habitats
g) protecting resource value damages from extreme events
h) taking precautionary adaptation and mitigation measures
i) improving the overall ecosystem health

} Multiple Management Reasons/Purposes

Figure 14. Management Reasons/Purposes as Related to the Six Pillars of Governance

4-4 The Meaning of Integration: IWRM vs. ILBM

IWRM vs. ILBM

The need for an integrated approach for water management is becoming a common understanding among water professionals since the Johannesburg Summit in 2002, when Integrated Water Resources Management (IWRM) was accepted as the common philosophy for all UN agencies to pursue in the future. Simply stated, IWRM stipulates a need to find appropriate means for coordinating policy-making, planning and implementation in an integrated manner across sectoral, institutional and professional boundaries for managing any water-related systems (GWP, 2000). In pursuing IWRM, the Global Water Partnership (GWP) identified a need to recognize some overriding criteria regarding social, economic and natural conditions; namely economic efficiency in water use; equity; and environmental and ecological sustainability. The IWRM framework and approach recognize that complementary elements of an effective water resources management system must be developed and strengthened concurrently, including the enabling environment, the institutional roles and functions of the various administrative levels and stakeholders, and management instruments, including effective regulation, monitoring and enforcement.

According to the GWP, IWRM is 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."

"Integration" in the IWRM sense stipulates the need to integrate "natural system components," including: (1) freshwater and coastal zone management; (2) land and water management; (3) "green water" and "blue water" management; (4) surface and groundwater management; (5) quantity and quality in water resources management; and (6) upstream and downstream water-related interests. IWRM also stipulates the need for integration of human system components, including: (1) cross-sectoral integration in national policy development; (2) macro-economic effects of water developments; (3) basic principles for integrated policy-making; (4) influencing economic sector decisions; (5) integration of all stakeholders in the planning and decision process; and (6) integrating water and wastewater management.

While few people would dispute the importance of IWRM in water management, the reality is that 'operationalization' of the IWRM principle has been difficult in some cases, particularly for those having to deal with on-the-ground basin management challenges facing lakes and other lentic water bodies. One of the overriding reasons for this deficiency is that most, if not all, lake basin management stakeholders are not in a position to play a role in influencing most IWRM integration needs. While ILBM also is based on an integrated approach (see **Box 15** for examples of integration approaches), it focuses on on-the-ground governance improvement, rather than on governance improvement at a higher level of policy making at the national government level. Further, ILBM takes an "integration by necessity" approach, as contrasted to IWRM, which takes more an "integration by design" approach, as previously illustrated.

Adaptive Integration in ILBM Platform Process

The Cyclic ILBM Platform Process discussed in **Section 3-2** is a process of integrating the Six Pillars of Governance. It is meant as a gradual process leading to overall lake basin governance improvements which, in turn, can lead to more efficient and more harmonized implementation of plans and programs that stakeholders can collectively be involved in developing. Even if they may not be able to take part in the process at the outset, the stakeholders should be able to gradually phase in via the ILBM Platform. While this proposed process seems to be well-suited for the "Common-Pool Resources" type problem, it is proposed that this approach also be actively applied to deal with lake basin management cases involving emerging important issues, examples being adaptation to climate change, restoration of biodiversity, and addressing hydrological extreme events such as flooding. The concluding chapter of this document also discusses this aspect to some extent.

Box 15. Ways to Replicate Success in the Integration Process

While the Cyclic ILBM Platform Process is meant to focus on a specific lake basin and its management challenges, the successful outcome of such a Process may be replicated through integration of a different kind. This does not mean only integration of the Six Pillars of Governance, but rather integration of the successful outcomes through the ILBM Platform Process. They may be considered within several categories, including (a) Integration by Encompassing; (b) Integration by Unification; and (c) Integration by Evolution. The following section provides a brief description and some examples of each category.

Integration by Encompassing (Figure a)

There are many instances in which independently-developed sectoral or regional programs or projects are implemented at the same time. Integration by Encompassing, however, recognizes that greater benefits can be gained by integrating these multiple sectoral activities within a coherent and collaborative framework. It typically involves implementation of a specific project or program to coordinate such independent programs and projects, usually focusing on cross-sectoral coordination across government ministries and, for transboundary lakes, even different countries.

Integration by Unification (Figure b)

Even when a lake basin community achieves a successful lake basin management experience, the public may sometimes ultimately lose interest and enthusiasm if such efforts are considered in isolation. Thus, the incentives gained through such previous successful experiences may be inadequate to keep the interest of many stakeholders. In contrast, a unified consideration of previously-successful experiences, even if only marginal in some cases, can provide a sense of mutual facilitation and collaboration. The goal of Integration by Unification is meant to provide a framework for promoting this unity.

Integration by Evolution (Figure c)

The activities within some projects may expand or evolve because of early successes, thereby expanding their spheres of operation over time, either spatially or sectorally. An example would be fringing wetlands around a lake that were originally restored for biodiversity conservation. Because of their success in gradually restoring the shoreline, however, they may have been expanded to provide natural habitats for wildlife. This type of 'broadening" illustrates an expansion over space. Another example would be the experiences in most developed countries in expanding from controlling point sources of pollution, to controlling toxic contaminants, to controlling invasive species and, more recently, to controlling nonpoint sources of pollution.

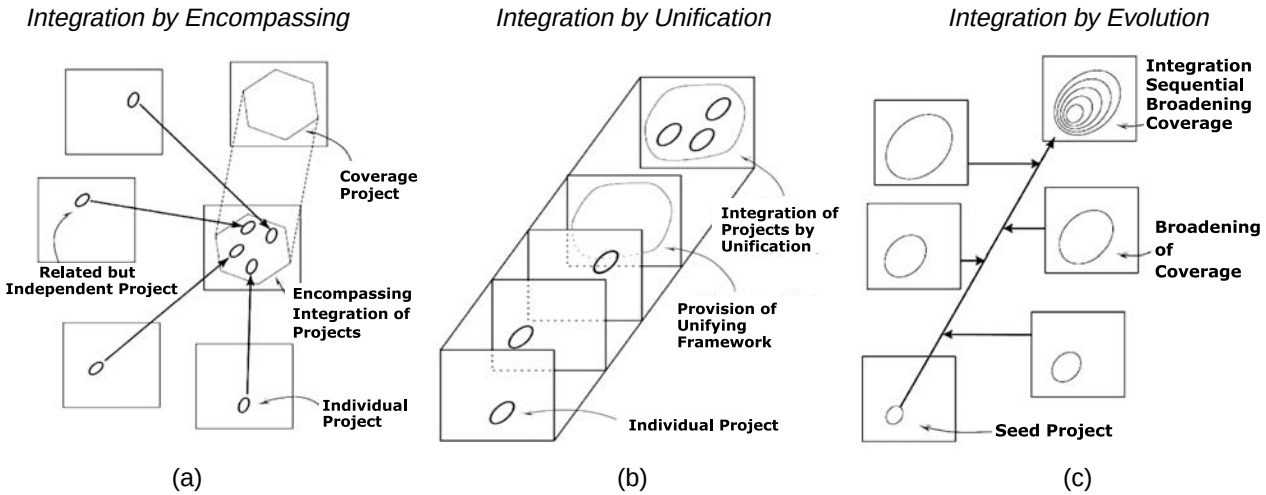


Figure B15. Three Forms of Coordination

4-5 Stages of the ILBM Platform Development

It is emphasized that development of an ILBM Platform Process is not a stand-alone, one-time project, but rather a long-term governance challenge to be met by the entire lake basin society and stakeholders. Once initiated, the Process must evolve and be sustained over coming decades and, over the course of time, the Process must become owned by the basin community at large, hopefully by being integrated into a local/national statutory framework. **Figure 15** provides a schematic example of such a long-term process, in which the time frame is divided into four phases. Phase I is a Preparatory Period; Phase II is a Getting-Started Period; Phase III is a Trial-and-Error Period; and Phase IV is a Sustainability-Challenge Period. In addition to being a governance improvement process by itself, the Cyclic Process during Phases II and III should also be able to guide the process of planning and implementation of various public and private sector management intervention projects. Introduction of a sewerage system, for example, would have to be well integrated into the ILBM Platform Process in order to facilitate the sustainability of its construction, management and operation. For already-existing management intervention programs, the Platform Process should be able to provide an informative retrospective, as well as prospective, assessment to help adjust the course of preparation toward the future with a more coherent, concerted approach to governance improvement. With such a broad range of reasons/purposes, managing lakes and their basins is approached within ILBM via the corresponding range of sectoral activities, with or without formal plans.

As the reasons/purposes become more and more inclusive and comprehensive (i.e., shifting in direction from **a)** to **i)** in **Figure 14**), the individual sector activities/plans must be brought together under the umbrella of a more comprehensive management plan. The type and the nature of such comprehensive management plans also can vary widely, depending on the existing national statutory and policy frameworks in the case of many developed countries, and on the contractual framework in regard to bilateral and multilateral technical collaboration involving developing countries. The ILBM Platform Process may be usefully engaged in either case, since these plans generally recognize the importance of broad engagement of the basin community in the implementation process, if not the actual development, of such plans. A typical example of the former is the Lake Water Quality Conservation Plan stipulated in the statutory framework of the Special Measures for the Preservation of Lake Water Quality (commonly referred to as the “Lake Law”) of Japan (introduced in **Annex 7**). A typical example of the latter is the Lake Victoria Environmental Management Plan, with Phases I and II being implemented by the World Bank for the East African Union member countries, as stipulated in the International Waters Framework of the Global Environment Facility (GEF).

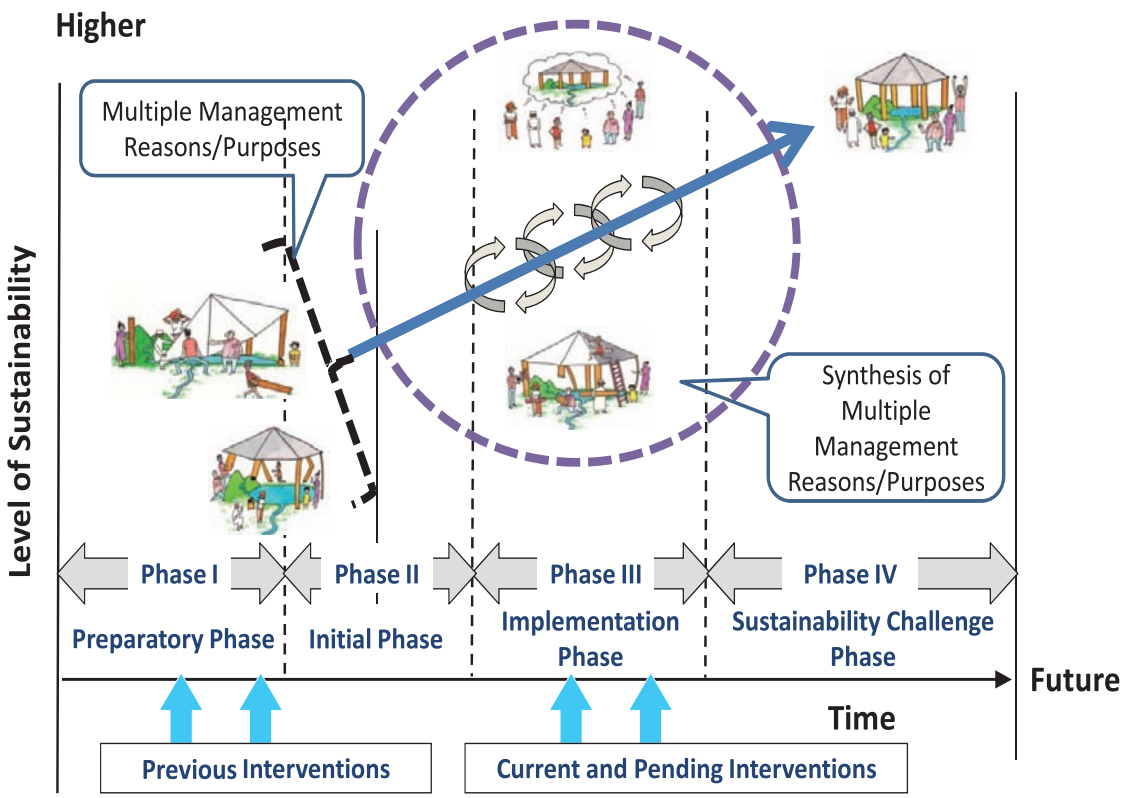


Figure 15. ILBM Platform Process in Stages, with Gradual Synthesis of Management Reasons/Purposes

4-6 Challenges in Sustaining an ILBM Platform Process

As noted in the introduction to this document, ILBM is a comprehensive approach for managing lakes and reservoirs for sustainable ecosystem services through gradual, continuous and holistic improvement of basin governance, with the ILBM Platform being a virtual stage for collective stakeholder actions for improving lake basin governance through the application of ILBM. While the number of ILBM application cases is increasing, whether or not a particular lake basin community being introduced to the concept would be inclined to actually engage in the Platform Process depends on many factors. Some of the most important factors are as follows:

1) Existence of Lead Organizations

The range of types and nature of organizations that can lead the ILBM Platform Process may include government agencies, local/national research institutions, including universities, citizen groups, local/national/international NGOs, and even private-sector organizations. Which of the above types of organizations would play lead roles in ILBM-related activities depends on the political, administrative and cultural climates in the involved country(ies). In highly centralistic nations, for example, the ILBM Platform Process may not function unless government organizations collectively play a lead role, with NGOs and citizens having little or no input. In contrast, for countries in which the government prefers a facilitative role, citizen groups and NGOs may have a much more prominent role in the Process. As long as the Platform can be developed to play an impartial facilitating role, however, the type and nature of the lead organizations can be decided upon by the basin community to suit national and local situations. Since there would be nothing for any particular organization to gain in attempting to exclusively own it, the Process initiated by any kind of organization is likely to be collectively owned as long as it is supported by the international ILBM network. In this regard, it is important to note in this regard that lake basin management projects in developing countries are sometimes supported by bilateral and multilateral funding and technical cooperation agencies. Because of their showcase nature, they tend to attract a disproportionate share of human and financial resources of the basin community, thereby perhaps also significantly affecting the way the entire lake basin is managed. It is quite important to recognize that such a project should be regarded only as a catalytic intervention project, and that lake basin management must be 'owned' by the basin community as a whole, making such a project become an integral part of the basin governance framework through the ILBM Platform Process.

2) Establishment of ILBM Secretariat

The lead organizations, as identified above, are usually best suited to also serve as the ILBM 'secretariat.' It is also possible, however, for the secretariat to be comprised of representatives from the major platform members, thereby collectively burdening the equitable share of the required human and financial resources. The secretariat can decide the focal point individual or organization of the regional and international network of ILBM activities. It can also organize ILBM-related local activities, including ILBM workshops/seminars, and develop a common knowledgebase platform for sharing the already-available data and information among the platform members. It may also develop a protocol for joint analysis of the state of lake basin governance.

3) Meeting Financial Requirements

Implementing the ILBM Platform Process also will have to address financial and manpower requirements for activities such as document preparation, convening of meetings, undertaking joint studies, and compiling and analyzing lake basin governance data and information. Even though the required resources are almost insignificant, compared to the long-term collective benefits likely to accrue to the lake basin community as a whole, there are cases in which inadequate financial resources can become a hindrance to efficient implementation of the Platform Process. There may be cases, for example, where some stakeholders may be located in areas too remote to be able to participate actively in the Platform activities, despite the fact

they should play an important role. In general, however, the Platform Process is a long-term process, with an important goal being to sustain collective interest and commitment, even at a minimal level of activities at the onset. The long-term, gradual improvement of lake basin governance should produce some noticeable changes in the minds of stakeholders in such a way that the necessary funds may somehow be raised from among platform members. It is also important for developing countries containing lake basins involved in external technical and financial collaboration projects to set aside a due portion of their financial commitment for such projects in order to address the sustenance of the ILBM Platform.

4) Access to Data and Information Resources

The data and information resource requirements are usually most intensive at the point at which a Lake Brief is being prepared for the first time. The Brief can be detailed and expansive, with expertise contributions from academic institutions and government offices willing to be counted among the founding members of the Platform Process. Although the more complete the Brief the better, it also can be gradually improved over time through a participatory process of data/information generation and compilation. Thus, an incomplete initial version of the Platform is not necessarily a serious concern, at least at the onset of the Process. It is important to have reliable scientific, as well as policy, data and information, thereby making reliance on academic and governmental sources of information essentially unavoidable. On the other hand, a Lake Brief is not meant to be a scientific paper characterized by the type typically published in academic publications, nor is it meant to be a classified governmental policy paper. Rather, it should be a document that can be prepared with the information already available in the public domain, and also be readily accessible to all stakeholders. What is important at this point is the process of jointly generating, compiling and analyzing the data to be continuously updated for assessing the incremental improvement of specific aspects of basin governance (i.e., Six Pillars of Governance), with which the platform members should become more and more familiar over the longer term. A serious problem may be faced by lake basin stakeholders, however, when the major source of information can only be acquired from government agencies at significant expense and time requirements, and/or in connection with implementation of externally-funded projects in which an enormous quantity of human and financial resources are invested within a short period of time, and with perhaps little or no involvement of the resident capacity of the lake basin stakeholder individuals and organizations. This is a matter that must be recognized both by the concerned bilateral and multilateral organizations and programs, and by the counterpart institutions in charge of the respective governmental programs.

While the aim of ILBM is to attain long-term sustainability of lake basin resources and their uses, the experience to date suggests that, in many parts of the world, the magnitude, as well as the rate, of lake basin resource degradation is enormous and continuing. Indeed, there are fundamental challenges in managing lakes and their basins, regardless of the ILBM applications. Although the emerged typology pertains to the way ILBM may help achieve the sustainability of lake basin resources and their uses, it is not designed to attain sustainability itself. In fact, attainment of the sustainable use of any ecosystem has been, and will continue to be, a long-term global challenge that must be integrated as a mainstream issue facing the international community now and into the future.

5. Knowledge Base and Database Systems

An enormous amount of information and data has already been generated, and will continue to be generated, on a wide range of thematic subjects pertaining to lake basin management, on both a national and international basis. Much of it pertains to natural science topics, including physical, chemical and biological aspects (limnology, hydrology, climatology, ecology, biochemistry, etc.), all of which contribute to a better understanding of the state of lakes, reservoirs and other lentic water bodies. There is also a growing number of studies on the managerial aspects of aquatic, terrestrial and riparian ecosystems, including water quality, sediment quality, and shoreline environments, in addition to the inflowing and outflowing water systems, extending out to the upper watershed tributaries. A needed component not yet produced, however, is a means of compiling and utilizing holistically- and practically-synthesized information and data on such thematic and disciplinary subjects. With a focus on the compilation of global experiences and lessons learned in managing lakes and their basins, a detailed account of the Six Governance Pillars of ILBM is provided in the document, "Managing Lakes and their Basins for Sustainable Use: A Report for Lake Basin Managers and Stakeholders" (ILEC. 2005), which is available on the website: (http://www.ilec.or.jp/eg/lbmi/index.html).

An electronic training module of this document also is available on the website: (http://wldb.ilec.or.jp/ILBMTrainingMaterials/index.html). The document had an instrumental role in the conceptualization process of ILBM and, now that the number of such efforts is growing, a means of developing and sharing the knowledge being continually generated and accumulated is ever more important. To address this goal, an interactive knowledge base cum knowledge mining system, called LAKES (Learning Acceleration and Knowledge Enhancement System) has been developed. LAKES currently has the capacity to process many hundreds of documents for the purpose of 'mining' the imbedded knowledge, utilizing free keywords, as well as an included thesaurus. The level of enquiry with LAKES ranges from whole documents to pages, paragraphs, and even individual sentences. LAKES is also linked to a database system called the World Lake Database, the latter a repository of the output of Survey of the State of World Lakes (1986-1988) for reviewing and downloading information and data for individual lakes, as well as for addressing cross-cutting analyses of water quality parameters among the lakes. In addition, LAKES is also capable of serving as a depository of lake basin management data that has already been generated and made public in the form of hard-copy reports and technical papers, but which does not currently exist in any form of an electronic database because of an inability to develop and maintain such a system. As the number of ILBM-related efforts increases, this need to access such material will definitely increase, since information and data compiled in the form of a Lake Brief are also expected to increase. Screenshot images of the "LAKES" Knowledge Base System and the "World Lake Database" System are presented in **Figures 16** and **17**, respectively. The prototype version of LAKES-III is accessible through the URL: (http://www3.lakes-sys.com/staffs/login) with an ID of "guest", and the password of "guest", and the prototype version of World Lake Database is accessible through the URL: (http://wldb.ilec.or.jp). These versions are operational at the present time mainly for ILBM workshops and training courses.

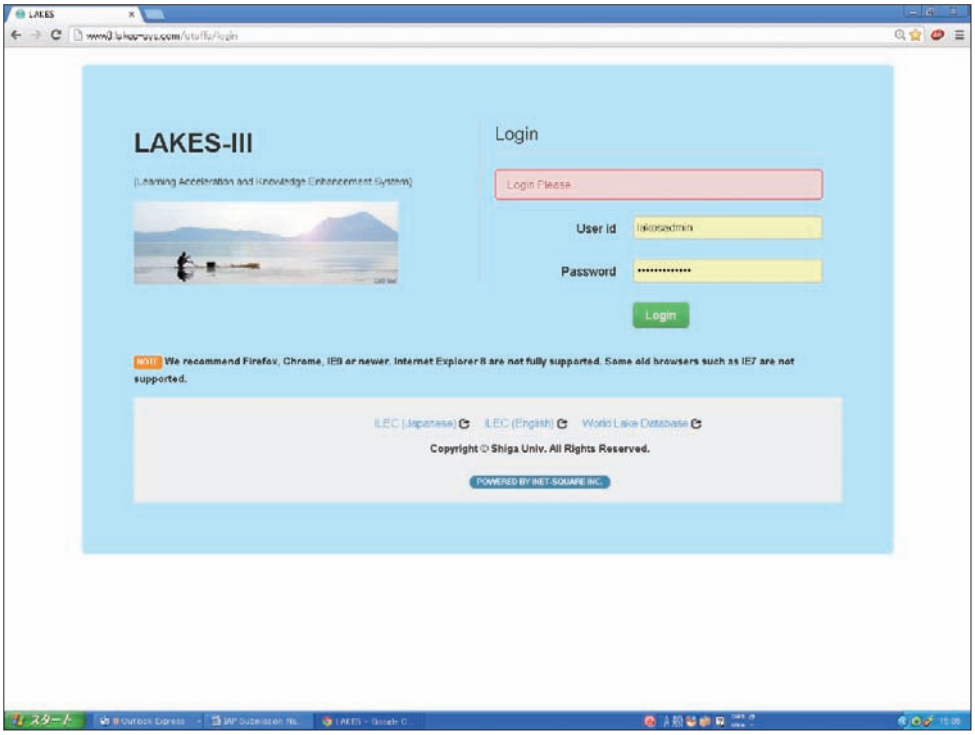


Figure 16. Screenshot Image of "LAKES-III" Knowledge Base System

Figure 17. Screenshot Image of World Lake Database

6. Summary and Way Forward

On a global scale, the terrestrial and sub-terrestrial land constituting the basins of rivers and their sub-surface flows, lakes, estuaries, as well as lagoons, marshlands and other enclosed and semi-enclosed water bodies, has undergone tremendous transformations over past centuries, with the rate of transformation further increasing over the past several decades for many of these water systems. The impacts of this transformation, in the form of environmental pollution and ecosystem degradation, have transcended far and wide to sub-surface and downstream receiving water systems as well, including aquifers, marine ecosystems, and the oceans. Despite all the efforts undertaken thus far to mitigate and restore such systems, this global trend of degradation and over-exploitation is far from being reversed. Because of this reality, the lentic parts of these linked water systems (i.e., naturally non-flowing, with historically-fostered ecosystem and anthropological implications, in contrast to simply being hydrostatic) have been seriously impacted, hindering the sustainable use of their resource values. Equally important is the fact that the pursuit toward environmental and ecosystem sustainability of these lentic water systems is very different from those involving lotic water systems (i.e., naturally flowing, with historically-fostered ecosystem and anthropological implications, in contrast to simply being hydrodynamic). Thus, managing linked water systems that have imbedded lentic properties requires an approach that recognizes and considers their unique physico-chemical and biological features, including their integrating nature, long water retention time, and complex response dynamics.

As a further consideration, management of linked water systems with imbedded lentic properties also must consider policy orientations amenable to their resource-use governance. This is because lake basin resources typically exhibit the characteristic of being “common property” in their existence and use. Thus, resource users must practice self-restraint in pursuing their resource values if they wish for these water systems to remain sustainable. The suitable institutional form to achieve this long-term goal, however, may emerge only after a long, gradual, adaptive process of collective adjustments. This is in contrast to the reality of the resource development sectors often being very hesitant to expend their funds and manpower for purposes other than meeting their own immediate resource requirements. It is difficult, therefore, if not impossible, to prescribe a management framework universally workable for water systems with imbedded lentic system properties. Herein lies the underlying reason for the need to conceptualize an approach that will facilitate the ability of lake basin stakeholders to manage lentic water systems for sustainable use through gradual, continuous and holistic improvement of basin governance. Indeed, if we have learned anything at all from managing lentic water systems to the present time, it is that their management is a continuing process, requiring adaptation to changing conditions, rather than simply being a one-time, stand-alone project.

The reasons/purposes for managing linked water systems range from developing resource values to improving overall ecosystem health. Although the conventional approach of developing and implementing a plan would obviously be indispensable for responding to the above reasons/purposes, it is nevertheless only half the story. This means implementing a prescribed plan may not necessarily result in improved governance that will ensure the sustainable use of lake basin resources. Thus, in focusing on improving the Six Pillars of Governance (i.e., institutions, policies, participation, information, technology and finance), Integrated Lake Basin Management (ILBM) was conceptualized to incorporate the essential requirements for managing water systems with lentic-lotic (not simply hydrostatic-hydrodynamic) properties for sustainable use.

The lake basin governance improvement process can take the form of the ILBM Platform Process, which itself can evolve from assessing the current governance challenges, as well as the means for incremental management improvements (i.e., from the preparation of a Lake Brief, to a Cyclic Process of governance improvement over time). In fact, the typological analysis of ILBM case applications between 2008-2012 has provided a number of illuminating insights. Examples include the

transformation from a non-ILBM approach to an ILBM approach in planning, and the management reasons/purposes, as related to the Six Governance Pillars of ILBM. For the latter, the important message is that basin stakeholders must achieve a greater level of inter-harmonization and inter-phasing of management reasons/purposes in order to reach an agreeable mix of governance qualities. Fortunately, there are now sufficient experiences in lake basins around the world to demonstrate that the ILBM Platform Process provides a useful basis for achieving this important sustainability goal.

With a continually increasing number of ILBM case applications, the cumulative knowledge about the ILBM Platform Process also continues to increase, allowing for new insights to be developed, as well as greater cross-fertilization of experiences to occur, as reflected in the expanding database, knowledge base and training modules. This increased knowledge and insight will definitely help address the increasing number of ILBM application needs. Indeed, if the environmental pollution and ecosystem degradation of aquifers, marine ecosystems, and the oceans are to be deterred, the lentic components of the linked terrestrial and sub-terrestrial water systems must be managed to achieve their sustainable use. Simply and directly stated, this means the issue of lentic water management must be mainstreamed in the global water arena, especially by policy directives which are currently focused too exclusively on Integrated Water Resources Management (IWRM). No United Nations initiative has yet been put forth to mainstream “lakes” within the global water agenda, despite the fact that many UN documents highlight the ‘importance’ of IWRM. This is not to say that IWRM is not important, but rather that global experiences to date indicate that it cannot adequately address the assessment and management challenges of lentic water systems, or the complexities and management implications of linked lentic-lotic water systems. Therefore, it is now time for all of us to recognize and appreciate that ILBM must be promoted to deal with linked water systems of a lentic-lotic nature, focusing on their governance improvement at local, national, sub-continental, continental and international levels. To do otherwise will ensure that these water systems will continue to be managed in such a manner that the overriding goal of their sustainable use now, and into the future, cannot be achieved.

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Annex 1. Lake Basin Typology, with a Focus on Lentic-Lotic Linkages

Although each and every lake basin is comprised of a unique combination of characteristics, it is helpful to group lake basins into types to assist those engaging in ILBM Platform development to find similar cases from which to learn.

Historically, the field of limnology has used lake origin as the main basis for typology (e.g., Hutchinson, 1957), and while these mainly geological approaches have been useful, they have been applied more as descriptions, and less for policy input, because of their lack of focus on the drainage basin. The Lake Basin Management Initiative (ILEC, 2005) took steps to remedy this by formulating a typology of lake basins with a focus on the key role of water balance in management (Ballatore and Muhandiki, 2005). Recent work on the GEF-funded Transboundary Waters Assessment Programme (ILEC, 2011) has produced a series of indicators which provide a basis for a more complete typology that looks not solely at the waterbody, but also at a range of socioeconomic, policy and institutional factors relevant for ILBM.

The focus of this document, however, is on lentic-lotic llinkages, with this Annex presenting typology based on these linkages. It makes use of the previous approaches discussed above, but also poses five simple questions that can serve to elucidate, from a decision-making perspective, which lake basins are similar to others from a lentic-lotic perspective.

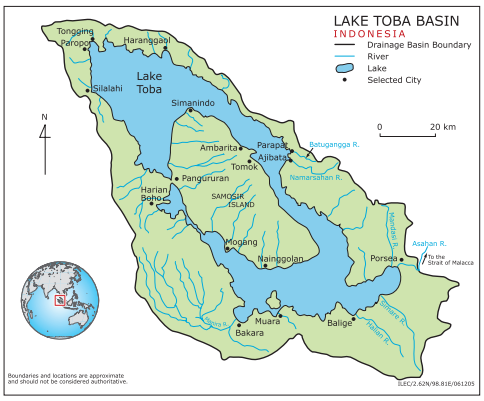
The five themes are: **Lenticity** (how of a basin's water is in lentic form?), **Hydrological Position** (how upstream or downstream is a lake within its broader drainage basin?), **Connections** (what are the major types of connections between lakes and other water bodies?), **Control of Outlet** (to what degree is the outlet of a lake controlled?), and **Diversions** (are there significant diversions of water diversions in or out of the basin?). The 28 LBMI lake basins are used to illustrate these various types.

Lenticity

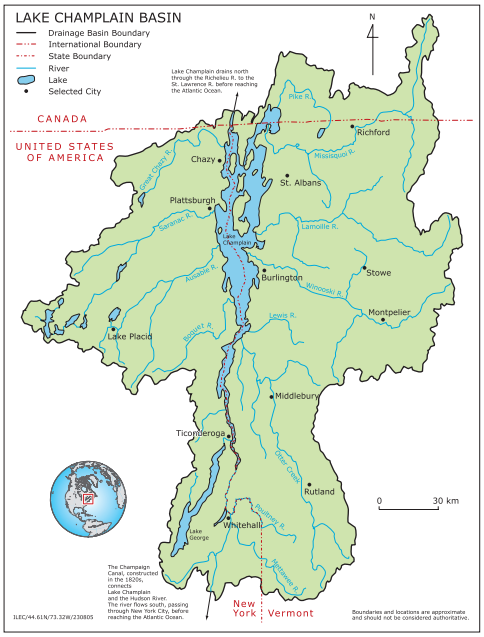
The term "lenticity" was coined in the TWAP report (ILEC, 2011) to describe how much water in a given basin is in lentic vs. lotic form. Systems with a greater percentage of water in lentic form have slower response times to stress. This also generally implies a higher buffer capacity. On the other hand, they respond relatively slowly to positive interventions.

Lenticity can be calculated by considering the total amount of volume in lakes in a given lake basin and comparing that with the annual runoff generated within the drainage area.

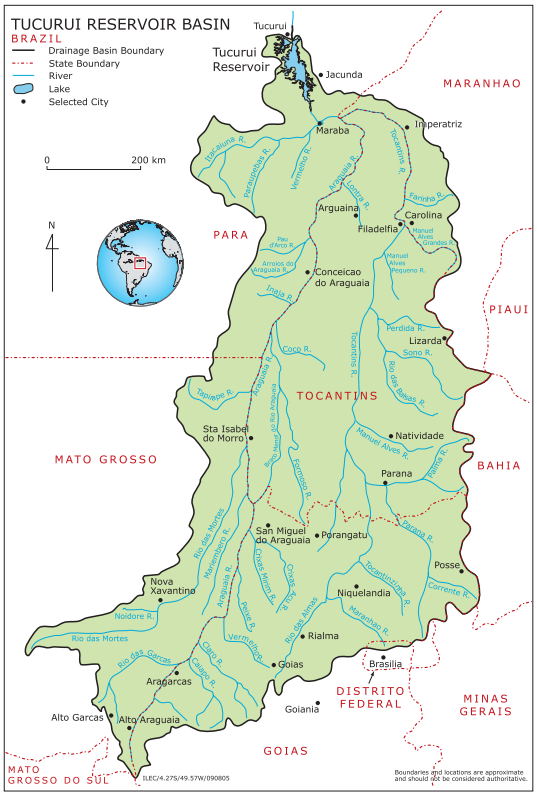
Figure A1-1 a-c gives examples of the range of lenticity seen in the LBMI lake basins. For example, the Lake Toba basin (Indonesia) has one of the highest lenticity values, given the small size of the drainage basin and the very large size of the lake itself (depth of 505 m). At the other extreme, the Tucurui Reservoir basin (Brazil) drains a massive area containing only a few lakes. The short hydrological retention time of the reservoir (0.12 years) reflects the "fast" hydrologic nature of this system. Between these two extremes is the Lake Champlain (USA, Canada) basin which, in addition to the main lake, contains a number of upstream lakes and exhibits moderate lenticity.



(a) High Lenticity: Lake Toba Basin



(b) Moderate Lenticity: Lake Champlain Basin



(c) Low Lenticity: Tucurui Reservoir Basin

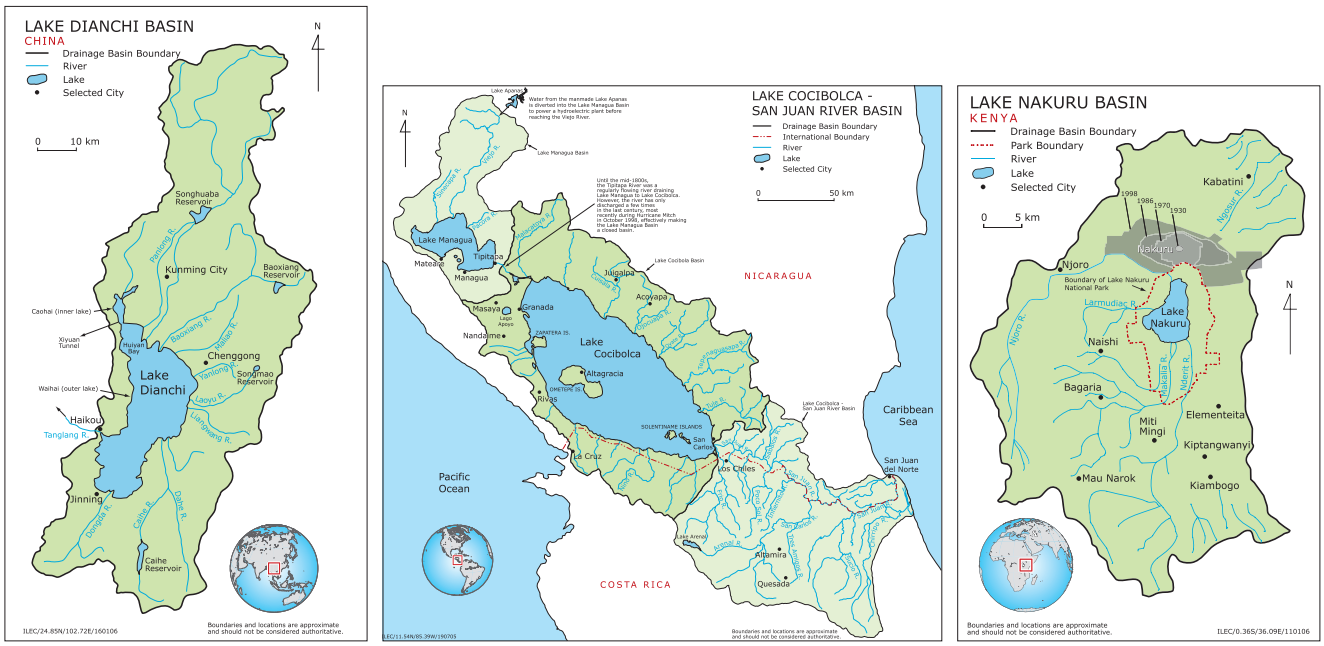
Figure A1-1 a-c. Examples Examples of Lenticity

Hydrological Position

ILEC (2011) notes that the farther downstream a lake basin is relative to its broader drainage basin, the more likely it is to receive upstream pressures. Additionally, it is more likely to be seen as 'important' from the broader drainage basin perspective.

One way of quantifying this "hydrological position" is to compare the amount of runoff generated in the lake's upstream with the total amount generated in the whole drainage basin. This includes not only the lake's upstream area, but also the downstream area of the lake's outlet all the way to the ocean.

Figure A1-2 a-c provides examples of the possible range of hydrological positions. One highly "upstream" case is Lake Dianchi Basin (China) whose outlet river drains into the Yangtze River and eventually into the sea over 2,000 km away. Internally-drained lake basins (endorheic basins), such as the Lake Nakuru Basin (Kenya), have no water outlet, except for evaporation. These lakes are completely "downstream." The Lake Cocibolca Basin (Nicaragua and Costa Rica) lies between these two extremes, with a significant upstream (including Lake Managua) and downstream (San Juan River) components.



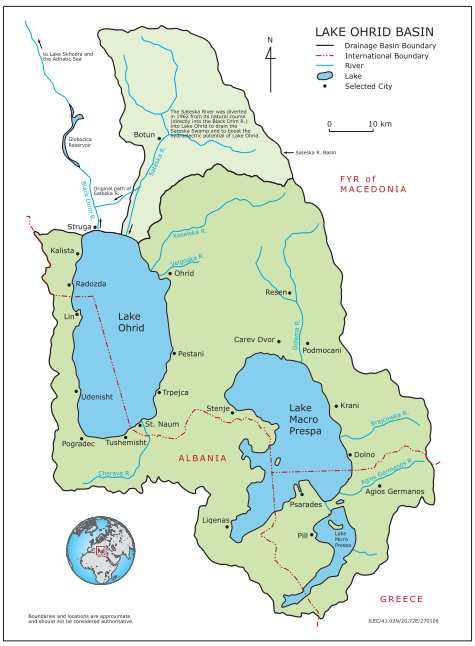
(a) Far Upstream: Lake Dianchi Basin (b) Midstream: Lake Cocibolca Basin (c) Completely Downstream: Lake Nakuru Basin

Figure A1-2 a-c. Examples of Hydrological Position

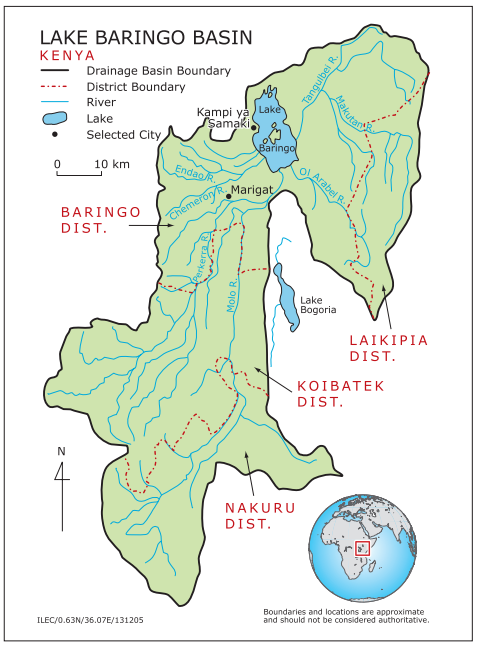
Connections to Other Types of Water Body

Connections between water body types have received increased attention in recent years. UNEP's Transboundary Waters Assessment Programme (TWAP) explicitly studies connections among aquifers, lakes, rivers, Large Marine Ecosystems (LMEs) and open oceans. ILEC's 14th World Lake Conference had "Lakes, Rivers, Groundwater, and Coastal Areas: Understanding Linkages" as its theme. Selected LBMI lake basins are used here to illustrate some of the more important connections between lakes and (1) groundwater, (2) LMEs, (3) rivers, (4) other lakes, and (5) the atmosphere.

Groundwater connections (**Figures 1-3 a-b**): The Lake Ohrid Basin case shows the importance of inflowing groundwater connections to a lake's water quantity and quality. Although there is no surface connection, Lake Prespa drains through a karst landscape into Lake Ohrid (Albania, FYR Macedonia, Greece), bringing with it some substantial pollution loadings. Outflowing groundwater can also be an important part of lake's water balance. Lake Baringo (Kenya) has no surface water outlets, but its water remains fresh due to the loss of salt through extensive groundwater outflows (similar to Lake Chad).



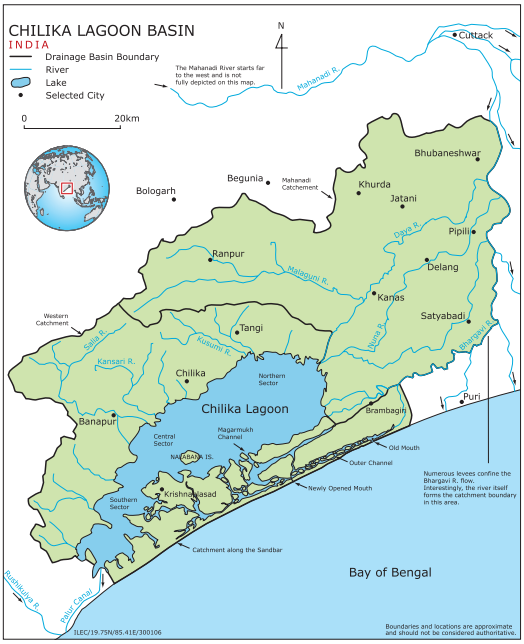
(a) Groundwater In: Lake Ohrid Basin



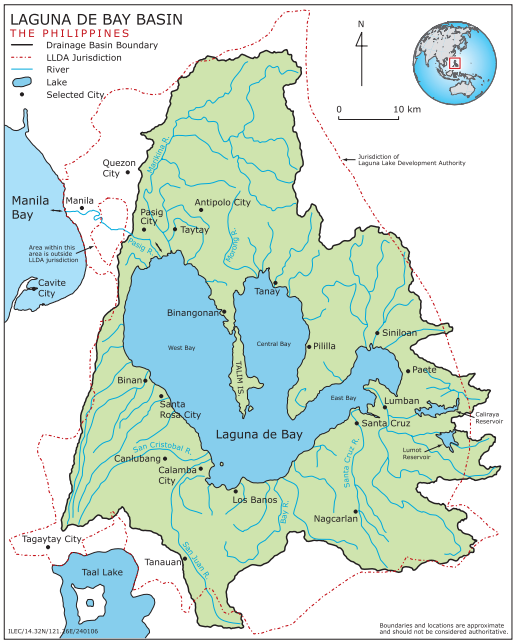
(b) Groundwater Out: Lake Baringo Basin

Figure A1-3 a-b. Examples of Groundwater Connections

Large Marine Ecosystems (LMEs) connections (**Figures 1-3 c-d**): There are a number of coastal lakes that are directly influenced by water inputs from LMEs. For example, in the Chilika Lagoon (India), closure of the lagoon's connection with the Bay of Bengal because of sedimentation from the lake basin, led to a marked decline in the lagoon's ecological status. Dredging of a new mouth allowed seawater to once again enter the lagoon, thereby restoring much of its ecological character, as well as the livelihoods of the fisherfolk in the basin. Lakes can also strongly influence downstream LMEs. A good example is Laguna de Bay (Philippines), which delivers a significant quantity of water and pollution to the Manila Bay system.



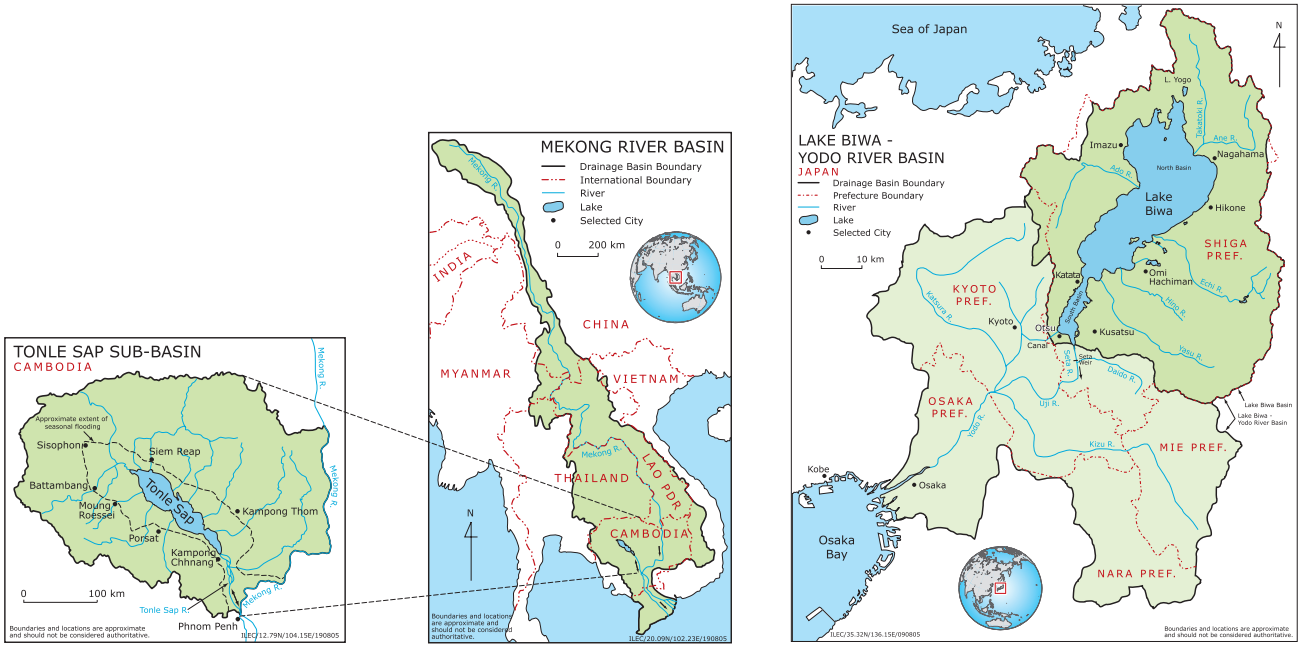
(c) LMEs In: Chilika Lagoon Basin



(d) Out to LMEs: Laguna de Bay Basin

Figure A1-3 c-d. Examples of LMEs Connections

River connections (**Figure A1-3 e-f**): Probably the most pervasive connection is between a lake and its inflowing and outflowing rivers. One interesting case of the importance of inflowing rivers is Tonle Sap (Cambodia) which exhibits a ten-fold change in its water level when the Mekong River floods and enters the lake. In some cases, such as Lake Biwa (Japan), a lake can be of national importance because of the water it provides through its outflow. Water from the Yodo River, for example, supplies drinking water for approximately 14 million people in central Japan, making Lake Biwa one of the world's most intensively-used freshwater resources.

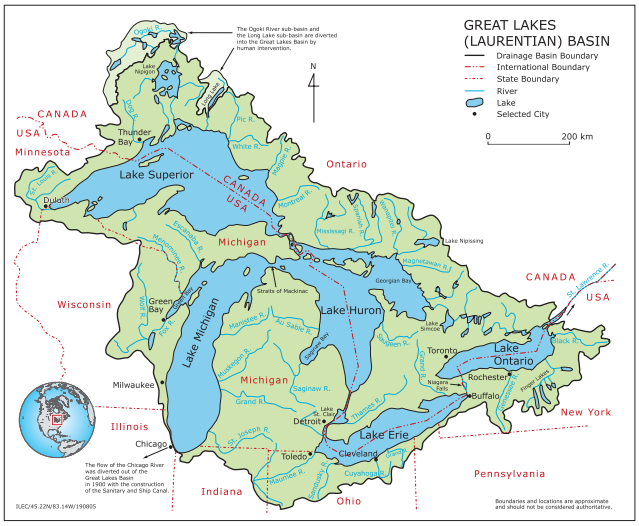


(e) River In: Tonle Sap Basin (f) Out to River: Lake Biwa-Yodo River Basin

Figure A1-3 e-f. Examples of River Connections

Lake connections (**Figure A1-3 g-h**): In some cases, a lake's water balance can be strongly controlled by outflows from an upstream lake. This is the case of Lake Malombe (Malawi), which lies just downstream of Lake Malawi, the former being a lake whose outflow is sensitive to annual climate variations. Similar to Lake Malawi, Lake Superior (Canada and USA) has important effects on the downstream lakes in the North American Great Lakes system.

(g) Lake In: Lake Malombe Basin

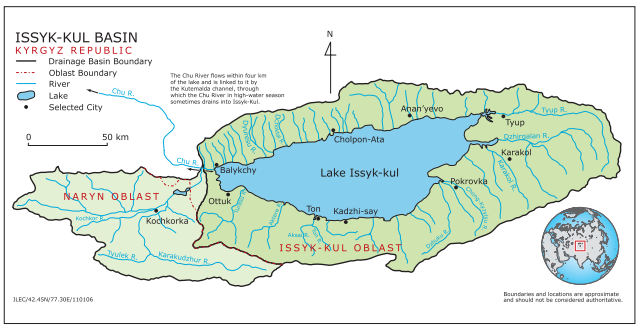


(h) Out to Lake: Lake Superior Basin

Figure A1-3 g-h. Examples of Lake Connections

Atmosphere connections (**Figure A1-3 i-j**): One of the often-overlooked connections is that with the atmosphere. All lakes, except perennially-frozen ones, have some connections to the atmosphere though direct precipitation on their surfaces, and through evaporation. In some cases, these connections can be the main drivers for a lake. Recent studies, for example, have indicated the majority of phosphorus loading to Lake Victoria (Kenya, Tanzania and Uganda) is via the atmosphere (Tamatamah et al., 2005). This is due in part to the lake's very large surface area, relative to its basin area. For lakes lacking a surface or sub-surface water outflow, evaporation dominates the water balance. Issyk-Kul (Kyrgyz Republic) is a prime example of how this evaporation dominance over the years can lead to an increased salinity.

(i) Precipitation In: Lake Victoria Basin



(j) Evaporation Out: Issyk-Kul Basin

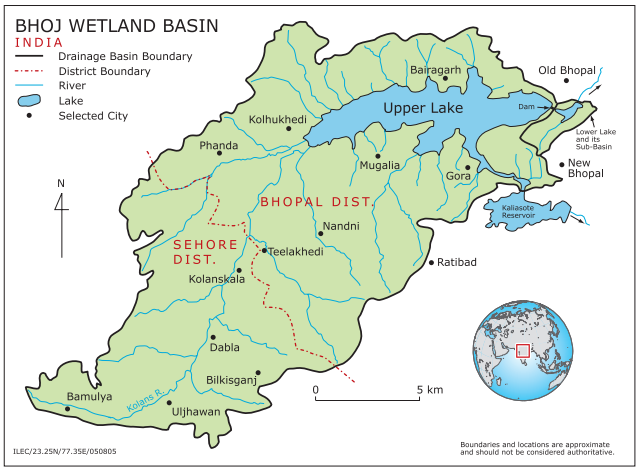
Figure A1-3 i-j. Examples of Atmospheric Connections

Control of Outlet

The degree to which a lake's outlet is controlled can have significant impacts on the lake's ecosystem (**Figure A1-4 a-c**). A main motivation in some cases for controlling a lake's outflow is to reduce the lotic nature of the downstream river in order to increase the ease with which hydropower can be generated. This indirect effects of mostly downstream users on a lake is often unappreciated, being a key point of the whole basin ILBM approach.

An extreme case of complete control is a reservoir such as seen in the Lake Kariba Basin (Zambia and Zimbabwe). By definition, these massive infrastructure developments are designed to convert a lotic system (usually a river with significant flows) into a lentic one. Except for emergency spillovers, all water releases from a dam, as well as the lake level, are controlled.

(a) Uncontrolled outlet: Lake Tanganyika Basin



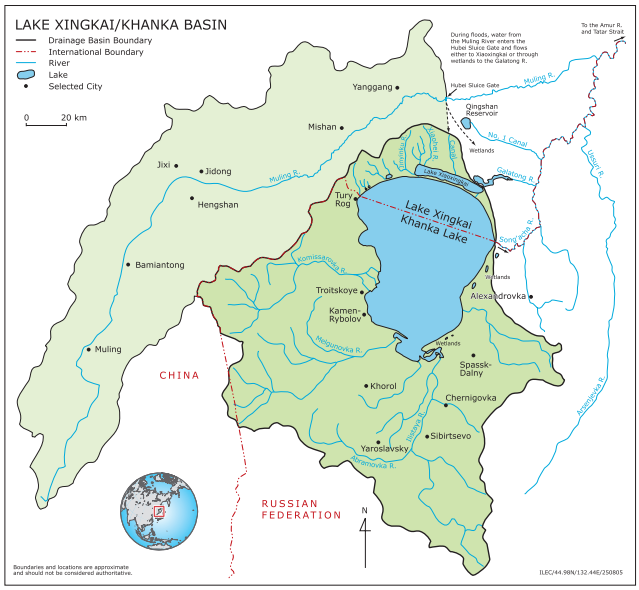
(b) Partially controlled outlet: Bhoj Wetland Basin

(c) Fully controlled outlet: Kariba Reservoir Basin

Figure A1-4 a-c. Examples of Degree of Outlet Control

Diversions

The diversion of water into or out of a lake basin can have significant effects on both the water quality and quantity of a lake (**Figure A1-5 a-b**). In order to prevent flooding of downstream farmland, for example, the Muling River is sometimes diverted into Lake Xingkai/Khanka (China and Russia). Although the natural lake basin has a low population density, the Muling River carries much untreated wastewater from large cities into the lake. Diversion out of a basin also can have serious effects on lake water balance, especially in closed lake basins dominated by evaporation. The diversion of upstream river water in the Aral Sea basin (Kazakhstan, Uzbekistan) for cotton farming, for example, played a major role in the rapid decline in the lake water levels over the last half century. Part of this irrigation scheme involves the Karakum Canal, which also supplied water to areas outside the Aral Sea drainage basin.



Diversion In: Lake Xingkai/Khanka Basin

Diversion Out: Aral Sea Basin

Figure A1-5 a-b. Examples of Degree of Diversions

References

Ballatore, T.J. and V.S. Muhandiki. 2005. "Biophysical Characteristics of Lakes" in *Managing Lakes and Their Basins for Sustainable Use: A Report for Lake Basin Managers and Stakeholders*. International Lake Environment Committee Foundation (ILEC), Kusatsu, Shiga, Japan. 146 p.

Hutchinson, E.G. 1957. *A Treatise on Limnology, Volume 1: Geography, Physics, and Chemistry*. Jon Wiley and Sons: New York, USA. 1,015 p.

ILEC. 2011. *Methodology for the GEF Transboundary Waters Assessment Programme. Volume 3. Methodology for the Assessment of Transboundary Lake Basins*. UNEP: Nairobi, Kenya. 69 p.

Tamatamah, R.A., R.E. Hecky and H.C. Duthie. 2005. The atmospheric deposition of phosphorus in Lake Victoria (East Africa). Biogeochemistry 73 (2): 325-344 pp.

Annex 2. Lake Questionnaire : (Annex A of Lake Brief, as outlined in Box 9 of this document)

The components listed below serve as a useful basis for preparing a Lake Brief. Although the questionnaire should be filled out as completely as possible, it may be necessary to initially ignore items for which there is little or no accessible information. The missing information and data may subsequently be obtained by the scientific community in the course of revising and improving the Lake Brief. As many reference materials as possible also should be identified for the subjects being discussed.

PART I. Characterization Information

PART I data and information is generally readily available from the inventory data source of a national database system, if not available in the publically-accessible information sources.

1. Basic Information

- 1.1 Name(s)
  - 1.1.1 In English (All official names if identified by different names in different countries)
  - 1.1.2 In local language(s)
- 1.2 Location
  - 1.2.1 Latitude (range from West to East) and longitude (range from south to north)
  - 1.2.2 Water surface elevation, relative to mean sea level
  - 1.2.3 Riparian country and sub-national (state, province, etc.) jurisdictions
  - 1.2.4 Non-riparian basin (upstream) countries and sub-national jurisdictions
- 1.3 Origin
  - 1.3.1 For natural lakes: Origin (e.g., glacial, tectonic, volcanic) and estimated age of lake
  - 1.3.2 For artificial lakes (reservoirs): Physical features and years of construction in phases
- 1.4 Basin and/or Watershed Map(s)
  - 1.4.1 Major inflowing and outflowing rivers
  - 1.4.2 Main cities and other relevant points of interest in basin
  - 1.4.3 National/sub-national jurisdictional boundaries
  - 1.4.4 Other maps, as appropriate
- 1.5 Basin Demography and Map(s)
  - 1.5.1 Population numbers, density and distribution
  - 1.5.2 Other relevant information (maps, etc., regarding geographical, demographical, land use, and geohydrological information for a lake and its basin and/or watershed, etc.)
- 1.6 Landscape and Waterscape
  - 1.6.1 Visual features of lake and basin (various photos of landscape, physical facilities, water quality problems, land and water uses in riparian and upstream regions, biological and ecosystem conditions, unique fauna and flora, etc.)

2. Morphology

- 2.1 Bathymetric Map (if available)
- 2.2 Lake Volume (km^3) and Surface Area (km^2)
- 2.3 Lake Length and Width (km) and Length of Shoreline (km)
- 2.4 Maximum and Mean Depths (m)
- 2.5 Intra- and Inter-annual Changes in Water Levels and Volumes; and Water Level Changes Due to Flow Regulation, If Available

3. Water Balance

- 3.1 Inflows (annual average in m^3/year), including Precipitation, Rivers (including indication if they are controlled), Groundwater, and Water Diversions

3.2 Outflows (annual average in m^3/year), including Evaporation, Rivers (including indication if they are controlled), Groundwater and Water Diversions

3.3 Water Retention Times (in years, if information is available), including Theoretical Filling Time (calculated as lake volume/annual inflow), and Theoretical Flushing Time (calculated as lake volume/annual outflow)

3.4 Information on Any Long-term Changes

4. Climate

4.1 Monthly Average, Minimum and Maximum Temperatures (℃) and Precipitation (mm)

4.2 Prevailing Wind Directions by Season; Wind Strength

4.3 Seasonal and Inter-annual Variability (description)

PART II. Biophysical, Chemical and Biotic Data and Information

5. State of Ecosystem

5.1 Description of State of Ecological Health, including Conservation of Fauna and Flora

5.2 Description of State of Biodiversity Conservation

6. Physical Characteristics

6.1 Water Temperature (versus time and depth)

6.2 Freezing Period and Extent of Freezing

6.3 Lake Mixing (vertical and horizontal, including main bays and sub-basins)

6.4 Lake Stratification (period and extent)

7. Chemical Data

7.1 Chemical Water Quality (e.g., oxygen demand; nitrogen and phosphorus [organic, inorganic, particulate, and total, if available] concentrations)

7.2 Pollutant Loadings (tons/year) from Rivers, Groundwater and Atmosphere

8. Biotic Data (Main Species, Exotic Species, Productivity Changes Over Time)

8.1 Overall State of Lake Ecosystem, including Biodiversity

8.2 Phytoplankton; Zooplankton; Fish

8.3 Benthos; Avifauna

8.4 Brief Description of General Ecosystem/ Biodiversity Issues in Regard to Littoral Wetlands, Rivers and Atmosphere

8.5 Aquatic and terretstrial fauna in the littoral environments (e.g., birds and small animals)

8.6 Aquatic and terrestrial flora in the littoral environments (e.g., vegetation, shrubs and forests)

PART II data and information may already exist in the form of a database developed by the government agency or the research institution dedicated to monitoring the subject water body. Some of the parameter items may be regularly and continually updated through monitoring and assessment. However, consistently updating this kind of biophysical data requires financial and manpower commitment, and is difficult to continue. National, regional and global efforts to support acquisition, compilation, assessment and analysis of such data and information is extremely useful and important.

PARTIII. Management and Policy Data and Information

9. State of Lake Basin

9.1 Description of Catchment Area (including size (km^2); general geography of region in relation to lake andneighboring water bodies [e.g., other lakes connected in cascade]); Inflow Catchment System; Outflow Catchment River System

9.2 Basin Hydrology (brief description of basin hydrology, including active and non-active parts)

9.3 Soil Types (refer to soil maps, if available)

9.4 Land Cover, including Changes Over Time (briefly describe seasonal land-use changes, via reference to land use maps)

9.5 Sub-surface Drainage (briefly description of groundwater flows, referring to hydrographical and hydrological maps, if available)

10. Uses of the Lake and Its Resource Development Facilities

10.1 Water, including Flood/Drought Control Facilities; Drinking Water Withdrawals and Facilities; Agricultural Water Withdrawals and Facilities; Industrial Water Withdrawals and Facilities

10.2 Fisheries and Facilities

10.3 Tourism Facilities

10.4 Other Uses

11. Impairments to Lake Resource Uses, including Ecosystem Regulating Services

11.1 Increased Algal Growth

11.2 Increased Salinity

11.3 Wetland Destruction

11.4 Declining Fish Stocks

11.5 Other Impairments, including Governance Issues

12. Causes of Impairments

12.1 Upper Watershed Degradation (including erosion and siltation)

12.2 Point and Nonpoint Source Runoff from Urban Areas

12.3 Shoreline Degradation and Alterations

12.4 Other Impairments

13. Structural Management Responses

13.1 Sewerage Systems

13.2 Industrial Wastewater Treatment Systems

13.3 Solid and Hazardous Waste Management Systems

13.4 Other Relevant Systems

PART III information is generally readily available as the basic inventory information at the government level. If they are not already available, a reconnaissance survey may be usefully conducted.

14. Non-Structural Management Responses

14.1 Rules (informal community rules; voluntary restrictions; formal rules such as industrial effluent regulations; protected areas [land use restrictions, ecological reserves]; etc.)

14.2 Economic Incentives (subsidies, taxes, etc.)

14.3 Raising Public Awareness (public awareness, including environmental education, environmental campaigns, activities of environmental NGOs and CBOs, etc.)

15. Socioeconomic Information (*partial duplication of item 1.5 above*)

15.1 Population Dynamics (numbers, distribution, main cities, percent urban/rural, etc.)

15.2 Education (extent and types of education, literacy rates, etc.)

15.3 Culture (languages, ethnicities, including indigenous peoples, religion, legends and beliefs about the lake)

15.4 Economic Sectors (major industries and production statistics; regional economic development issues, including transportation, commerce sectors, livelihood issues in different parts of lake basin such as coastal upland and upper watershed regions; gross national income per capita within basin [noting also how it might differ from national average(s)])

16. Political Situation (*partial duplication of item 1.2 above*)

16.1 Nations within Lake Basin

16.2 Sub-national Boundaries

16.3 Brief Description of Region's History (brief description of governance challenges facing people, including access to information, rights to participation, access to justice system, etc.)

Annex 3. Six Pillars of Lake Basin Governance: (Annex B of Lake Brief, as outlined in Box 9 of this document)

(A) Institutions (Developing Organizations for Action):

<Fact-checks on the state of governance>

- *Is there a (are there) an existing lake basin management institution(s)?*
- *If yes, what do they do? Who plays the major role(s)? How well is the role(s) played? Is the organizational structure appropriate? What are their strengths and weaknesses? How can their institutional capacity be improved?*
- *If no, is there an organization or a program that should play the role(s)? Should a new organization or program be established?*
- *What are the priority needs for further strengthening the institutional capacity?*

For making organizations and programs more effective for action:

<Exploratory assessment for governance improvement>

- *How should the institutional setting be improved at the national, regional and local levels for helping formulate and implement individual lake basin management plans and programs?*
- *Is the institutional linkage between the national program and the regional and local programs (i.e., vertical institutional linkage) sufficiently strong in both directions? Do good links exist between the decision makers and the stakeholders at all levels? If not, how should they be established and strengthened?*
- *Does the national policy allow and encourage all stakeholder organizations, including governments, industries, scientific institutions and citizen groups, to work together (i.e., to promote the horizontal institutional linkages)? What are the obstacles to this linkage and how could they be addressed?*
- *Do capacity building (training) programs exist within the institutional arrangement? Are they working well? If not, what are the priority needs in capacity building and how can they be fulfilled?*
- *What improvements are required to enhance institutional capacities, particularly to deal with rules of law (e.g., command-and-control) and behavioral modifications and changes (economic incentives, voluntary compliance, etc.), and how can such improvements be made?*

(B) Policies (Identifying Effective Actions):

<Fact-checks on the state of governance>

- *Do relevant national, regional or local lake basin management policies, plans and programs exist?*
- *If they do, are they up-to-date and have they been properly implemented? Have they been effective in addressing the identified problem(s)? If they do, but have not been properly implemented, or are not sufficiently effective, what are the possible major reasons for this deficiency?*
- *If they don't exist, should a new policy be developed to address the identified problem(s)? What issues should addressed be looked into as priority in the new policy.*

For identifying policies and actions that may be most needed and most effective:

<Exploratory assessment for governance improvement>

- *Does an overall national policy framework exist, with provisions for development and implementation of plans for lake basin management (i.e., are there national/regional conservation plans)? If yes, have the plans and programs been properly implemented with relevant priority considerations and phasing over time?*
- *If no, what specific provisions must be included, and how can such inclusions be realized?*
- *Do existing national/regional development plans recognize the importance of the sustainable use and conservation of lake basin resources?*
- *Do laws, ordinances and/or other regulatory provisions specifically directed to lake basin management exist (i.e., effluent standards; ambient standards [e.g., nutrient and chemical concentrations]; source-water protection classifications; etc.)? Have they been usefully implemented? Have they been effective? If not, how can the situation regarding these elements be improved?*
- *If there are legal provisions in place, but they have not been usefully implemented or effective, what are major reasons for this deficiency? Is it a result of inadequate enforcement, or inadequate public awareness, or both? How can their implementation be improved (other than simply providing more funding)?*
- *What types of policy reforms have taken place, or are being considered, to address the sustainable use of lake basin resources? What is currently being done to strengthen institutional capacity, promote environmental investments, and develop human resources?*

(C) Stakeholder Participation (Involving People and Stakeholders):

<Fact-checks on the state of governance>

- *What are the major lake basin management stakeholder groups (i.e., government agencies and/or sectors; institutions; organizations; interest groups; private sector; lakeshore residents, downstream water users, etc.)? Do they share their mutual concerns, and if so, how?*
- *Do good mechanisms exist for all the stakeholders to be involved in development and implementation of lake basin management plans and programs? If yes, how well are they functioning?*

For developing mechanisms and fora for obtaining public opinion and input:

<Exploratory assessment for governance improvement>

- *How can existing stakeholder involvement be improved, particularly in designing and implementing specific plans and programs in lake basin management?*
- *How can the involvement of voluntary associations, village organizations, CBOs, NGOs, etc., be promoted to complement the role played by the government?*
- *What methods might be effective for stakeholder involvement (i.e., to allow citizen groups and NGOs to convey their concerns about the plans and programs developed without their involvement)?*
- *How can the involvement be better promoted/assured for women, disadvantaged peoples, and potentially adversely affected members of the community, particularly in relation to sustainable livelihoods and improved living conditions?*
- *How should the stakeholders collectively enhance lake basin biodiversity, which often plays a vital role in community livelihood enhancement and health status improvements in many developing countries?*
- *What are the merits and demerits of involving international/external NGOs in lake basin management? What are their relevant roles and potential benefits that are otherwise difficult to obtain?*
- *When rules are developed, are those potentially affected by them involved in their development?*

(D) Knowledge and Information (Informing the Process):

<Fact-checks on the state of governance>

- *What information and data prescribed in **Annex 2** is available and, if so, from what source and how?*
- *Have the information and data identified above been sufficient to inform the stakeholders, and are they sufficiently reliable for decision-making? If not, what is currently being done to change the situation?*
- *Are the information and data identified above sufficiently inclusive of pertinent local sources, particularly of fishermen, farmers, housewives, children, and similar individuals?*
- *Have regular monitoring programs been implemented, and have they been proven useful for local decision-making?*

For filling the knowledge gap for more informed decision making in collaboration:

<Exploratory assessment for governance improvement>

- *Are past and current data and information collected, compiled, and analyzed for a target lake basin easily identifiable and/or accessible? If not, how should they be made more accessible and used for more informed decision making?*
- *Does a database exist to support the common interests and concerns of stakeholders, including one having data and information such as those listed in **Annex 2**? If not, is it possible for one of the stakeholder organizations to play a provisional role to liaise with a global database, such as ILEC's World Lake Database? Under such circumstances, what data and information should be regularly updated, by whom, and how can the updated data and information be widely shared for collective and informed stakeholder decision making?*
- *How can institutions with data and information on a target lake basin, such as universities, governmental/non-governmental research institutes, private sector laboratories, etc., increase their collaboration without being too possessive of their own data and information?*
- *What are some of the major knowledge gaps that require information on global experience and lessons learned, and how can access to such information sources be enhanced? Does a focal point organization already exist for undertaking this role? If not, who (what organization) could play such a role, and how should the role be undertaken to benefit the broadest range of potential beneficiaries in the basin?*
- *How can information dissemination to, and sharing with, the public be improved? How can transparency and access to such data and information be improved?*

(E) Technological Opportunities and Limitations (Responding with Technology):

<Fact-checks on the state of governance>

- *What technological interventions have been introduced for resource development (hydropower, water resources, etc.) and/or resource conservation (sediment removal, sewerage and pollution control, etc.)? How successful have they been, and what have been their positive and negative impacts?*
- *What technological innovations should be and/or should have been introduced, but have not been introduced? What are the reasons for this deficiency, and should they be addressed and, if so, how?*
- *What types of lower-cost and appropriate technologies are available and implementable, and how?*

For identifying and applying an appropriate mix of technological options:

<Exploratory assessment for governance improvement>

- *Have the adopted technologies successfully fulfilled their original expectations, considering that all technologies have their limitations, as well as unexpected increases in their application costs? If they have not, what are the reasons for this deficiency, and how can the situation be improved? Sometimes these technologies may shed undue adverse impacts on the lake ecosystem, particularly for large-scale technologies (hydropower, sewerage facilities, etc.).*
- *Have the introduced technologies subsequently interfaced well with the environmental and ecosystem behaviors that were generally not well known at the onset of their introduction? The adaptive approach (i.e., making adjustments based on the observed results of application) should be the key to any technology applications in lake basin management, with various stakeholders playing their respective important roles.*
- *Are lake basin stakeholders sufficiently aware of the cost implications of technological interventions, and the need for mid-course correction based on a consultative process involving all of the stakeholder groups, including government agencies? Some technologies can incur high initial costs, but low recurring cost. Other may have low initial costs, but high recurring costs. Still others may have both high initial and recurring costs. It is noted that, even if loans and grants are available, the recurring costs, including the initial costs to be paid off over a long period of time, and the operation and maintenance costs, must ultimately be paid by the basin population.*
- *What have the application results of such technologies been? What types of technological and non-technological solutions can be usefully combined, and how could they be implemented?*

(F) Sustainable Finance (Mobilizing Sustainable Financing):

<Fact-checks on the state of governance>

- *What is the status of local funding and financial mechanisms for lake basin management, and what is their sustainability? Is this important knowledge sufficiently understood by the stakeholders for them to take appropriate financial responsibility?*
- *What are some of the important factors to consider in having access to international (external), national and state funding sources, and to make use of the respective financing mechanisms? What are the major issues that must be considered, or about which it is necessary to be prepared to address?*
- *What are other financial and funding possibilities, and how should they be pursued?*

For exploring different funding sources and financial mechanisms:

<Exploratory assessment for governance improvement>

- *Have past investments for lake restoration resulted in measurable improvements in water quality and ecosystem integrity? If yes, have the improvements increased related economic outputs, with more tourists, better quality water supplies, greater yield fish harvests, etc.? If not, what are some of the reasons for this failure, and how can the situation be improved?*
- *Are both the Polluters Pay Principle (e.g., strict enforcement of point and nonpoint source pollution control) and the Beneficiaries Pay Principle (e.g., appropriate charges for the users of lake water quantity and quantity) appropriately enforced? If not, why not, and how can the situation be corrected?*
- *Has the responsible lake basin focal agency maintained strong links with the national government? Has it been successful in receiving preferential funding and subsidies for improving the lake's resource values (e.g., improved water quality), because such considerations will depend on the viewpoint of regional/national economic development policies being in balance with environmental quality improvement? A sewerage system, for example, may serve both to enhance livelihood amenities and to improve the lake environment. While the former benefit must be paid for by the beneficiaries, the latter may be paid for with general tax revenue, since it may be considered a benefit for the public at large.*
- *Are economic instruments (taxes; user charges; pollution fines; etc.) currently being practiced for lake basin management? How successful have they been, and what are the possibilities for improvement? What is the status of the application of more advanced economic policy tools, such as pollution charges and tradable permits? What is the possibility of promoting PES (Payment for Ecosystem Services) or PWS (Payment for Watershed Services) within the context of global interests in enhancing biodiversity? What about the possibility of being part of the global movement toward establishment of a trust fund for protecting ecosystems of international and/or global significance?*
- *Can locally-raised revenues from lake basin resources be retained for local use and, if not, what actions might be possible to ensure such funds are retained?*

(G) Some Overall Governance Issues:

- *How should trans-jurisdictional and trans-boundary issues be addressed in the Lake Briefs, and how should the regional and global governance improvements be pursued using such Briefs?*
- *What are the climate change implications, and those of possible adaptation challenges to lake basin governance? How should the global environmental issues, such as the long-range transport of airborne pollutants, and virtual water exploitation (the cause of virtual pollution at the source; that is, growing crops in the lake watershed for exportation that leads to pollution of the lake, but does not affect the conditions at the locations to which the crops are being exported) be addressed in terms of improved lake basin governance?*
- *How can the need for capacity development, including not just targeted skills, but also a broad range of approaches for improving governance for lake basin management, be met? For example, what kind of programs would be useful for addressing such broad-scale issues as enhancing collaboration among concerned government agencies, promoting the establishment of stakeholder alliances, encouraging mid-course corrections in pursuing long-term plans and programs, etc.?*
- *How can the lake basin society promote the building and sustaining, rather than waning, of political will to improve lake basin governance?*

Annex 4. PDCA Cycle and a Cyclic Process of Governance Improvement

Being a long-term and gradual process, lake basin management typically requires a cyclic process resembling the so-called PDCA process of planning. The PDCA process consists of: 1) setting the management objectives based on analysis of the situation [PLAN=P]; 2) evaluating alternative strategies and actions to formulate a policy [DO-D]; 3) implementing selected actions [CHECK-C]; and 4) monitoring and evaluating the policy in order to adjust it to arising needs [ACTION=A], leading to the first step (see **Figure A4**). The governance improvement process, as previously described in **Figures 7** and **9**, are also cyclic, and resemble the above-noted PDCA process. There is, however, an important distinction between the planning PDCA cycle and that referred to in **Figures 7** and **9**. The following section discusses this distinction.

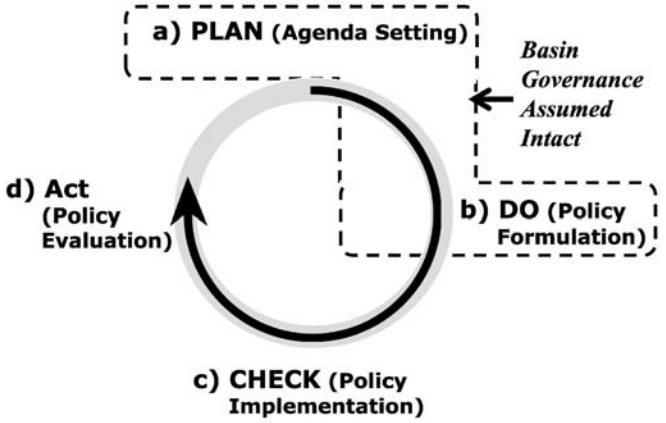


Figure A4. A Typical PDCA Planning Process

First, implementing actions to strengthen the Governance Pillars of lake basin management will incur transactions costs (streamlining the administration, reorganizing institutions, developing capacity, mobilizing financial resources, etc.), thereby making governance improvement a slow, and time-consuming process. If ILBM Platform members can share a common vision about the future of a lake basin's management efforts, the transaction costs will be much less. On the other hand, developing a vision also can be a very complicated and demanding task, particularly when directly linked to governmental policy-making. Developing and agreeing on a "common vision," particularly in a statutory sense, does not translate simply into having a gathering of interested parties assembled at the ILBM Platform. The participatory vision development of an ILBM-Platform is actually undertaken more for the purpose of public sensitization, in that the original vision could gradually be refined to fit the accepted process of the Platform activities. Thus, the "realistic common vision" in this case of governance improvement is more to be fostered and evolved, rather than developed outright at the outset of governance activities.

Second, the vision pertaining to governance improvement being fostered, rather than developed, may be explained using the concept of "tame" versus "wicked" public sector planning problems, and use of the PDCA cycle in planning versus its use in governance improvement. The PDCA cycle is a concept broadly used to describe a wide range of planning cases, including both the "tame" problems (i.e., private sector production management planning and implementation) and the "wicked" problems (i.e., public sector planning and implementation situations such as lake water quality and ecosystem restoration). Thus, we must be careful to recognize there is a fundamental difference between the two in the assumption of "governance readiness." In the "tame" problem cases, the implicit assumption for step a) PLAN (Agenda Setting), and step b) DO (Policy Formulation), could be interpreted as meaning the "governance readiness" for the cyclic process is fundamentally sound and intact from the outset. This means, for example, that rules and regulations will be properly observed and implemented, and that funding for implementing the necessary component activities are available, or will be made available as needed, before starting the cyclic process. As an example, in a private sector manufacturing plan, the production target, product quality control, and necessary funds to be made available, must be guaranteed *a priori*. The implicit assumption of sound and intact "governance readiness" does not hold for the "wicked" problem cases. This means, for example, that the rules and regulations may, or

may not, be observed and implemented, and that funding for implementing necessary component activities tends to be in a state of flux, and subjected to policy and political decisions in effect when the activities were developed and implemented. Another way to describe the difference between the two ("tame" versus "wicked") is that planning for the "tame" problems is basically "output" oriented (i.e., most of the private sector planning is to produce a target level of output), while that for the "wicked" problems is "outcome" oriented (i.e., most of the public sector planning is to bring about a desirable outcome). The meaning of the cyclic PDCA process for the "tame" problem is that, by going through the cycle of actions, the production of "output" may be optimally controlled by, for example, accelerating or decelerating the production speed. The meaning of the cyclic PDCA process for the "wicked" problem is that by going through the cyclic actions, the desirable outcome must be gradually shaped, while also improving the "governance readiness," with mutual facilitation and collective actions of the stakeholders-at-large.

Lake basin management may represent either a "tame" or "wicked" problem, depending on the defined situation. Implementation of a regional sewerage system master plan to construct and reduce point-source pollution loading into a lake, for example, may be considered a "tame" problem if implemented as part of a national program, with the necessary legal framework in place, and the needed financial and technological resources mobilized. The same regional sewerage system master plan implementation will have to be regarded as a "wicked" problem, if some people resist the siting of the plant 'in their backyard,' or some individual households resist investing their own money to replace their septic tank system with a flushing system having connection pipelines to the main sewer. Much more "wicked" are problems such as improving the water quality and ecosystem integrity of a lake characterized by extensively urbanized and industrialized riparian lands, its lowland agricultural activities unable to control excessive fertilizer and pesticide runoff, its upper watershed deforested and exhibiting occasional flush floods discharging enormous quantities of silts from eroded river banks and surface runoff, and the watershed's rural population suffering from incidences of waterborne diseases. These "wicked" planning problems in lake basin management are found ubiquitously throughout the world, in both developed and developing countries, and they are often dealt with as if they are "tame" problems, particularly in the case of ODA (Official Development Assistance) funded projects.

Annex 5. A Practical Approach in ILBM Pillar Assessment: An Example

Evaluating Governance Pillars in the Lerma-Chapala-Santiago Basin: <Based on "Governance Monitoring from the Integral Managing of Basins and Water Bodies," A. Juarez, 2010[xxiii] >

Although the conceptual basis of ILBM pertains to lakes and other lentic water systems, their relationship with inflowing and outflowing rivers (lotic water systems) also cannot be ignored. In the case of Lake Chapala[xxiv] (Lago Chapala), for example, which a surface area of 1,140 km^2 the upstream basin of this lake is the Lerma River (Rio Lerma) Basin. It extends over five states[xxv], and contains a population of 10.5 million[xxvi]. Covering an area of 54,000 km^2, the basin provides almost three quarters of the total water inflow to the lake, with the remaining quantity being mainly from precipitation directly onto the lake surface. The basin also produces 35% of Mexico's industrial GNP, and 20% of its commercial output[xxvii]. The river system downstream from the lake, called the Rio Santiago Basin, extends across five states. Guadalajara, the second largest city in Mexico, is located just downstream of the lake, and contains a population of approximately 4 million people. It receives water directly from the lake through a pipeline, the volume being five times that which outflows from the lake to the downstream Santiago River. The water quality of the Santiago River is very poor, since the city wastewater flows directly into the river with little or no treatment. The responsibility of managing water distribution in this water-scarce region is shared by three water management councils, one for the upstream region, another for the lake region, and the last for the downstream region. Among other factors, this fragmentation of responsibility and authority is a major factor contributing to the continuing degradation of the water resources in all three water systems. Thus, evaluation of the institutional and policy effectiveness, among the components comprising the ILBM Governance 'Pillars,' is an essential step in managing this lentic-lotic water system for sustainable use, and maintenance of important ecosystem services.

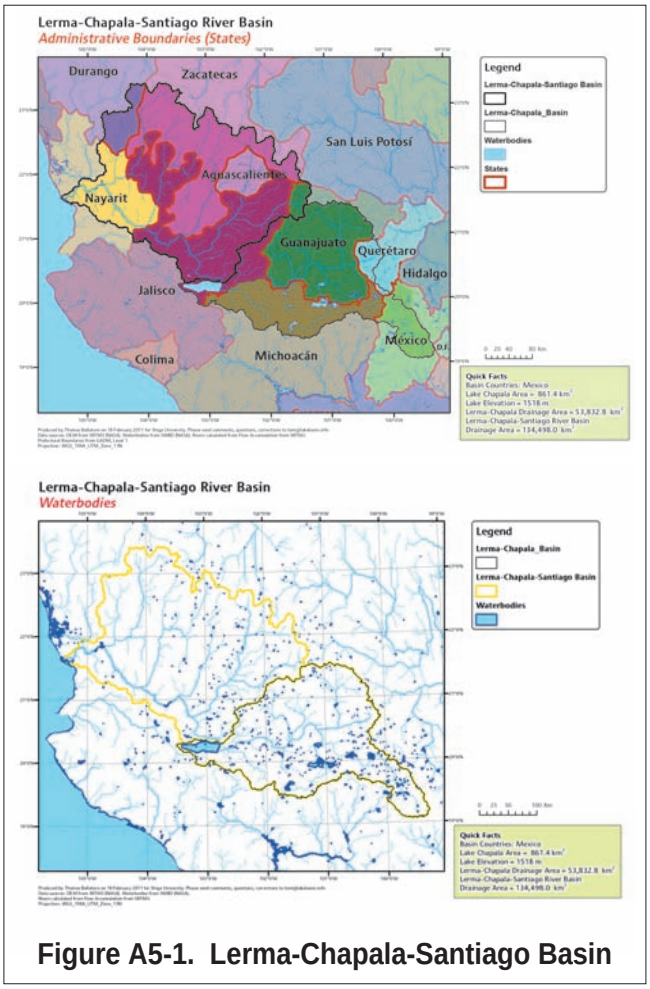


Figure A5-1. Lerma-Chapala-Santiago Basin

A method for assessing the ILBM governance improvement, called the Governance Diagnosis System (GDS), was developed in the Mexican ILBM case study project (A. J. Aguilar, 2010). It uses 10 indicators for each of the Six Governance Pillars of ILBM. The degree of fulfillment of the governance improvement need is rated using a scale between "0" and "10," with "0" being totally lacking, and "10" being totally fulfilled. All the indicators were expressed in a question form, to be answered by various sectors involved in the basin management. The set of indicator questions for the Six Pillars are as follows:

INSTITUTIONS

1. Do national and state regulations contents include mechanisms to promote collaborative work of the government sector with civic groups, universities and other institutions?
2. Do mechanisms exist for joint municipalities' work and for linking the municipal level with and state and federal agencies?

3. What is the level of collaboration with existing research institutions? Do platforms and/or joint proposals exist?
4. Are community groups (grassroots) experiences considered for management of part or the entire basin territory?
5. Do the productive sectors (fisheries, agriculture and livestock) associated with representative institutions that are functional and effective?
6. Do civil society organizations have representative coalitions with defined goals and common actions for basin and water body management?
7. What is the level of recognition and acceptance by the general public of institutions involved in watershed management?
8. Do mechanisms exist for collaboration (working groups, coalitions and steering committees) that effectively and consistently bring together different sectors?
9. Does a coordinating agency exist with a legal structure to consistently and effectively perform duties of linkage between sectors?
10. Does any agency exist for basin and/or water body management with the capacity to enforce regulations and sanctions effectively?

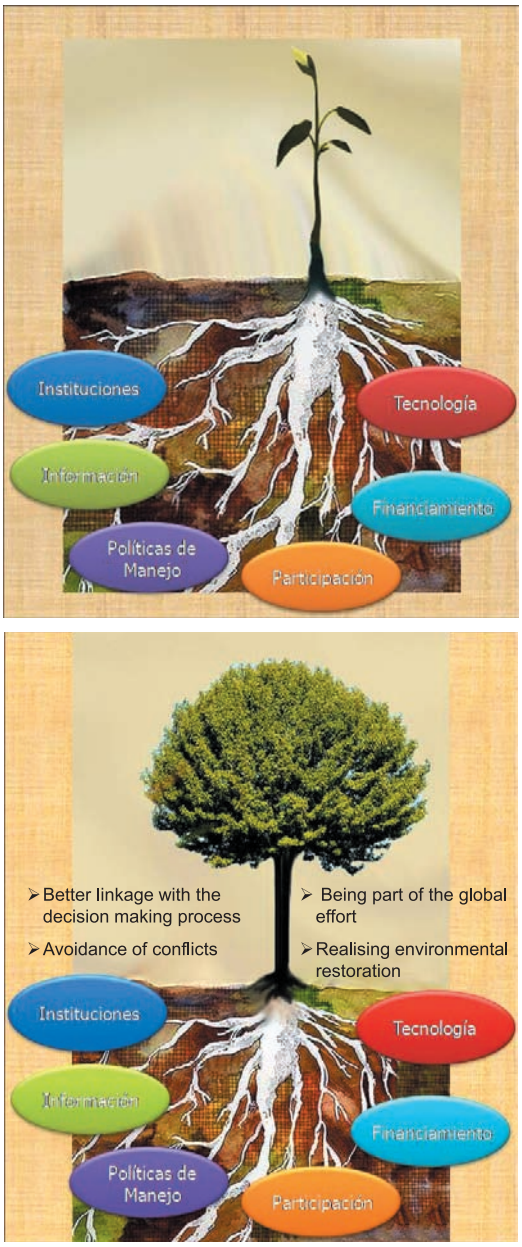


Figure A5-2. A Six Roots of Governance Tree

POLICIES

1. In what measure national and regional development plans recognize the importance of conservation and sustainable use of basin resources?
2. Are there legal mechanisms (laws, rules, etc.) for a proper management of the water bodies and basin?
3. Are there mechanisms to ensure policy continuity despite the municipal and state administrative changes?
4. Do existing appropriate operational mechanisms (structure, personnel, equipment, etc.) for implementation of existing laws and regulations?
5. How coherent are the basin implemented actions related to municipal, state and federal policies?
6. Does the existing legal framework have a set of effective sanctions?
7. Are there efficient incentives to engage population in conservation and watershed management?
8. How well are current management policies geared to the interests of society?
9. How efficient are the implemented management policies?
10. How adaptable are the management actions when they fail, or in circumstances that allow its application change?

PARTICIPATION

1. Is there a clear identification of the major stakeholder groups for the management of the watershed?
2. Are there consultative mechanisms to involve stakeholder groups in basin management?
3. Are there available training mechanisms to strengthen priority stakeholders' capacities for a sustainable management of the watershed?

4. Are there mechanisms of joint participation to make proposals and specific agreements for basin management?
5. Do the key sectors consider that their representation in these spaces are being done in a transparent and effective way?
6. Are the proposals presented in such participatory spaces effectively taken into account in management decisions for the watershed?
7. Are agreements reached at the participation instances identified and recognized by the general public?
8. Is the performance of participants regularly monitored and disseminated?
9. Do existing participation mechanisms collaborate effectively to prevent and resolve conflicts between sectors?
10. Are there support mechanisms to ensure participation of the economically weaker sections?

TECHNOLOGY

1. What is the level of coverage of sewage treatment?
2. How effective is the wastewater treatment system used to reduce solids and pathogens?
3. Are alternatives such as wetlands, composting toilets and other sustainable eco-techniques used properly?
4. Are industrial water discharges being treated appropriately?
5. Is there an appropriate hydrological management to ensure ecological flow in basin rivers?
6. Are forest management processes being applied appropriately for the type of forest in the region?
7. Is there a monitoring system to properly measure water quality and quantity in the watershed?
8. Are there control systems for agriculture originated pollutants (pesticides and fertilizers) to prevent their entry into water bodies?
9. Is the control of invasive species (water hyacinth, fishes and others) effective and without harmful secondary effects?
10. Do the activities of water bodies management allow the maintenance of quality and generation of ecological services in a sustainable way?

INFORMATION

1. Is there reliable diagnosis of the ecological conditions of the territory (ecosystems, functions and biodiversity)?
2. Is there reliable diagnosis of the territory's social characteristics (demographics, economic conditions, level of poverty, groups of stakeholders, trends and attitudes)?
3. Are there collections of knowledge about traditional systems of ecosystem management?
4. Are there mechanisms for transferring scientific information to groups of government, civil organizations and other groups?
5. Is the existing information updated on a regular basis?
6. Are there databases that organize the existing information?
7. Is access to existing information adequate?
8. Is there institutional capacity to use and feed back scientific and technical information?
9. Are there mechanisms for information dissemination through mass media?
10. Are there mechanisms for periodic publication (announcements, newsletters and magazines) on the actions and the restoration process?

FUNDING

1. Is the amount of existing funding adequate to meet the basin management priorities?
2. Are financing sources maintainable in a medium and long term?
3. Is the available funding channeled properly to the needs of watershed management?
4. How transparent and reliable is the access to funding mechanisms?
5. Are there specific budgets for basin/water bodies management provided by local authorities?

6. How well developed are private funding mechanisms?
7. Are there adequate state and federal budgets for basin/water bodies management?
8. Are currently international funding mechanisms applied in the basin?
9. Are the funding mechanisms available in proper time for their effective use?
10. Are there local funding mechanisms through the payment of fines and/or contributions?

Based on these survey results, if the assigned values for specific ILBM Governance Pillars were 5.0 (for Indicator 1), 7.0 (for 2), 3.0 (for 3), 2.0 (for 4), 1.0 (for 5), 1.0 (for 6), 1.0 for (for 7), 4.0 (for 8), 6.0 (for 9), 5.0 (for 10), the average scores would be 3.5.

Two requirements were imposed on the stakeholder sectors participating in this process. The first was that all key sectors (i.e., municipal, state and federal government sectors, civil society organizations, research institutions, private sectors, and others), as represented by the selected members, must take part in one or two Diagnostic Workshops, depending on their design and duration. The second was the preparation of a Lake Brief, an extremely important reference document for measuring accomplishments over the course of the succeeding workshops. The Lake Brief could be prepared with existing literature, field research and interviews with key people, using a simple questionnaire form.

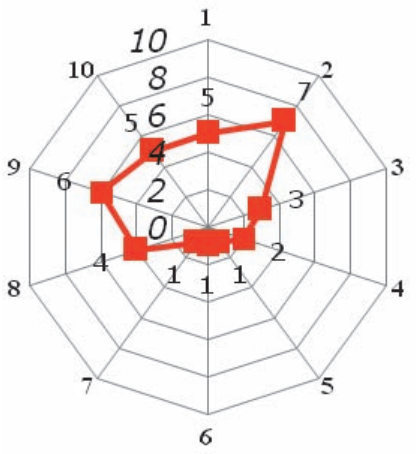


Figure A5-3. A Radar Graph of Ten Assessment Scores for One of Six Governance Pillars

Also necessary is a Stakeholder Map depicting the roles and interactions of groups and sectors involved in lake basin management, and a Description File of each participating member stipulating their "Resourcefulness" (i.e., areas of expertise, relational networks, recognitions, and prestige acquired), as well as their leadership. The Stakeholder Map and the Description File are necessary to clearly comprehend the specific groups that interact in the basin, and the linkages they have with each other. From the gathered information, an invitation will be sent to stakeholder group leaders to participate in the Diagnosis Workshops. The groups of workshop participants are referred to as the "Workgroups."

To satisfactorily lead the workshops, the workgroup participants are required to:

- Exhibit a well-recognized career in their respective sector;
- Know the conditions and problems of the basin;
- Have an attitude needed to maintain an open dialogue, and the capacity to express ideas in a clear manner;
- Accept the workshop participation rules, including respecting other participant opinions and viewpoints, and to respect time schedules even for difficult topics being discussed; and
- Take part in both workshop meetings, since the two comprise a unit.

For reasons of time management, and to facilitate good interactions among participants, the number of workgroup members can be set between 10 and 20, with at least one representative from each stakeholder group. In the case of the Mexican case study, the participants identified at the outset of the workshop series were invited to succeeding workshops to ensure the GDS scores would not be unduly affected by membership changes. Those stakeholders/people acquainted with the indicator subject tend to give higher scores to Governance Pillar elements, while those distanced from the indicator subjects tend to give lower scores. Having a balanced participation allows the rating results to be more realistic.

In the first workshop session, after presenting its aim and structures, the participants are reminded that the purpose of the workshop is mainly to address conflicting views among the participants, which the dialogue does not mean automatic acceptance of divergent positions, and that exchanging of information may bring about possible agreements. The workshop also serves to appease doubts about the aims of the exercise, the methodology employed, and the use of the final products. A commitment must be established to present the final results to the whole team, as well as to deliver a written summary to each workshop participant. Once it is completed, a summary of the basin information obtained in the preparatory stage is presented to the participants, allowing individual commentaries on their experiences and knowledge be reported. The information is organized to build a Timeline (list of relevant events for the basin, arranged in a chronological form) and to identify useful Impact Stories (details of especially relevant events, either positive or negative) that will be reported in a detailed way in the final document. Before finishing, a review of the session results should be reported and a preview of the Diagnosis Set of Indicators to be used in the next session should be informed.

The second workshop session determines the governance indicator values. The workgroup members are divided into teams consisting of 4 to 6 participants. The workshop facilitators present definitions of the Six Pillars, and the associated list of 10 indicators (questions), both in written and verbal forms. Every team has 10 minutes to assign a value between 0 and 10 to each indicator. Once completed, all the teams present in the Workgroup indicate the values they assigned to each Governance Pillar, allowing the opportunity to present arguments regarding different conclusions. After augmentation (very brief and avoiding confrontations) the Workgroup defines a value that reflects the situation of the indicator in a more refined manner. These discussion activities are extremely important for establishing and/or to strengthening links among the participants, to update information, and to create collaboration platforms for improving governance, beyond the duration of the workshop itself. After evaluating the 10 indicator results of every group, the governance component value is determined as the average of related 10 indicators. At the end of the session, the overall value of governance in the basin is determined by the average of the 6 components.

This above methodology identifies the strong and weak points of the process, and facilitates creation of Action Lines to improve basin governance, favoring the efficiency of the decisions, effective joint actions among sectors, and creation of short-term and long-term alliances.

In conclusion, the ILBM Governance Diagnostic System exhibited the following features:

- Its results allowed the formulation of routes and effective strategies to foster an integrated basin management, clarifying the specific importance of the stakeholder participation interacting within the process. It also facilitated identification of key sectors and institutions to be involved in order to solve conflicts. A better understanding of the specific paper of stakeholders favors collaboration among governmental agencies, groups of producers and other instances, opening possibilities of confluence to reach agreements;
- By identifying weak and strong points in governance, stakeholder roles became clearer;
- It clarified the sectoral roles, and helped develop consensus for developing and implementing management plans and programs;
- It increased opportunities for joint actions, leading efficient actions and reducing costs.
- Establishing a diagnosis allowed for monitoring the process to evaluate the improvement/setback of the Governance Pillar indicators; and
- The ILBM Governance Diagnosis System proved to be a practical instrument, with the possibility of being duplicated in any part of the world, adapting to the particular characteristics of a given basin. In follow-up stages, it is being considered for application to the remaining 17 sub-basins comprising the Lerma-Chapala basin, and to promote its utilization as a management tool with the institutions and countries linked to the ILBM Process.

Annex 6. Past and Ongoing ILBM-Related Projects

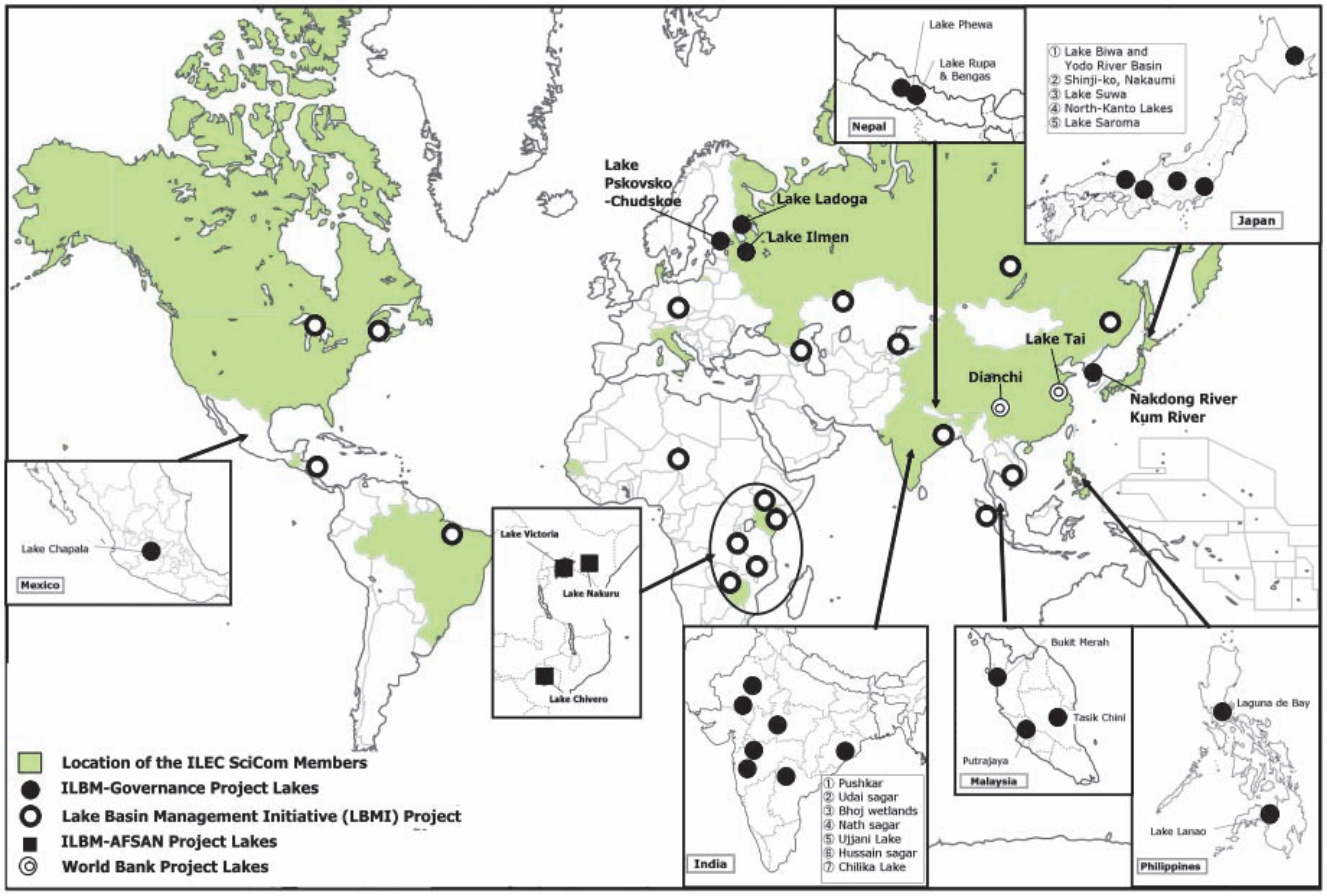


Figure A6. ILBM-Related Case Study Lakes

<Case Study Lake Basins Participated in the ILBM Governance Project, 2008-2010>

The conceptual ILBM Platform framework described above has been developed since early 2000, in connection with various consultative and research-based projects in Japan[xxviii] as well as internationally[xxix]. These consultative projects include a three-year project identified as the ILBM-G Project (2008-2010)[xxx]. This Project included some 20 case study lake basins identified from Southeast Asia (Lake Laguna, Lake Lanao, and Rinconada Lakes in the Philippines; Lake Putrajaya, Lake Chini and Lake Bukit Merrah in Malaysia); South Asia (Lakes Bhopal, Lake Hussain Sagar, Lake Pushkar, Lake Udasagar, and Ujjani Reservoir in India; Lake Phewa, Lake Rupa, Lake Begnas and other small lakes in Nepal); Northern Europe (Lake Ladoga, Lake Chudskoe/Peipsi and Lake Illmen in Russia), and Latin America (Lake Chapala and the Rio Lerma Basin in Mexico).

1) Philippines

There were 211 identified lakes in the Philippines as of 2001[xxxi]. They include two major lakes; namely, Lake Laguna (Laguna de Bay) and Lake Lanao. Lake Laguna is a shallow (mean depth of 2 m) lake, but with one of the largest surface areas in Southeast Asia (900 km^2), situated next to the main part of the Manila Metropolitan jurisdiction. The lake basin has a population of about 6 million spread across 6 provinces, and includes 13 cities and 48 municipalities, with a land area of 3,820 km^2. The Laguna Lake "Experience and Lessons Learnt Report," prepared by Laguna Lake Development Authority (LLDA) in 2005, was revised in 2009, following the above-noted ILBM Guidelines. Lake Lanao is the deepest (maximum depth of 112 m) and largest (surface area of 352 km^2) freshwater lake in the Philippines, on the island of Mindanao[xxxii]. It is located about 700 m above

sea level along the Agus River discharging to the Illigan Bay of the Bohol Sea, and connected to the Sulu Sea and the South China Sea. The local NGO and the Government of Lanao de Sul, with support from LLDA, were able to prepare a Lake Lanao Brief, reflecting the output of the ILBM workshop held in 2009. The *"Rinconada Lakes"* refers to three sister lakes (Lake Bato, Lake Buhi, Lake Baao-Bula) located in the Province of Bicol, Southern Luzon Island. Bato and Buhi are basically fishery culture lakes, while Baao-Bula is an irrigation lake. The ILBM Platform activities have begun to be nicely integrated into the existing national program framework, with full recognition of its added value.

2) Malaysia

The National Academy of Science, Malaysia (ASM), and the National Hydraulic Research Institute of Malaysia (NAHRIM), jointly undertook a preliminary desktop assessment of the status of lake eutrophication in 2005, subsequently reporting that, out of 90 natural and manmade lakes, about 62% were eutrophic, while the rest were mesotrophic[xxxiii]. The assessment exercise was followed by the "Colloquium on Management of Lakes and Reservoirs in Malaysia" in July 2007, with a focus on development of a Strategic Plan for Lake and Reservoir Management in Malaysia[xxxiv]. During the course of developing the Strategic Plan, eight Lake Briefs have already been prepared, including one each for Lake Putrajaya, Lake Chini and Lake Bukit Merrah. Lake Putrajaya is a ten-year old manmade lake, constructed as a part of the landscape of Putra Jaya, a planned city[xxxv] inaugurated as the federal administrative center of Malaysia in 1999. Lake Chini (also called Tasek Chini) is one of the few natural freshwater lakes in the Peninsular Malaysia. The main water sources contributing to the lake is the Chini River (also called the Sungai Chini), a tributary to one of the largest river in Peninsular Malaysia, the Pahang River. Constructed in 1906, Lake Bukit Merah is the oldest manmade lake in Malaysia, being located in the north western part of Peninsular Malaysia. The ILBM Platform activities are being pursued as a basis for the national program development, with a very organized plan to integrate as well as expand on the ILBM framework.

3) Nepal

The Nepalese Government established the National Lake Conservation and Development Committee (NLCDC) in 2006 within the Ministry of Culture, Tourism and Civil Aviation. The Committee undertook a national survey, identifying nearly 5,400 lakes located in the low altitude, midland altitude and high altitude regions. These lakes serve for various purposes, including being vital sources of water and related livelihood possibilities for the riparian communities. They also support tourism, playing a key role in the preservation of biodiversity in the Himalayan environment. The momentum generated though the initial round of activities will be expanded to lakes in the high mountains, the mid-hill region and the Tarai district[xxxvi]. During the study period, individual Lake Briefs were prepared for Lake Phewa, Lake Rupa and Lake Begnas in the Pokara Region. The ILBM activity framework is expected to play an instrumental role in carrying forward the momentum created by NLCDC.

4) India

Impounded (lentic) water systems in India, numbering more than one million, can be categorized into natural lakes, reservoirs, ponds, temple tanks, step wells[xxxvii], and wetlands. All are relatively shallow and small in size. The proportion of manmade water bodies is much larger than that for natural water bodies. They have historically been subjected to three major causes of resource degradation, as follows: (a) urbanization reclaimed a number of smaller lakes, drastically reducing their water body morphology; (b) water pollution due to sewage, nutrient-rich agricultural runoff, and toxic industrial effluents, which results in lost productivity and quality use in such sectors as fisheries, dairy, and recreational activities; and (c) failure of sustainable management because of a variety of socio-economic, political and religious factors, according to one report[xxxviii]. The Lake Briefs were prepared for: (1) the reservoirs located on rivers (i.e., Ujjani Reservoir on the Upper Bhima River, a tributary of the Krishna River; Lake Bhopal or Bhoj Wetland on the Kolans River, a tributary of the Halali

River); (2) the impoundments based on topography (Lake Hussaisagar in Hyderabad; Lake Anasagar in Ajimer); (3) temple tanks (Lake Pushkar); and (4) reservoirs downstream of urban areas (Lake Udaisagar and related lakes in Udaipur)

The ILBM Platform activities have begun in earnest and have been actively pursued in most of the above lake basins, with possible linkages to the National Lake Conservation Plan promoted by the National Government.

5) Mexico

The ILBM Platform activities in Mexico have focused on Lake Chapala (Lago Chapala), the largest, most important inland water body in the country. Its major inflowing river is the Lerma River (also called the Rio Lerma). This water system was selected as a focal case study lake basin in Latin and Central America. Since its first workshop in September 2008, through the project entitled “Planning for Integrated Management of Lerma-Chapala Basin,” a Lake Brief was prepared over the course of three years, based in part on three regional ILBM workshops. The project was instrumental in raising the profile of the Lake Chapala Basin management challenges by bringing together Lerma River watershed stakeholder organizations in many sub-basins in parts of the States of Jalisco, Guanajuato, Michoacan, Edo de Mexico, Queretaro that have since jointly been seeking ways to realize practical application of the ILBM Platform framework. Corazón de la Tierra, an international NGO in Mexico, continues to play a major national focal point role. The ILBM framework is now being promoted to interface with the State Water Commission Programs on lake basin management.

6) Russia

The case study lake basins are Lakes Ladoga, Chudskoe (Peipsi) and Illmen in northwestern Europe (Lake Chudskoe/Peipsi is a transboundary lake between Russia and Estonia, while the other two lakes are located entirely in Russia). Their Lake Briefs were prepared as an initiative of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg. These Lake Briefs are the first batch of such reports in Russia, and there is an ongoing effort to expand these activities to other major lakes in the region, including those in Central Asia. These activities are expected to be linked to the activities of the International Data Centre on the Hydrology of Lakes and Reservoirs (HYDROLARE), the latter operated by the Institute of Limnology, Russian Academy of Sciences, which is also spearheading ILBM promotion in other parts of Russia and Central Asia, as well as in the Baltic Sea Region.

Annex 7. Japan's Lake Water Quality Conservation Plan

The Special Measures for the Preservation of Lake Water Quality (commonly referred to as "the Lake Law") was first enacted in 1984, and revised in 2005. It is one that specifically aimed at improving the water quality of those lakes that are specified to develop a lake water quality conservation plan. An assortment of measures are required to be implemented to achieve the lake water quality in terms of organic and nutrient concentrations, the levels of which are targeted to be reduced to the ambient lake water quality standards. Within this plan, various plans and programs belonging to other resource development sectors will have to be harmonized collectively to contribute for the water quality parameter values to eventually to meet the environmental quality standards specifically applicable to the lake. The details of the planning process is described in Okada and Perterson (2000). The descriptions on the revised Law, which now include nonpoint source control by designating the Lake Environment Protection Area, is given in Kai-Qin, et. al. (2009).

The Law specifically targets mainly those lakes where water quality improvement is urgently needed, and which the Prime Minister identifies as "designated lakes." The Law aims at: (1) Introducing special regulations to control pollutant discharges into the watershed of designated lakes over and above existing regulations of the Water Pollution Control Law, and at (2) Carrying out comprehensive lake water improvement measures by achieving cooperation and consensus between the central and local governments for each of the designated lakes. The comprehensive measures should include projects for improving sewerage water quality. Close cooperation among the national government, local governments, private enterprises, and local residents is indispensable in order to implement lake water quality improvement measures in a comprehensive mannter. To that end, the national government decided to establish a "Basic Policy for the Preservation of Lake Water Quality" which covers not only the designated lakes, but also all other lakes in Japan" (Okada, et. al. 2000).

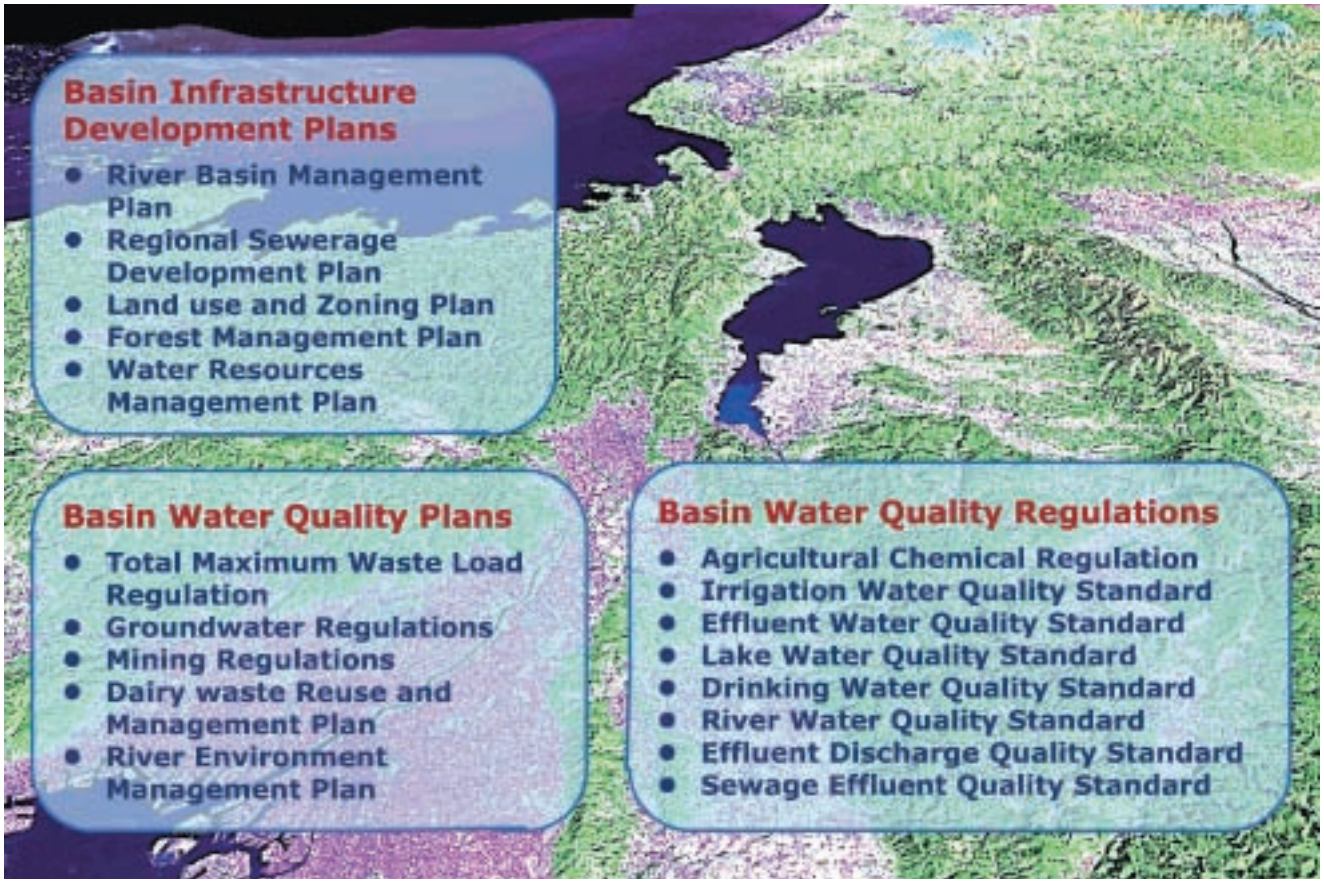


Figure A7-1. Many Sector Plans and Regulatory Frameworks for Lake Biwa Basin Management

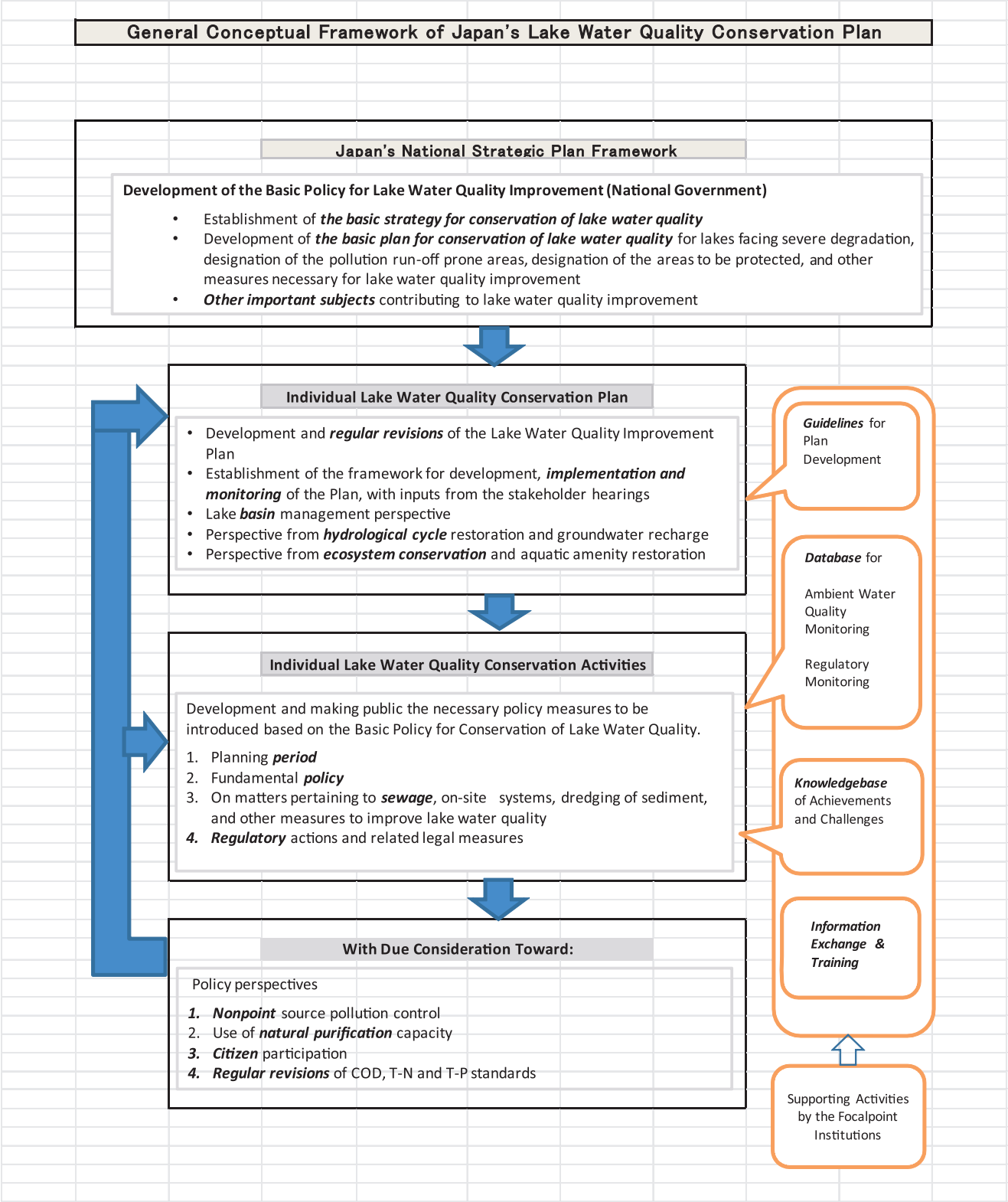


Figure A7-2. A Cyclic Process Associated with Japan's Lake Water Quality Conservation Plan

[i] In fact, this integrating nature often provides the 'trigger' for development and implementation of remediation programs, in that many symptoms of pollutant loadings become visible in a lake only after they have had sufficient time to become obvious problems. Thus, the condition of a lake can be viewed as a type of 'barometer' of human activities within the basin of the lake. This observation has particularly significant in regard to lakes because they are used for a greater range of human uses than any other type of water system, thereby ensuring that such degradation can affect a greater number and range of these uses. Algal blooms provide an example of this phenomenon, noting that algal cells require the same nutrient, temperature and light requirements in both rivers and lakes. However, excessive nutrient loads produce algal blooms in lakes because the algae have sufficient time to accumulate to nuisance levels in the lentic environment of lakes, whereas this is not normally possible in a lotic river environment.

[ii] See, for example, "The Degrading Trend of the World's Lakes" in "How Can We Stop Degradation of the World's Lake Environments? Integrated Lake Basin Management (ILBM): Towards Prevention and Sustainable Use of Lake Ecosystems" (p.6, ILEC, 2007).

[iii] Recognizing the unique resource values, and management challenges of lakes, ILEC has studied lake basin management experiences in a number of countries around the world, with the goal of developing a practical, rational and scientifically-defensible means of managing lakes and their basins for the sustainable use of these resources. ILEC has subsequently focused on the resource values of lakes within the context of ecosystem services, as originally defined within the framework of the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2005).

[iv] The historical development of the concept of "ecosystem services" is considered by some economists as a shift from the original economic conception of nature's benefits as "use values" in Classical Economics to the notion of "exchange values" in Neoclassical Economics.

[v] An ancient lake is a lake that carried water uninterrupted for more than one million years. The vast majority of lakes, including very large ones (e.g., North American Great Lakes) are of much more recent origin. The short life of most lakes is due to continued sedimentation from sediments entering via their tributaries, which typically leads to complete siltation after several thousand years. In contrast, the longevity of ancient lakes can mostly be attributed to geological factors, such as plate tectonics, which can counter siltation effects.
See: http://en.wikipedia.org/wiki/Ancient_lake. (From Wikipedia, the free encyclopedia)

[vi] The Protected Area Management Board (PAMB) is a multi-sectoral body responsible for the administration and management of all protected areas in the Philippines. Created through the National Integrated Protected Areas System Act, the Board decides on budget allocations, approval of funding proposals and planning on matters concerning the ecology, particularly the protected areas. It is under the direct supervision of the Protected Area Office (PAO) through the Protected Area Superintendent, who acts as the PAMB secretariat (From Wikipedia, the free encyclopedia).

[vii] The term "Common-Pool Resources" is synonymous to the term "Common-Property Resources."

[viii] See http://en.wikipedia.org/wiki/Tragedy_of_the_commons, in addition to Footnote 2 above.

[ix] In essence, her main message is that the users develop their own rule to monitor each other and improve their management by broad engagement. Among them is the issue of common-property resources at the micro-watershed and tribal community levels. In many developing countries, particularly in Africa, Asia and Central-South America, small impoundments in remote rural areas are often communally owned, and their resources may be managed according to traditionally-acquired rights and their resource use conflicts may be addressed by their customary laws. In places where there are indigenous tribes conducting livelihood activities in the lake basins, the governments are inclined to allow for their management practices to prevail as long as they are in harmony with the general legal provisions.

[x] There is a wide range of important issues that pertains to ownership and responsibilities for lake basin management. Who owns the lake and the riparian lands and who are responsible in managing the lake water and the shoreline? Who should get the credit if the resource value is increased by managing the water and land better, and who should be blamed if the value is decreased by poor management? For these and related questions, the legal stipulations of ownership and management responsibilities are indispensable. In reality, however, the blanket application of a single legal framework to the wide variety of resource values is not possible. Lake fisheries provide an example. While management of the artisanal fishery must depend a lot on the historically-fostered communal rules of fishermen, management of the commercial maritime fishery may be regulated with a stringent regulatory framework of international standard. The issue of water and shoreline land ownership could be much more complicated, as they relate to the prevailing water right and land tenure issues. They are often the subjects of continuous legal battle particularly in relation to the historic claim of priority allocation. The application of individual laws and regulations may also become a challenging task in cases where the resource use is highly congested and conflicted among the users (fishermen, water extractions, tour boat operators, etc.), among the use sectors (fishery, irrigation, municipal water supplies, hydropower, etc.), among the spatial implications (upstream- downstream, riparian perimeter, in-lake, etc.), as well as among the temporal implications (dry-wet seasons, month of the year, hour of the day, etc.). The conflict situation can get even more complicated and time consuming to resolve in the case of transboundary lakes, particularly when there has been limited effort to harmonize the respective legal frameworks. The effort to compile the global experience in dealing with such complicated situations is increasing, however, and the cross-fertilization of such experiences is beginning to provide many useful clues for conflict resolution in lake basin management (See pp.39, 123, and 124, of "World Lake Vision Action Report").

[xi] See, for example, http://www.eoearth.org/article/Open_access_resources for a definition.

[xii] The term Governance is defined in a variety of ways. Some of the major definitions as summarized by IUCN (As part of the TWAP

Bangkok Workshop distribution materials) include :

1. “Governance is the exercise of political, economic and administrative authority in the management of a country’s affairs at all levels” (UNDP)
2. “Governance is the process of decision-making and the process by which decisions are implemented, or not implemented” (UNESCAP)
3. “Governance is the exercise of political, economic and administrative authority necessary to manage a nation’s affairs.” (OECD)
4. “Good governance is the transparent and accountable management of human, natural, economic and financial resources for the purposes of equitable and sustainable development.” (Council of the European Union)
5. “Governance means rules, processes and behavior that affect the way in which powers are exercised at European level, particularly as regards openness, participation, accountability, effectiveness and coherence.” (Commission of the European Communities-CEC)
6. “Governance consists of the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them.” (The World Bank)
7. “(Governance is) A process referring to the manner in which power is exercised in the management of the affairs of a nation, and its relations with other nations” (African Development Bank-ADB)
8. “Governance is about the institutional environment in which citizens interact among themselves and with government agencies/officials.” (Asian Development Bank-ADB)
9. “Governance encompasses the values, rules, institutions, and processes through which people and organizations attempt to work towards common objectives, make decisions, generate authority and legitimacy, and exercise power.” (Canadian International Development Agency-CIDA)
10. “Governance is about the use of power and authority and how a country manages its affairs.” (Department for International Development (DFID)
11. “Governance is the process whereby societies or organizations make important decisions, determine whom they involve and how they render account. “ (Institute on Governance)
12. “Governance is the process or method by which society is governed.” (nternational Institute for Environment and Development -IIED)
13. “Governance describes the overall manner in which public officials and institutions acquire and exercise their authority to shape public policy and provide public goods and services.” (The Brookings Institution)

[xiii] See ILEC (2005).

[xiv] See, ILEC (2005). See also ILBM Training Module: (http://wldb.ilec.or.jp/ILBMTrainingMaterials/index.html).

[xv] See Annex 7 on Japan’s Special Measures for the Preservation of Lake Water Quality (commonly referred to as “the Lake Law”).

[xvi] PDCA was made popular by Dr. W. Edwards Deming, who is considered by many to be the father of modern quality control. However, he always referred to it as the “Shewhart cycle.” Deming later modified PDCA to “Plan, Do, Study, Act” (PDSA), so as to better describe his recommendations. According to Deming, during lectures he gave in Japan in the early 1950s, the Japanese participants shortened the steps to the now traditional Plan, Do, Check, and Act: (Wikipedia:http://en.wikipedia.org/wiki/PDCA).

[xvii] We refer here to the concept proposed by Global Environment Fund (GEF), as presented by Duda (2002), “Monitoring and Evaluation Indicators for GEF International Waters Projects,” Monitoring and Evaluation Working Paper 10, World Bank, Washington, D.C..

[xviii] See, for example, “The Degrading Trend of the World’s Lakes” in “How Can We Stop Degradation of the World’s Lake Environments? Integrated Lake Basin Management (ILBM): Towards Prevention and Sustainable Use of Lake Ecosystems” (p. 6, ILEC, 2007).

[xix] Mushrifah Idris, “Tasik Chini, Pahan, Lake Brief” in “Managing Lakes and Their Basins for Sustainable Use in Malaysia,” Lake Briefs Report Series No.1, Academi Sains Malaysia and the National Hydraulic Research Institute of Malaysia, 2010. pp. 171-210.

[xx] Tan, K.W. and M. B. Mokhtar, An Appropriate Institutional Framework Towards Integrated Water Resources Management in Pahang River Basin, European Journal of Scientific Research, Vol.7, No.4, 2009, pp. 536-547.

[xxi] For example, see: (http://www.eoearth.org/article/Tasik_Chini_Biosphere_Reserve,_Malaysia?topic=49560).

[xxii] This document serves neither as a source of information on specific aspect of lake and reservoir management such as lake water quality management, nor on the specialized thematic subjects such as modeling or monitoring. See, for example, Holdren, et al. (2001) as an example of such a resource material.

[xxiii] Prepared by Alejandro Juarez Aguilar, Director General, Corazón de la Tierra, A.C. The author acknowledges the Instituto Nacional de Desarrollo Social (INDESOL, Mexico) for financial support to conduct the project to apply the methodology in the Lerma-Chapala basin during 2010; Helena Cotler and Karina Ruiz from the Instituto Nacional de Ecologia (INE, Mexico) for helping develop the structure indicators of Policies and Technology; and; and Masahisa Nakamura, ILEC Scientific Committee Chair, for taking part in the ILBM-G working group meeting, to ILEC and the Shiga University Research Center for Sustainability and Environment for the financial support to attend the international meetings, to the participants to the Mexican ILBM-G project, and to Corazón de la Tierra’s staff.

[xxiv] Details are available on the following website: (http://rcse.edu.shiga-u.ac.jp/gov-pro/plan/2010list/10/mexico_chapala_and_rivers/lake_brief-lake_chapala__mexico.pdf).

[xxv] Mexico consists of 31 States and the Federal Territory.

[xxvi] The total population of Mexico is about 110 million people.

[xxvii] Details are provided on the following website: (http://rcse.edu.shiga-u.ac.jp/gov-pro/plan/2009list/14arm_in_malaysia/ilbm_egm_presentations/mexico/03sergioasilva_lerma-chapala-presented_in_malaysia.pdf).

[xxviii] Development of the main conceptual framework was undertaken as part of a project of the Lake Biwa Research Institute (now Lake Biwa Environmental Research Institute), Japan, from 2001 to 2005, and the Shiga University Research Center for Sustainability for Environment, Japan, from 2005 to date.

[xxix] Among them is the “Lake Basin Management Initiative” Project, financially supported by the Global Environment Facility (GEF) and administered by the World Bank (WB), and implemented by International Lake Environment Committee Foundation (ILEC) during the period between 2003 and 2005, for which Lake Biwa Research Institute also provided support from its own research fund.

[xxx] The project was called the “ILBM-Governance (ILBM-G) Project,” being financially supported by Ministry of Education, Sports, Science and Technology, and Culture, Japan. It was implemented by Research Center for Sustainability and Environment (RCSE), Shiga University, Japan, with financial support from the Ministry of Education, Culture, Sports, Science and Technology, Japan. RCSE received support from the River Systems Institute, Texas State University, San Marcos, Texas, USA, and in collaboration from the Environmental Science Department of the University of Shiga Prefecture, Japan. The ILEC Secretariat in Kusatsu, Shiga Prefecture, played an instrumental role by supporting the project both in terms of logistic assistance and also partial funding of the participation of its Scientific Committee members.

[xxxi] See: (http://rcse.edu.shiga-u.ac.jp/gov-pro/plan/2010list/10/philippine_lakes/ilbm_philippines_ppt.pdf).

[xxxii] See: (http://rcse.edu.shiga-u.ac.jp/gov-pro/plan/2010list/10/philippine_lakes/lake_lanao_brief_27102010.pdf).

[xxxiiix] Intermediate level of the state of eutrophication, or the state in between eutrophic and oligotrophic.

[xxiv] Managing Lakes and their Basins for Sustainable Use in Malaysia: Synthesis Report of Eight Selected Malaysian Lakes and Reservoirs, ASM and NAHRIM, presented at Final Review Meeting of the ILBM-Governance Project, 2-6 November 2010, Kusatsu, Japan.

[xxxv] Lake Putrajaya is an artificial lake, constructed as part of the landscape of Putra Jaya, a planned city inaugurated as the federal administrative centre of Malaysia in 1999.

[xxxvi] The wetland areas at the lowest outer foothills of the Himalaya.

[xxxvii] Step wells are wells in which the water can be reached by descending a set of steps.

[xxxviii] Rast, W. and M. S. Kodarkar, “World Lake Vision (WLV) Advocated Integrated Approach for Conservation of Lakes in South Asia,” in “Indian lakes and World Lake Vision”, Souvenir, ILEC-IAAB International Workshop on Integrated Lake Basin Management (ILBM), Hyderabad, Andhra Pradesh, India 28-29 August 2008.

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