

RIVER/LAKE BASIN APPROACHES TO
ENVIRONMENTALLY SOUND MANAGEMENT OF WATER RESOURCES

Report of the UNCRD/ILEC/UNEP Expert Group Workshop on
River/Lake Basin Approaches to Environmentally Sound Management of
Water Resources, 8-19 February 1988, Otsu and Nagoya, Japan



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REPORT OF THE/EXPERT GROUP WORKSHOP ON
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ENVIRONMENTALLY SOUND MANAGEMENT OF WATER RESOURCES

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FOREWORD

This report presents the results of the Expert Group Workshop on River/Lake Basin Approaches to Environmentally Sound Management of Water Resources which was held in Otsu and Nagoya, Japan, from 8 to 19 February 1988 under the joint sponsorship of the United Nations Centre for Regional Development (UNCRD), the International Lake Environment Committee Foundation (ILEC), and the United Nations Environment Programme (UNEP).

The workshop was organized as an integral part of a three-year research project on river/lake basin approaches to water resources management, which was launched in 1987 jointly by UNCRD, ILEC, and UNEP. The joint project aims at producing, on the basis of the output of the project, training materials useful to water resources managers, regional planners and administrators in making better decisions on the use and management of water resources in a river/lake basin context. Three categories of papers were produced in the first year of the project, and presented at the workshop:

- (1) Resource papers on key concepts and methodologies for the integration of environmental and social concerns in the water resources management;
- (2) Case study reports on water resources management problems in specific river/lake basins of selected countries, viz., Brazil, China, Indonesia, Kenya, Philippines, and Thailand; and
- (3) Case study reports on the Japanese experience in river/lake basin management, viz., Kasumigaura Lake, Yahagi River Basin, and Lake Biwa.

The workshop was well attended and stimulated lively deliberations. Many participants contributed papers and case study reports, and were active in the discussion. The seminar gave the participants the chance to exchange ideas and experiences in water resources management from a river/lake basin perspective. It also gave an opportunity to examine key concepts and methodologies for ensuring effective incorporation of environmental and social considerations into the water resources development and management process.

During the workshop, three working groups were formed to discuss selected themes, viz., (a) the applicability of river/lake basin approaches to land and water resources development and management; (b) the integration of environmental and social concerns in water resources development and management with focus on methodological aspects; and (c) manpower development in the field of water resources management. The reports of the working groups are included in this publication.

We wish to acknowledge with deep gratitude and appreciation the contribution of all those who have been involved in the workshop, whether in presenting the resource papers and case study reports, serving as chairpersons, discussants and rapporteurs, or providing other support, without whom the workshop could not have been successful.

The Shiga Prefectural Government under the leadership of Governor Minoru Inaba has greatly honoured us by its tremendous support for the workshop. We wish to acknowledge a special debt of gratitude to the prefectural government. We wish also to acknowledge with sincere gratitude the encouraging support extended by the Ministry of Foreign Affairs and the Environment Agency, Government of Japan.

It is our sincere hope that the work initiated at the workshop will be continued, and also that this report will serve as a point of departure for advancing the frontiers of our understanding in environmentally sound and socially acceptable management of water resources in a river/lake basin context.

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CONTENTS

FOREWORD

I. REPORTS OF WORKING GROUPS

Report of Group I: The Applicability of River/Lake Basin Approaches to Land and Water Resources Development and Management	3
Report of Group II: The Integration of Environmental and Social Concerns in Water Resources Development and Management with Focus on Methodological Aspects	9
Report of Group III: Manpower Development in the Field of Water Resources Management	10

II. REPORT OF THE WORKSHOP

A. Attendance	25
B. Opening Session	25
C. Organization of the Workshop	25
D. Summary of Resource Papers and Case Study Reports Presented	27

ANNEX

Annex 1: Outline of the Research Project on River/Lake Basin Approaches to Water Resources Management	49
Annex 2: Opening Addresses	59
Annex 3: Workshop Programme	75
Annex 4: List of Papers	87
Annex 5: List of Participants	89

I. REPORTS OF WORKING GROUPS

I. REPORTS OF WORKING GROUPS

WORKING GROUP I (*)

THE APPLICABILITY OF RIVER/LAKE BASIN APPROACHES TO LAND AND WATER RESOURCES DEVELOPMENT AND MANAGEMENT

Topic 1: What is the rationale for (advantages and disadvantages of) using the river/lake basin as a spatial unit for land and water resources management?

The river/lake basin is the best unit for scientific understanding of natural processes including hydrological flows in well-defined catchment areas, although certain processes concerned with groundwater may not be captured by a river/lake basin perspective. To the extent that regional development planning requires an understanding of relationships concerning water quantity (distribution over time and space) and quality--particularly the effects of human activities and natural disasters such as floods--these can best be studied in a river/lake basin context.

However, many of the pressures on, and alternatives for, water resources management may not be easily defined in terms of river/lake basins, and this perspective provides, in any case, only one way of examining the development opportunities and constraints facing a given region.

Except where there is a congruence of boundaries between a river/lake basin (or sub-basin) and administrative/political units, it is preferable to use the latter as the basis for execution of land and water resource utilization activities and for regulations to govern these actions. A direct relationship also exists between the size of the basin and the difficulties and costs of organizing land and water resource planning according to basin boundaries.

Consequently, it will be advisable to break up extremely large basins into sub-basins for anything but the most general planning purposes, and to give specific consideration to the most appropriate size of basins for management. To the extent that there are strong internal linkages--both in biophysical and socioeconomic terms--and that external linkages are weak, there will be advantages to using river/lake basins as spatial units for the analysis and planning of land and water resources management. This especially applies to the planning of public water programmes and projects as well as those private sector activities which greatly affect the demand for and supply of water, including its quality.

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Topic 2: What kinds of institutional relationships are required to integrate land-use plans and decisions with water resources management within a framework of sustainable development?

An institutional mechanism (board, council, commission, etc.) would be appropriate for each river/lake basin where major land and water management activities are underway or planned. This body would have a composition balanced by public and private membership to achieve vertical (national vs. regional and local) and horizontal (cross-sectoral) integration as well as the representation of those interests most affected by resource management decisions, including groups whose viewpoints are unlikely to be represented elsewhere. Such an integrating mechanism would give attention to upstream-downstream relationships. As a general model--to be adjusted to specific cases--this body could be quasi-governmental in nature with a permanent secretariat, and it would be assigned at least the following tasks:

- (1) Generation of public and private awareness of river/lake basin problems and issues through studies and dissemination of information concerning hydrological, ecological and socioeconomic relationships in the basin area;
- (2) Framework planning for land and water use in the basin;
- (3) Authority to approve a master plan as well as major projects affecting basin land and water resources including the issuance of guidelines concerning their execution--though implementation of these activities is best left to member organizations where they are capable;
- (4) Monitoring and evaluation of land and water resource management activities in the basin; and
- (5) An advisory role on programme and budgetary planning and the review of natural resources management policy for the basin--especially for the cluster of activities closely linked through hydrological flows.

Application of this model to any given basin will need to be adapted to local institutional (including legal) and resource management conditions. Examples have been examined from several countries. In the Philippines, the Laguna Lake Development Authority roughly follows this model, except that it is also involved in the implementation of several water management projects. The Indonesian government is struggling with similar issues, and it has experimented with alternative institutional mechanisms in several basins. The Yahagi and Biwa cases in Japan, as well as several of the other case study basins, have also incorporated elements of the suggested approach. Although in some cases more than one organization may fulfill the functions described, it is important that an integrating mechanism exists to deal with issues requiring a basin perspective for their cooperative examination in order to complement the management activities of those groups represented in the coordination forum.

Topic 3: How can both national and local/regional interests be served in the management of land and water resources in river/lake basins?

It is assumed that most countries aspire to balancing national and regional goals on equity grounds. The establishment of a body such as that described in the discussion of Topic 2 above will be an important step towards providing a forum for the dialogue among local, regional, and national interests.

Where water resources development projects (such as dams for hydropower generation or inter-basin water transfer schemes) clearly produce large national benefits, detailed planning should be included in the management process to see that those residing in the vicinity of the development will also receive benefits. In other cases local or regional resource management patterns may conflict with those which would best serve national interests. In either case, any institutional response to such vertical integration problems will include an effort to identify local aspirations and opportunities. If there is a national planning process in place, the results of these activities can be used.

Another means for both identifying local goals and seeing that efforts to achieve them are incorporated into national plans and regional resource management strategies is to directly involve local and regional groups in the planning and implementation (and perhaps, also, the monitoring and evaluation) of management activities. Specific steps for sharing project benefits with local and regional groups may include, for example, the use of tax revenues generated by hydropower projects for regional development activities or other measures to alleviate economic burdens imposed on local groups as a result of resource management patterns altered to serve national interests.

Topic 4: What kinds of mechanisms should be developed to facilitate local participation in the management of land and water resources in river/lake basins?

In order to participate directly in land and water resources management, basin residents need (1) to understand the manner in which resource management decisions (including their own) can affect them, (2) to be capable of articulating their concerns about the consequences of these decisions, (3) to have the resources and organization to allow their representation at fora where management options are discussed, and (4) popular and legal recognition of the legitimacy of their rights to be heard by all those who make resources management decisions.

The ability of local groups to meet these conditions varies greatly. With many of those potentially affected by land and water resources management decisions engaged in subsistence agriculture, the situation in developing countries often argues strongly for the assistance of advocates (either local governments, or, more commonly, nongovernmental organizations) who can serve as surrogates for local groups to see that their views are represented in the decision-making process. One important forum for the expression of these opinions would be provided by the establishment of an integrating mechanism such as that described in the discussion of Topic 2 above.

Topic 5: What are the appropriate considerations in applying a "demand side" analysis to water resources management alternatives in a given basin?

Where available water supplies are limited in relation to present and/or projected demands, and costs of developing new supplies are high, a "demand management" approach could well be adopted. This environmentally benign approach, which seeks to allocate water to its highest valued uses and to reduce inefficiencies and waste in water use, is contrasted with the conventional approach of augmenting water supplies to meet projected "demands" without serious attempts to limit demand or conserve water.

The "supply management" approach also adjusts very slowly to changes in the demand for water. This alternative perspective considers water as a commodity for analytical purposes and, through a combination of pricing and technical conservation measures, seeks institutionally viable options for the reallocation of water from low valued uses (typically away from agriculture) toward higher valued uses (often to meet municipal and industrial demands), and for the reduction of water-use rates, whether per capita or per unit of output value. Wasteful practices are identified and corrected among all types of users, and the use and allocation of both surface (including rainwater) and groundwater sources are considered conjunctively.

Major water-conserving measures such as sprinkler and drip irrigation, recycling of industrial water supplies, water-conserving plumbing, and waste water treatment and re-use are adopted where costs are less than those for developing new water supplies. Opportunities are generally sought for encouraging cost effective "circular" as opposed to "linear" water utilization strategies.

Demand management, along with increased efficiency of water delivery, is being effectively used in such water-short places as Israel and some cities in the western United States, and it is now being adopted in the Beijing/Tianjin region of China. Though applicable to the analysis of water management options under all circumstances, this approach should be of particular interest to water resources managers in river/lake basins where water shortages are already apparent or are likely to emerge.

Additional Remarks

The institutional and programme changes suggested above may not be easy to make. Yet, experience has shown that opportunities for making such adjustments/changes often arise suddenly in response to changes in social organization or catastrophes such as floods or other natural disasters. This should be borne in mind by those concerned with problems of natural resources and environmental management, but it does not preclude the need for patient efforts to achieve incremental change.

Also, movement towards the implementation of the proposed arrangements can be facilitated by sustained efforts to provide environmental/natural resources management education and training to the general public, managers and public officials, and also by the training of professionals in methods for working together with local groups.

Suggestions to the Secretariat for the Next Year of the Project

A. Suggestions for the case study teams

- (1) Suggested topics to be described in greater detail by the case study teams, given the emphasis during the second year on responses of resources managers to problems faced in their area(s) of study:
 - a. Institutional mechanisms for the integration of land-use plans and decisions with water resources management (within a framework of sustainable development).
 - b. Vertical integration efforts designed to see that both national and local/regional interests are served by natural resources management strategies.
 - c. Mechanisms designed to facilitate local participation in the management of land and water resources.
 - d. Management responses should be evaluated particularly in terms of the extent to which the full range of water management alternatives were or are being considered--especially "demand side" options.
- (2) An effort should be made by at least a few of the case study teams to assess the merits of conceptual frameworks presented during the workshop as guides for analysis of the management experience in case study basins.

B. Suggested topics for resource papers

- (1) A review of institutional mechanisms used outside of the case study sites to achieve integration between land and water resources management planning.
- (2) A review of approaches for facilitating local participation in the management of land and water resources in river/lake basins.
- (3) A preliminary comparative analysis of the management approaches used in the nine case study sites.
- (4) A review of the "demand management" or "non-structural" approach with particular reference to the analysis of water resource management options in the case study basins.
- (5) An assessment of the current approaches and professional orientations of the project's target audiences: What needs to change, and what the project's new approach has to offer them.
- (6) An appraisal of methods for, and the usefulness of, examining the perceptions of different groups in a river/lake basin, and of water resources management problems and opportunities.

C. General suggestions for the UNCRD Secretariat

(1) The project's activities should be tied into other current related international initiatives, including:

- a. UN Drinking Water Decade (resource paper to make the link?);
- b. UN Decade for Natural Disaster Reduction (proposed);
- c. IBRD (World Bank) effort to integrate natural resources management considerations into national and regional development planning processes.

(2) Objectives of the UNCRD/ILEC/UNEP joint project:

- a. To develop a generalized approach for incorporating environmental considerations into regional development planning in specific river/lake basin contexts in the format of materials for a short-course on the subject;
- b. To work with one or more institutions in countries producing case studies to assist in adapting these training materials to local conditions (using local examples and language) and in initiating a series of training programmes to build local institutional capabilities. These programmes would be aimed at a combined audience of planners and resources managers, though they might be conducted on two levels to take into account variations in the course participants' level of previous training and experience.
- c. To use the networking abilities of UNCRD and collaborating agencies to disseminate information about, and to promote the adoption of, this new approach in the case study countries and in cooperating international agencies.
 - Emphasis should be placed on the advantages/strengths of the new approach rather than the disadvantages/weaknesses of past frameworks; and
 - Both a highly targeted dissemination strategy aimed at individuals and agencies with known shared interests as well as a broader-based strategy for dissemination of current findings and plans should be undertaken.
- d. UNEP and ILEC may want to use these more general materials as the basis for the development of narrower training courses aimed at environmental specialists.

WORKING GROUP II (*)

INTEGRATION OF ENVIRONMENTAL AND SOCIAL CONCERNS INTO WATER RESOURCES DEVELOPMENT AND MANAGEMENT: FOCUS ON METHODOLOGICAL ASPECTS

Preface

The working group began its deliberations with a wide-ranging open discussion on the general topic before addressing the specific questions provided by the Secretariat. From this discussion a consensus emerged that the traditional environmental impact analysis (EIA) process had a number of methodological weaknesses in practice but was basically a sound idea and should not be completely discarded. It is insufficient, however, because it does not permit environmental and social concerns to be considered early enough in the planning process to affect critical decisions. As practiced today, EIA is principally an impact mitigation process, a form of social and environmental damage control. That kind of exercise is, and will remain, necessary as long as large-scale development of any kind takes place.

However, full integration of social and environmental concerns into the planning/decision making process must take place at a much earlier stage than the one at which EIA is generally considered. The working group considered this question more thoroughly during the second working group session and it is addressed in Part V of this report. Parts I through IV are concerned with the specific questions put before the group at the beginning of the workshop. These questions address only the improvement of EIA with respect to its narrowly defined traditional purposes.

Questions for Discussion

Integration of environmental and social concerns into water resources development and management: Focus on methodological aspects.

- (1) What needs to be done, specifically, to develop impact analysis methodologies which are usable in developing countries?
- (2) How can we expand the concept of environmental impact assessment to encompass positive impacts (benefits) as well as negative impacts (costs)?
- (3) How can impacts during and after the construction of projects be minimized?

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- (4) How can environmental considerations be incorporated into each stage of the management process for river/lake basins?
- (5) What role is there for 'traditional' EIAs, and how can the apparent conflict between the existing EIA procedures and the need to incorporate environmental considerations into the entire management process be resolved?

Conclusions of the Working Group

1. Improving Environmental Management and Its Processes in Developing Countries

Many water resource development projects have caused significant positive and negative impacts on the environment, including socioeconomic and cultural impacts on the human population at the project site and its surroundings. Most developing countries do not have an adequate legal basis for impact assessment and many impact assessment studies have been carried out with the objective of fulfilling the requirements of the donor countries and organizations. Therefore, many impact assessment studies have been conducted as a formality, and the recommendations of the study have not been properly followed up and applied to the long-term management of the project.

For these reasons the working group recommends that every country provide a legislative basis for environmental impact assessment which includes the following elements:

- (1) For every water resources development project proposal which may have significant impact on the environment, an environmental impact assessment or EIA should be carried out, which should include a determination of whether the selected project should be developed to full capacity. This EIA should include biogeophysical, socioeconomic and cultural factors. The EIA report should have an environmental management plan as well as a long-term environmental monitoring plan. The EIA should be used as a tool in the decision-making process of the concerned proposed projects.
- (2) In order to provide for a thorough and multi-partisan review, there should be a committee, at a high level in the governmental body, whose task would be to critically and objectively evaluate the EIA. This Committee may consists of:
 - a. Permanent staff, which consists of personnel from the governmental body or bodies responsible in water resource development, and
 - b. Ad hoc members from related agencies, experts from universities and research institutions and other interested parties, including non-governmental organizations (NGOs) and representatives of the public from the proposed project site.

- (3) The legislation should provide for procedures and mechanisms to ensure that the recommendations described in the EIA environmental management plan and environmental monitoring plan are fully considered and applied in the execution of the project.

Environmental assessment (EA) should be carried out in the early stages of planning for the proposed project, when several alternatives for the project site and design are still available (see figure 1). This analysis should be conducted simultaneously with the technical feasibility studies and economic feasibility studies, and it should have equal weight in the decision-making processes. There should be interaction among the three components to achieve an optimal balance among the technical, economical, and environmental aspects of decisions concerning the project.

The impact evaluation (EIA) process which follows this environmental assessment should be interdisciplinary in nature. Methods used in the prediction of impacts should be those available in the respective disciplines and may be traditional methods such as checklists, matrices, network/flowcharts, overlays, simulation models and others, or they may be designed to accommodate local circumstances, resources, and technical skills. Impact analysis should consider the positive and negative project impacts on the social and natural environment and the positive and negative social and natural environmental impacts on the project.

2. Developing the Concept of EIA to Encompass Positive as well as Negative Impacts

Historically, EIA was enacted as a response and reaction to the economic development projects which worsened the overall environmental quality and therefore many EIA studies emphasize only negative impacts of the proposed project. This is inadequate. The working group feels that the following steps should be taken to improve the EIA process.

- (1) Analysts should identify and review both the negative and positive impacts of the proposed water resource development projects. It is quite often the case that positive impacts are long term and may not emerge for many years, while negative impacts are more immediate. Under other circumstances the exact reverse may occur. Environmental impact assessment should be as long range as possible in order to give balance to the analysis. A single multi-criteria evaluation process which included measurement and evaluation of all impacts, positive and negative, should be developed for use in EIA. This evaluation should allow for distributional analysis so it can be made clear which groups benefit and which groups absorb the economic, social, and environmental costs.
- (2) The environmental and social management programme should propose mitigative measures for negative impacts in order to reduce them to a minimum. On the other hand, it should encourage and enhance the positive impacts and their multiplier effects in order to increase the total benefits of the proposed projects to further enhance the quality of life in the environment. The plan should

also strive for an equitable distribution of economic, social and environmental benefits, and costs among affected groups.

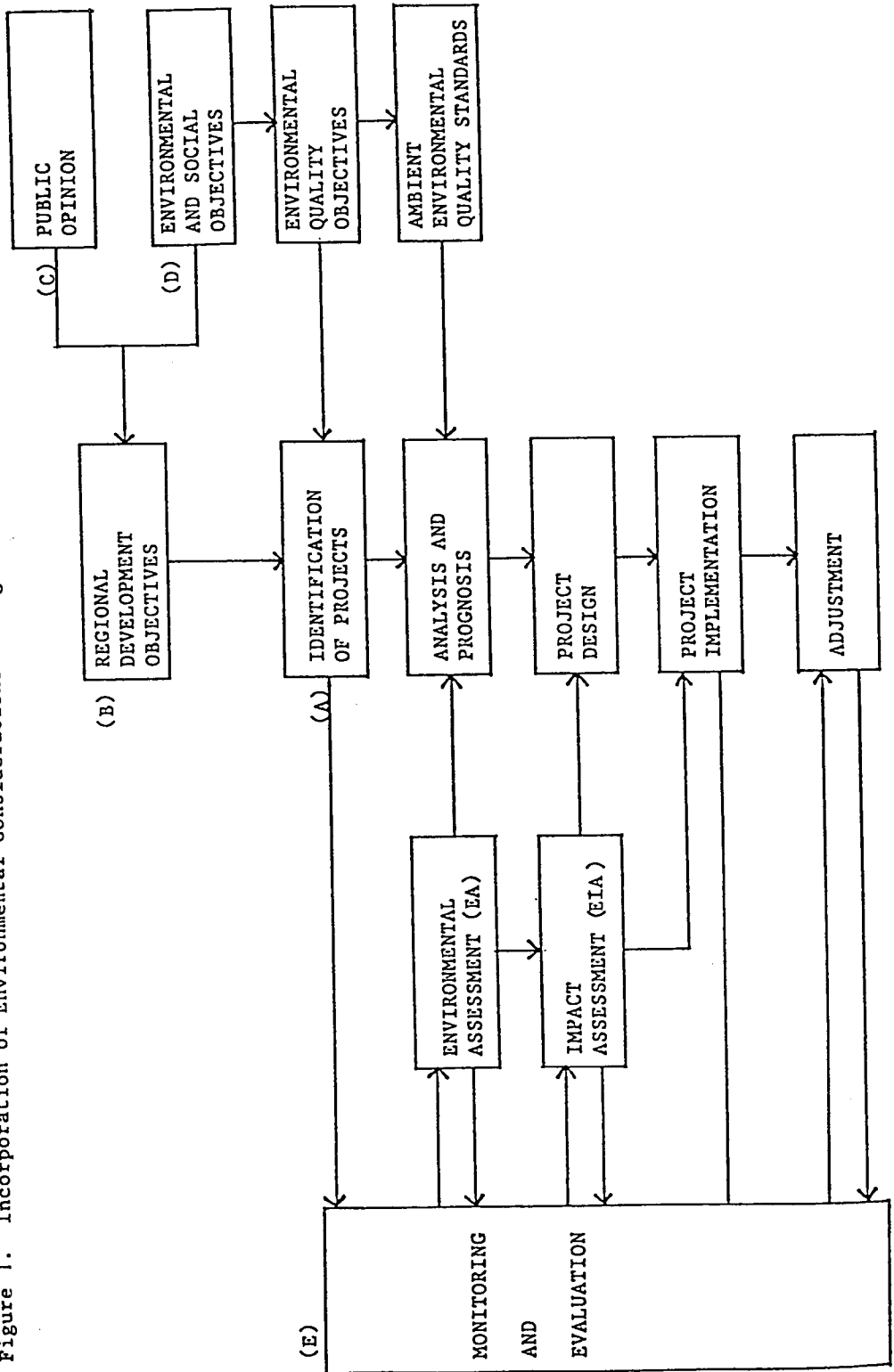
- (3) Efforts should be made to integrate economic analysis and risk analysis into the environmental impact analysis as integral parts of the project evaluation process.
- (4) All information concerning the project, including any raw data, should be available to the public from the early stages of the project-planning process. This information should include forecasts of changes in economic, social, and environmental conditions.
- (5) Public participation should be encouraged and specific mechanisms for accommodating such participation into the management process should be developed.

3. Environmental Impacts during the Development of Water Resources Development Projects

Natural environmental impacts start from the preconstruction phase and continue through construction and operational phases of the project. A large number of studies have shown that the most serious negative impacts often occur during actual construction and these are often so great that the natural environment never recovers. Furthermore, it is possible that a number of environmental impacts will occur which may not have been foreseen during the EIA. Accordingly, no management measures may have been designed to mitigate the adverse impacts and enhance the positive impacts. To protect against these problems, the following steps should be taken.

- (1) In the project management plan, special attention should be paid to conservation measures during project construction, as shown in the examples of golf course construction in the Yahagi River Basin. Specific standards should be set for tolerable levels of each kind of impact, based on scientific and engineering understanding, and protection measures designed to meet those standards.
- (2) A monitoring programme should be initiated during the pre-construction phases, when the impacts are likely to be mostly socioeconomic and cultural in nature, and continue through the construction and operational phases (see figure 1). Data from the monitoring programme should be used to modify and improve the environmental management of the project.
- (3) Since monitoring is costly, analysts and managers should identify critical variables which will be the most informative about changing social, economic, and natural environmental conditions. It is better to monitor a few critical variables continuously over the long term than attempt to monitor nearly all variables for a brief time or intermittently.

Figure 1. Incorporation of Environmental Considerations Throughout the Project Cycle



- (4) Agencies which should undertake the monitoring programme should be identified at the earliest possible time and should prepare a monitoring plan that meets the approval of the environmental impact review committee recommended in Section I.

4. Data Base Requirements for Social and Environmental Objectives

It is very difficult to address comprehensively the question of data requirements because the thrust of the major findings of the working group is that traditional environmental impact assessment is (i) insufficient in and of, itself and needs to be augmented in earlier stages of project development and (ii) inadequate in its present methodologies to accomplish even its present, limited purposes. Since new methodological approaches are called for (but which are beyond the charge or resources of the working group) there is little to be gained by attempting to identify data requirements for these new approaches before they have been developed.

However, past experience with data problems in EIA exercises suggests a number of principles which should be kept in mind, regardless of the techniques used.

- (1) Environmental and social data should be collected as far in advance of a project as possible and continuously collected, through a monitoring programme, for several years after project completion (the actual time depending upon the nature and scale of the project itself). Secondary historical data should be incorporated into the data base if it is available, and primary data collection should begin as soon as a project proposal begins to take shape -- well before final approvals.
- (2) In water resource development projects the use of satellite imagery and aerial photography can be particularly useful in evaluating the land-use system in a watershed. Their use is particularly encouraged during the pre-approval stages of project planning.
- (3) All data should be organized and stored in such a manner that it is readily available to all parties, public and private, who have a stake in the project.
- (4) Data should be collected and analysed on any special climatological and meteorological phenomena, such as El-Nino, which might affect a water resources project on a regular or irregular basis.
- (5) The validity and reliability of all data should be verified to the extent possible and suspect data should not be used in any analysis. No data at all is usually better than poor data.

5. Incorporation of Environmental Considerations into Each Stage of the Management Process

Typically, a management process consists of the following steps:

- (1) Preparation of a national/regional development plan;
- (2) Identification of a site-specific project;
- (3) Construction of a facility or facilities specified in the design; and
- (4) Monitoring and evaluation of the project.

Generally, environmental impact analysis is a process which follows the decision to implement (construct) a particular project. These steps may be illustrated in many different ways and in a variety of modified versions, but invariably the first consideration of environmental and social concerns comes after the site-specific project has been selected. Therefore, thought is given only to identifying and mitigating the adverse impacts. The working group considers this to be a serious deficiency in the present management and planning processes and feels strongly that environmental and social concerns must be considered in two different ways. First they must become an integral part of the set of regional development objectives and second they should serve as the basis for impact mitigation measures in the conventional manner.

The working group also feels that monitoring and evaluation of the social and environmental changes must be spread over the entire project cycle and extend for several years after completion of a project. In most large-scale projects monitoring is in effect for only a short time during and after construction.

Incorporation of environmental and social objectives in the set of regional development objectives ensures a balance between development and preservation and allows fundamental issues to be objectively examined; while the analysis/mitigation/monitoring process permits a continual management control of the processes of environmental and social change.

Figure 1 presents a representation of how these two very different focuses for environmental and social concerns would be integrated into the overall management and planning process. Any specific project (A) must be selected not only on the basis of regional development objectives (B), but also on the basis of environmental and social objectives (D) supported by an appropriate level of participation by the public (C). A social and environmental monitoring programme (E) should be initiated as soon as the project is identified and in some cases (eg., if there is lengthy debate over more than one site) even earlier. This monitoring should be continued throughout the project cycle.

The monitoring programme may not need to be a full-fledged and extensive undertaking but it should be purposeful and confined in scope to meet specific requirements.

Traditional environmental impact assessment and the newly proposed framework which integrates environmental monitoring and evaluation from the initial stages of the project do not conflict, but complement one another. If the scope and scale of the monitoring programme are kept problem-specific the additional resources needed are reasonable and the returns are

potentially very great. In addition, the entire monitoring and evaluation programme would attain flexibility to accommodate analyses of various other aspects of land and water resources management activities which might take place in conjunction with the project under consideration.

It also becomes more and more attractive to have the research activity component integrated within the framework of environmental and social monitoring and evaluation. This component adds to the dimension of routine undertakings associated with monitoring two additional aspects: (1) identification of underlying mechanisms; and (2) propagation of technical skills to a broader spectrum of environmental specialists.

Recommended Follow-up Activities

The two days of discussions by the working group raised a number of issues which seemed to need further research or elaboration. The group therefore recommends that in the forthcoming expert group workshop resource papers be solicited on the following subjects directly related to improving the methodology of environmental and social analysis with respect to water resource projects:

- (1) Improvement of the methodology of Risk-Benefit Analysis, to encompass the assessment of impacts resulting from the destruction of unique ecosystems and/or endangered species. The paper should also address the question of costs of environmental degradation unaccounted for at the stage of project planning and implementation;
- (2) A review of the limitations and critical deficiencies of the conventional EIA procedure currently being followed in both developed and developing countries; and
- (3) Development of a recommended procedure for integrating environmental and social considerations into the project evaluation process at a stage early enough to influence the decisions about which projects to carry out, redesign or abandon.

Environmental impact assessment may not function as expected, not only because of the problems associated with its procedural inadequacies but also because of the fundamental weakness of environmental administration, particularly in developing countries. There are various causes for the weakness, some of which are difficult to overcome because they are deep rooted in their own sociocultural orientation and political systems. On the other hand, incremental improvements could be made with respect to efficient use of limited resources as well as mobilization of additional resources through a close examination of the existing practices of environmental administration. For example, it may be worthwhile reviewing and improving the following procedural aspects, and the working group recommends that further research be undertaken to identify the specific techniques for potential improvement:

- (4) Institutional inefficiencies, i.e., the appropriate distribution of manpower and financial resources;

- (5) Lack of accountability and specificity in information management;
- (6) Over-reliance on imported approaches and methodologies rather than devising their own, in part based on common sense; and
- (7) Inadequate enforcement of existing legislation.

WORKING GROUP III (*)

MANPOWER DEVELOPMENT IN THE FIELD OF WATER RESOURCES MANAGEMENT

Preface

Following the suggestion of the workshop secretariat, the following topics were discussed:

Topic 1: What should be done to improve the institutional structure and management skills for water resources development and management?

Topic 2: What is the appropriate education and training for impact analysis specialists of water resources projects in developing countries?

Resulting from the discussion on the above topics, the following issues emerged:

- (a) Basic concepts for training of water resources managers;
- (b) Mechanisms for improving institutional structure and management skills;
- (c) Approaches and methods of education and training for impact analysis specialists of water resources projects in developing countries; and
- (d) Structure and content of a model training course for water resources managers.

Training of Water Resources Managers

The availability, allocation, and usage of water resources are diverse and complex, and their complexity is augmented by social and economic issues. Also, objectives and standards for managing water resources differ from place to place, so managers need to have a wide variety of knowledge and skills to deal with situation-specific issues, besides an understanding of the ecosystem, how it functions, and the main interrelationships within a socioeconomic context. Therefore, water resources managers need training, among others, on:

- (1) The concepts of an ecosystem and their application to water resources management;

(*) Chairpersons: M. Hashimoto (part I); J. G. Tundisi (part II)
Rapporteurs: J. G. Tundisi (part I); C. H. D. Magadza (part II)
Members: N. Ginsburg; H. Liu; Y. Liu; C. H. D. Magadza;
K. M. Mavuti; R. Newels; H. Sazanami; Y. Shimizu;
S. Sottibandhu; J. Zhang; M. Ando

- (2) Technical aspects of water resources development and management;
- (3) Economic and social implications of water resources development and management;
- (4) Conflict management and resolution strategies for competing water uses and users;
- (5) Communication skills with decision makers/administrators and the people; and
- (6) National and regional water resources development policies and programmes.

In view of the fact that most water resources managers are assigned to work at the regional or local levels, they are expected to serve as communication facilitators between the national and local levels. In other words, their main expected role is to ensure that the felt needs and aspirations of local communities are properly reflected in the policy formulation process at the national level, while communicating the main thrust of national policy decisions to the public as well as to the local-level implementing agencies. This role is particularly crucial when incorporating local-level management plans into national government-initiated, large-scale water resources development schemes. It is therefore considered essential to provide water resources managers with the knowledge and skills to appreciate the long-term dynamics of water resources development and its social and economic implications at the local community level.

Water resources managers are also expected to be generalist-planners with an interdisciplinary background as well as the capability of working together with scientists, planners, and administrators from other fields. This capability could be developed most effectively through the actual experience in, and exposure to, the real world processes of formulating and implementing programmes and projects for water resources development and management. The second best alternative would be to incorporate well-structured simulation games and casework on water resources development and management in the training courses.

Mechanisms for Improving Institutional Framework and Management Skills

Large-scale water resources development projects are, in many cases, formulated and implemented at the national level without due consideration for the specific needs and requirements of local communities where the projects are located. This often gives rise to a variety of environmental and social problems adversely affecting the local communities. In order to avoid such situations, it is crucial to create a two-way flow of communication and information between the project proponents at the national level and the local communities concerned.

At the same time, local community-based environmental management actions supported by expert knowledge as well as information derived from environmental monitoring activities are considered effective in reviewing the water resources management policies and programmes at the national

level. An example of such action can be seen in the action research projects undertaken in the reservoir areas in Brazil where close linkages and cooperation ties have been developed among the university research institutes, local governments and local communities in promoting water resources management, including water quality monitoring, watershed management, eutrophication control, and water allocation among competing users.

The use of microcomputers to improve water resource management skills was discussed. Microcomputers can be effectively used for a wide variety of data processing activities, such as data compilation and storage, data retrieval, and diagnostic and evaluation analysis. In developing countries, however, the access to microcomputers is, in many cases, limited. At the same time, it is often observed that the effective use of microcomputers is constrained due to the lack of reliable data bases.

Networking of water-related organizations, research institutions and local communities concerned could be another effective mechanism to strengthen the institutional framework for water resources management capabilities at the local and regional levels. Through such a network, a wide variety of activities can be promoted, including the conduct of a series of comparative case studies, exchange of data and information, exchange of personnel, and the conduct of meetings and symposia.

A network of relevant training programmes in the field of water resources development and management can also be considered another possible way to improve the water management capabilities at the local and regional levels.

Education and Training for Environmental Impact Analysis in Developing Countries

Both academic and in-service training in environmental sciences were emphasized as part of the overall training programme for water resources managers and environmental scientists alike. The difficulties of balancing the general orientation needed for EIA and specialized knowledge could be handled in training phases, whereby the manager and the environmental scientist would undergo the same training during the first phase. Thereafter, the manager would move to the administrative sector for in-service training, and the environmental scientist would undergo specialized training. Their initial common training experience would provide them with a common language and understanding on the concepts and methods of their work that would allow them to work together towards the same ends.

In order to design effective education and training programmes in the field of water resources development and management, the following subject domains should be given priority: (a) Key policy issues in environmental management and water resources management in the country; (b) analysis of social, cultural, and economic implications of water resources development and management projects; (c) efficiency vs. equity considerations; (d) systems analysis perspectives and use of computers; (e) risk assessment and management; (f) short-term-and-long-term perspectives in water resources management.

A model training course in environmental impact assessment of water related projects may be designed with the following sequence of subjects and activities: (a) Introduction to the concept of ecology, interrelationships within an ecosystem, and natural processes; (b) models of environmental impact analysis, procedures, methods and techniques, examples and illustrations; (c) case studies and fieldwork; (d) gaming-simulation exercises to appreciate the necessary skills and knowledge for decision making;

To facilitate effective training and education activities in the field of environmental sciences and environmental impact assessment, it was considered indispensable to establish a relevant data bank with the following subsystems: (a) Environmental monitoring networks; (b) information exchange and dissemination; and (c) advisory services for data users.

Additional Observations and Remarks on Strategies for Optimization of Training Programmes in the Field of Water Resources Management

The group expressed concern about the need for the development of environmental awareness among the public in developing countries and also expressed the views that a successful environmental training programme is one that ultimately results in the augmentation of public environmental concern. Without this, the lack of social acceptance of environmental management programmes will remain a stumbling block.

It was stressed that a successful training programme should be one that is sustainable and transferable from the primary recipients to other members of the community (multiplicative effect).

The group expressed concern about the recipient's ability to make full use of the management skills acquired through training programmes. In this regard, it was recommended that follow-up activities should be undertaken to monitor the impact of the training programmes.

While recognizing the role of UNCRD/ILEC in meeting short-term objectives of manpower development in the field of water resources management, the group stressed the importance of developing and strengthening local training institutions. In this regard, the group recommended that technical assistance should be extended by international organizations such as UNCRD, ILEC, and UNEP in enhancing the national training capabilities in environmental planning and management with a special focus on water resources management.

The group also recommended that UNCRD/ILEC/UNEP assist in networking training institutions in developing countries, already engaged in ongoing research and training activities. In identifying institutions for support the group recommended the following criteria: (a) The institution must have a visible financial viability in terms of local funding; (b) the institution must be engaged in ongoing action research programmes for water resources management; (c) the institution must have an existing training programme in water resources management; and (d) the institution must have facilities for accepting candidates from other countries.

The group considered three possible sets of materials for use by national training institutions. The first set of materials should deal with key concepts and methods of water resources management. The second set of materials may consist of a series of case studies on water resources management. These two sets of materials could be developed through proper compilation of the resource papers and case study reports being prepared in connection with the UNCRD/ILEC three-year research project on river/lake basin approaches to water resources management. The third possible set of materials is the series of guideline books on lake environment management being prepared by ILEC with special focus on the following topics: (a) Principles of lake management; (b) socioeconomic aspects of lake management; (c) lake shore management; and (d) case study synthesis and critique. In addition to these sets of material, the group recommended the development of : (a) Audio-visual aids; and (b) computer software that can be used for training purposes in the field of water resources development and management.

II. REPORT OF THE WORKSHOP

II. REPORT OF THE WORKSHOP

A. ATTENDANCE

The Expert Group Workshop on River/Lake Basin Approaches to Environmentally Sound Management of Water Resources was held in Otsu and Nagoya, Japan from 8 to 19 February 1988 under the joint sponsorship of the United Nations Centre for Regional Development (UNCRD), the International Lake Environment Committee (ILEC), and the United Nations Environment Programme (UNEP), with the support of the Government of Japan (Ministry of Foreign Affairs and Environment Agency) and the Government of Shiga Prefecture, Japan. Twenty-five scholars and practitioners from abroad, together with approximately sixty from Japan participated in the workshop. A list of the participants is provided in annex 5.

B. OPENING SESSION

Mr. Hidehiko Sazanami, Director of UNCRD opened the workshop by elaborating on the background and purpose of the workshop as well as on the major issue domains in the field of water resources management to be addressed from a river/lake basin perspective. Dr. Tatsuo Kira, Chairperson, ILEC Scientific Committee noted in his opening address the need for working out effective methodologies for dealing with lake management issues. Dr. Genady N. Golubev, Assistant Executive Director of UNEP, stressed the importance of the workshop in connection with the UNEP's programme on environmentally sound management of inland waters (EMINWA).

Welcoming and congratulatory speeches were also given by the following officials: Mr. Yuji Kurokawa, Director, International Affairs Division, Environment Agency and Mr. Shigeaki Akutagawa, Director General, Civil Life and Environment Department, Government of Shiga Prefecture.

The complete texts of the addresses and speeches are reproduced in annex 1.

C. ORGANIZATION OF THE WORKSHOP

The workshop was programmed in two parts with the following general themes: Part I: Key Concepts and Approaches to Water Resources Management (8-13 February 1988 at the Lake Biwa Research Institute); and Part II: Case Studies on Water Resources Management in Developing Countries (15-19 February 1988, at UNCRD).

Following the opening session on the first day of the workshop, five plenary sessions were held wherein presentations and discussions were conducted under the following headings: (1) Environmentally Sound Management of Water Resources; (2) Water Resources Management in a River/Lake Basin Context; (3) Environmental Considerations in the Development Process; (4) Scientific Approaches to Water Resources Management; and (5) the Japanese Experience in Water Resources Management.

On the fourth day of part I of the workshop, the participants were divided into three groups for intensive discussion. The topics suggested by the workshop secretariat for discussion were: Group I: Need for, and rationale of, river/lake basin approaches to water resources management; Group II: Integration of environmental and social concerns into water resources development and management: Focus on methodological aspects; and Group III: Manpower development in the field of water resources management.

During part I of the workshop, a series of briefing sessions on the research projects of the Lake Biwa Research Institute were organized by the faculty members of the Institute.

Followed by the special lecture session by Dr. T. Kira on the fifth day of the workshop, a half-day fieldtrip was organized, which visited (a) the Lake Biwa Works Office of the Ministry of Construction; and (b) the site of anti-flood afforestation and sabo works at Tanakamiyama in the southern part of Shiga Prefecture.

The closing session of part I of the workshop was held on 13 February 1988 wherein the results of the three working groups were presented and discussed.

Part II of the workshop commenced on 15 February 1988 with an opening remark by Mr. H. Sazanami, which was followed by a series of presentations and discussions on case studies from Brazil, China, Indonesia, Kenya, the Philippines, and Thailand.

The second phase of group discussion was conducted on 17 February 1988 to further elaborate upon the suggested topics.

On 18 February 1988, a one-day fieldtrip was organized in the Yahagi River Basin. The places visited were: (a) The golf course development project site at Nakadachi, Asuke-cho, Aichi Prefecture; (b) Toyota Motor Corporation; (c) the headworks and intake gate of the Meiji Irrigation System; and (d) Okazaki Park and Okazaki Castle at the confluence of Yahagi River and Tomoe River.

The closing session of part II of the workshop was held on 19 February 1988 wherein the final reports of the three working groups were presented, discussed and finally adopted.

The programme of the workshop, including the names of all those who served as chairpersons, speakers, discussants, and rapporteurs, together with a listing of the papers and reports presented at the workshop is reproduced in annex 3.

D. SUMMARY OF RESOURCE PAPERS AND CASE STUDY REPORTS PRESENTED

1. ENVIRONMENTALLY SOUND MANAGEMENT OF WATER RESOURCES

Sustainable Management of Water Resources: A Basinwide Approach by Genady N. Golubev

Golubev commenced his presentation by reviewing the concept of sustainable development advocated by UNEP. According to the report "Our Common Future" produced in 1987 by the World Commission on Environment and Development, sustainable development is defined as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional changes are made to meet the needs of the present without compromising the ability of future generations to meet their own needs.

This concept of sustainable development is directly relevant to water resources development and management. The conventional approaches to water resources management have dealt only with demand-supply interactions with little consideration for the environmental and social side-effects of development. In this respect, water should be viewed not only as a resource but also as a major actor in ecosystems and as a carrier of matters in the global biogeochemical cycles. These functions of water put it in the centre of practically every territorial system in such a way that neither economic development of a territory nor water management of it are possible without due mutual regard. Understanding of this relationship suggests the need of basinwide management where the links between various parts and components of a basin as a system are taken into account.

Having presented the conceptual framework of basinwide environmental management, Golubev elaborated on some examples of water-related territorial problems. He stressed the need to carefully consider optimal strategies in the question of trade-offs since it is impossible to find the best strategy for basinwide sustainable environmental management.

Golubev then described the programme for environmentally sound management of inland waters (EMINWA) launched in 1986 by UNEP. The main aims of the programme are to: (a) Assist governments to formulate and implement environmentally sound water management programmes; (b) train experts and establish training networks in developing countries; (c) prepare a manual of principles of, and guidelines for, the environmentally sound management of inland water systems; (d) make regular worldwide assessment of the state of the environment for inland waters; and (e) increase public awareness for environmentally sound water resources development.

Sustainable Water Development for Developing Countries by Asit K. Biswas

Biswas assessed, in his presentation, the "application gap" of available knowledge by engineers and decision makers in developing countries in ensuring the sustainability of water resources development and management projects. The problems identified and elaborated as limiting

factors for the potential application of available knowledge include: (a) incomplete framework for analysis of environmental impacts; (b) lack of operational methodology for environmental impact assessment (EIA); (c) inadequacy of technical knowledge for water resources management; (d) institutional constraints; and (e) absence of regular monitoring and evaluation as an integral part of water resources management.

The framework used at present to analyse water development projects is seriously flawed. While it is axiomatic that any larger water resources development project will have environmental impacts, such impacts, at least in recent years, have involved only negative connotations. It is necessary to have a balanced framework for analysis, which will identify both positive and negative impacts. The next step should be how to maximize the positive impacts and minimize the negative impacts.

For developing countries, appropriate methodologies do not exist to carry out environmental impact assessment. What is needed is an operational methodology that can be used successfully with limited expertise, limited resources and time. Complete, lengthy and time-consuming EIAs, as practiced in developed countries, are not the right approaches for developing countries; they may often prove to be detrimental and may even hinder rather than improve the planning.

There are many areas where adequate technical knowledge may not exist for obtaining reliable answers. Sometimes, even the correct questions are not being asked. For example, linkages between irrigation development and the incidence of malaria are not clear. If a simple question such as to what extent does a water development project, per se, increase malaria or schistosomiasis is posed, it becomes apparent that there is no straightforward answer.

In some areas where we do have adequate knowledge, for various reasons it is not used. For example, it is now well-known that a lack of drainage will result in salinity development in irrigated areas. It is no longer a question of whether or not salinity will develop in the absence of drainage but "when." It is also well-known what steps should be taken but they are frequently ignored.

The sectoral approach to water resources development is a major institutional constraint that has an important bearing on the sustainability of projects. Water resources development projects not only increase agricultural production and electricity generation but also have substantial impacts on many factors (industrial development, employment generation, education, health facilities, communication, fuelwood availability, and so on). Since various ministries are in charge of these issues, and coordination between them leaves much to be desired, a holistic approach is rarely taken.

Finally, regular monitoring and evaluation of water projects is rarely an integral part of the water resources management process. For sustainable water development regular monitoring and evaluation is essential.

2. WATER RESOURCES MANAGEMENT IN A RIVER/LAKE BASIN CONTEXT

Water Resources Management in a River/Lake Basin Context: A Conceptual Framework with Examples from Developing Countries
by Maynard M. Hufschmidt and David S. McCauley

Hufschmidt's presentation was divided into four parts: (i) Important water management problems and a new approach to management in order to deal with them; (ii) the rationale for using the river/lake basin as a management unit; (iii) a conceptual framework for analysing water management problems; and (iv) a review of country cases using the conceptual framework.

Given the pervasive problems of obtaining useful output from water projects which is both timely and produced in an efficient manner, and of adverse environmental and social impacts of water projects, a new approach to water resources management has been suggested, as follows:

- (1) Emphasize the environmental and social consequences of water resources projects from the very outset of planning through the stages of project implementation;
- (2) In funding water resources programmes, emphasize rehabilitation of existing projects, investment in small-scale, local projects, and effective operation and maintenance of existing projects;
- (3) Especially in areas of water shortage, emphasize demand management, including coordinated use of pricing policy and technical water-saving measures; and
- (4) Emphasize (i) allocation of water among competing users/uses to meet economic, social, and environmental goals; (ii) coordination of upstream watershed management and downstream water resources development; and (iii) effective implementation of projects, using appropriate incentives, local involvement, and institutional changes.

The river/lake basin is an especially appropriate spatial unit for scientific understanding of natural processes, planning of water resources development, and assessing its environmental and social impacts. On the other hand, the river/lake basin is not well-suited to implement water management projects when the administrative/political boundaries are not congruent with watershed boundaries.

The systems-oriented conceptual framework that can be usefully adopted for analysing water resources management issues and problems is made up of three dimensions, namely: (i) the management process dimension, consisting of the linked steps of planning, design, construction or installation, and operation and maintenance; (ii) the management activities dimension, consisting of physical measures ("things to be done"), implementation incentives ("means to get things done") and institutional arrangements for management; and (iii) the management system elements dimension, consisting of linked activities, involving, for example, upper watershed management, irrigation management and drainage management.

Using this framework as an analytical guide, a review is made of five cases of water resources development and management experiences in Bangladesh, China, Indonesia, Nepal, and Thailand. Important issues identified in the review include: (i) adverse social effects of the relocation of people for reservoir areas; (ii) adverse reservoir sedimentation effects of upstream erosion; (iii) issues of allocation of scarce water resources among competing users/uses; and (iv) failures in implementing water project plans.

3. ENVIRONMENTAL CONSIDERATION IN THE DEVELOPMENT PROCESS

Environmental Effects of Metropolitan Growth and Development by Richard L. Ludwig

Ludwig's presentation was based on an extensive review of the literature on the ecological/environmental effects of metropolitan growth and development on water resources. In view of the fact that much of what is known is poorly disseminated and communicated to the planners and managers of water resources and to regional planners by the scientific community and the hydro-engineering profession, he stressed that there is a need to synthesize, in non-technical language, complex environmental processes which emerge in hydrological regimes in the course of urban growth and development.

The first type of environmental effect analysed was floodwater impacts. Three reasons were identified as to why flooding of streams is considerably increased in metropolitan areas: (a) Cities themselves create a somewhat rainier microclimate due to heat production and retention and the carrying aloft of particulate matter; (b) in cities water is moved more quickly and efficiently into the streams because of paving, improvement of stream channels, removal of vegetative cover and generally making ground surface more impervious; and (c) concentration of buildings in the flood plains.

The second type of environmental effects resulting from metropolitan growth and development, on water resources was concerned with sedimentation impacts. There are two major reasons for increased sediment in streams: (a) the reduction in the number of low order channels in metropolitan areas; and (b) the increase in sediments directly or indirectly produced by the development process, including construction and intensification of agricultural activities. Environmental effects of increased sediments are many and varied, including (a) change of water quality and consequent change of aquatic life; (b) siltation of reservoirs behind dams; and (c) increased costs for operation and maintenance of water-related facilities such as hydro-power generators and water supply facilities.

The third type of environmental effect analysed is water temperature changes in urban lakes and streams. Metropolitan development has a number of side-effects which have impacts upon stream temperature: (a) Groundwater flows, which are generally much cooler, are considerably reduced in urban catchment areas; (b) increased quantity of waste water from domestic and industrial activities is discharged into streams and lakes; (c) vegetation is commonly cleared from the banks of streams when channels are "improved" or to permit access to the streams; (d) storm run-off is increased; and (e)

ponds and lakes are constructed along stream courses for recreational use or for water retention. Ecological effects of increased water temperature are many and varied.

The fourth type of environmental effects concerned with the impacts of metropolitan wastewater. Major sources of waste materials deposited in streams and lakes include: (a) Storm run-off from built-up areas, (b) storm run-off from agricultural areas on the urban periphery; (c) residential wastes; and (d) wastewater from the industrial and service sectors. There are two major areas of concern as far as water pollution in metropolitan areas is concerned. The first is the problem of the long lag time in the identification of ecological changes resulting from toxic materials. The second is the problem of eutrophication.

Finally, the importance of groundwater flows into the water resource system, was highlighted during a discussion of the following issues: (a) Groundwater exploitation and aquifer recharge; (b) loss of base flow and concentration of environmental impacts; (c) saltwater intrusion; and (d) ground subsidence.

In his concluding remarks, Ludwig echoed the call of international agencies for more environmental impact analysis and reiterated his own plea for breaking down the communication barriers which exist between the scientific and hydro-engineering professions on the one hand and the public policy and resource management officials on the other.

Integration of Environmental Considerations into the Management of Regional Development: Focus on Water Resources Development and Management
by Conrado E. Bauer

Bauer outlined the concept and method of "environmental management of development (EMD)." The major premise of EMD is the recognition that "people are the subject." If one accepts the validity of the total needs of people, including quality of life aspects such as health, education, and recreation in addition to the basic needs of food, housing and employment, then environmental concerns must be considered. In this way economic development and environmental care are inseparably linked. Of course, this environmental orientation must not merely be recognized, but must actually become widely accepted as a guiding principle if successful environmental management of development is to be practiced.

According to Bauer, EMD can be defined as a continuous and interactive process of management, involving three interrelated stages: Planning, implementation, and surveillance and control. Key areas in which environmental orientation is needed are: (a) Motivated and trained planners and managers; (b) scientific and technical knowledge; (c) institutional and organizational arrangements; (d) legislation and regulations; (e) budgetary support; (f) local community participation; and (g) political commitment.

The application of the concept of EMD to water resources development and management involves some specific issues and questions which need to be addressed: (a) The need for using river or lake basins as the territorial unit of analysis and understanding of the natural processes and ecological features; (b) the need to manage water and soil resources in an integrated

manner; (c) the issue of inter-basin relationships with respect to population migration, information flow, energy flow, and water transfer; (d) the need to adopt a wider perspective over the economic, social, and environmental roles water resources play in the society; (e) the question of how to rationally organize water use activities spatially; and (f) the need to give due attention to the hydrologically and ecologically unique characteristics of lakes and reservoirs.

4. SCIENTIFIC APPROACHES TO WATER RESOURCES MANAGEMENT

Monitoring and Measurable Indices for Water Resources by Takeshi Goda

Goda presented a comprehensive and practical description of a wide variety of methods of monitoring water resources. After briefly reviewing the major objectives of water resources monitoring, he summarized his paper by focusing on (a) key meteorological and hydrological data to be collected; (b) the monitoring of the qualitative aspects of water resources; and (c) other relevant aspects to be monitored.

Key meteorological and hydrological data required for the purpose of reliable prediction of water availability on a monthly or annual basis include those pertaining to atmospheric temperature and humidity, evaporation and transpiration, rainfall and snowfall, radiation, infiltration, and overland flow. A brief explanation of the principles of hydrological and hydraulic measurement was also presented.

In discussing the qualitative aspects of water monitoring, Goda made a remark regarding which considerations should be kept in mind in selecting from among a wide variety of available water quality indices. He then explained that items such as turbidity, colour, pH, electric conductivity, biological oxygen demand (BOD), and ammonia, are relatively easy to monitor, whereas such data as most biological indices, heavy metals, phenol and various halogenated hydrocarbons cannot be obtained through automatic measurement. For the purpose of presentation, water quality indices were divided into two categories: (a) Physical and chemical indices; and (b) biological indices relevant to assessing water pollution and eutrophication.

The importance of monitoring biological indices was stressed. Bacteriological criteria are used for determining drinking water standards in many countries. Various pathogenic bacteria can be detected through the use of bacteriological monitoring.

The degree of organic pollution and eutrophication in a given river or lake can be classified with the use of data gained through monitoring phytoplankton, zooplankton, insects, and benthic organisms. Species diversification indices also reveals ecological changes.

Finally, Goda identified some other aspects to be monitored, including the long-term ecological dynamics, aesthetic factors, psychological elements, and organoleptic items.

Hazards and Health Risks from Lakes
by Heinz Löffler

In his presentation Löffler discussed hydrological hazards as well as health risks associated with lakes. Several examples of catastrophic events of natural hazards associated with lakes were described, including (a) gaseous outbursts, (b) floods caused by the sudden collapse of lakes and reservoirs formed by landslides, moraines, avalanches or artificial dams, (c) drought caused by the desiccation of lakes, (d) eruption of lakes, and (e) increased earthquake risks stimulated by the construction of large dammed lakes. The 1986 carbon dioxide eruption of Lake Nyos in Cameroon was also described with two major hypotheses of the cause of the event: (a) A jet-like outburst from the volcanic core below the lake; and (b) the monimolimnion of the meromictic lake gradually became oversaturated with carbon dioxide; cooling from above, heating from below, or rockfall caused the final outburst.

Regarding health risks associated with lakes, several water-borne diseases were discussed. According to the World Health Organization, 80 per cent of all diseases in the world are attributable to inadequate water and/or sanitation. This includes the effects of drinking contaminated water, water acting as a breeding ground for the carriers of diseases, and diseases caused by lack of washing water being most often responsible for these diseases. There is no doubt that natural as well as artificial lakes contribute to water-borne and water-related diseases.

Löffler, in his concluding remarks, stressed the need to give due policy attention to natural hazards and health risks in lake basin management.

5. JAPANESE EXPERIENCE IN WATER RESOURCES MANAGEMENT IN A RIVER/LAKE BASIN CONTEXT

Ecological Principles of Watershed Management -- With Emphasis on Eutrophication Control
by Tatuo Kira

Kira's presentation demonstrated practical approaches and methods of water quality management on the basis of the studies undertaken and the experiences gained in the course of implementing policy measures against eutrophication in the basin of Japan's largest lake, Lake Biwa.

According to Kira, the principles of ecological watershed management are to: (a) Utilize as far as possible such functions of natural and semi-natural ecosystems as soil erosion control, water retention, trapping and decomposition of pollutants, etc., for buffering and improving watershed and aquatic environments; (b) minimize the destruction of ecosystems and conserve them so as to maintain their natural processes, biological diversity, productivity and aesthetic values; (c) optimize the allocation of natural ecosystems, agricultural and grazing lands, human settlements and industrial activities over space so as to ensure the sustainability of development in the watershed.

These principles are derived from the fact that there are close correlations between the selected variables of river water quality and watershed conditions. For example, it has been proven, through field investigation, that forests serve to remove nutrients from rainwater. It is also widely known that wetlands and wet paddy fields serve to enhance the deposition of silt and sand transported by water before they enter rivers and lakes, precipitate certain nutrients such as dissolved phosphates and organic matters, and absorb part of the nutrients.

Catchments of individual rivers or their tributaries are the most natural and convenient units for watershed management. The appropriate size of catchment may vary according to the purpose of management and local conditions, but a unit should preferably have, besides human settlements and intensely used land, a considerable area of natural and semi-natural ecosystems that will allow for improved water quality management.

The first step of watershed management for eutrophication control is the collection of data on nutrient loads. The watershed diagnosis card developed by the Lake Biwa Research Institute is designed to inventorize all nutrient emission sources classified according to their unit nutrient emission (UNE) rates. Data collected by this card system is used to estimate the present total pollution loads in the respective watersheds and to predict future trends. Kira suggested that, in situations where sufficient data is not available, a simple, less sophisticated inventory of watershed variables, such as total population, the extent of area under different categories of land use, the types and number of industrial plants could be effectively used for planning purposes.

Kira's paper concluded with a discussion centered on the fact that the environmental impacts of development, particularly in areas significantly affected by industrialization and urbanization, are apparently beyond the recovery capacities of natural processes, a proper combination of the ecological principles of watershed management and technological measures, such as the installation of large-scale sewerage systems, is indispensable in eutrophication control.

A Soft Approach to Watershed Management: Case Histories in Japan with Special Focus on the Transferability of the Japanese Experience
by Yasuo Shimazu

Shimazu examined some important issues and problems involved with environmental planning and management in the context of regional development in Japan, and stressed the need for adopting a "soft approach." This approach is characterized as being (a) manageable by local government officials; (b) responsive to the vulnerability of local communities; and (c) incremental and bottom-up in decision making.

In the light of these attributes, Shimazu reviewed the experiences of Japan in rural regional development and watershed management with special focus on the Yahagi River Basin and the Lake Biwa Basin. An important lesson drawn from this review is that environmental degradation is caused mainly by the haphazard siting of development projects largely due to the inadequacy of environmental consideration in the decision-making process as

well as by the insufficiency of environmental monitoring during the phase of project implementation.

Transferability of the Japanese experience to developing countries was then discussed with special reference to the issues of institutional and organizational frameworks for development administration, information systems for development planning and environmental management, and manpower development. Development programmes and projects in developing countries are mostly formulated at the central level with little regard for the needs and aspirations of local communities. They are essentially geared to resource exploitation to meet the requirements for national development. Thus, development decisions are external to the local communities whereas environmental problems caused by development projects are always issues of direct concern to local communities. This situation implies the need for equipping local and regional governments with planning and management capabilities in order for them to effectively respond to the conflicts between external forces and local community interests.

The minimum requirements of skills and knowledge which local and regional planners and environmental managers should be expected to have were also analysed. In order to properly respond to development decisions from an environmental perspective, they should be able to review environmental impact assessment reports submitted by the central development agencies or by the funding agencies. At the same time, they should be able to monitor environmental changes triggered-off by project implementation and operation.

Finally, Shimazu proposed two strategic methods of training. The first method is based on the use of microcomputer-aided training in incremental decision making in environmental management. The second is designed to enhance the skills and know-how for undertaking intensive fieldwork for environmental watch and monitoring, covering biophysical and social environmental factors. Preparation of relevant training materials including a manual and software packages was suggested.

6. JAPANESE EXPERIENCE IN WATER RESOURCES MANAGEMENT: CASE STUDIES

Consideration of Management Systems and Consensus Forming in River Basin Management: The Development of the "Yahagi Method"

by the Yahagi River Method Study Team: Renzo Naito, Masamitsu Sugimoto, and Ryoji Harashima

The presentation of the "Yahagi method" study team's report was divided into two parts: (a) a review of the historical development of an environmental movement in the Yahagi river basin, from Naito; and (b) an analysis of factors and mechanisms contributing to the development of the "Yahagi Method" of river basin management, by Harashima.

Naito identified three stages in the development of a nongovernmental environmental organization, known as the Yahagi River Basin Water Quality Protection Association (hereinafter abbreviated as YWPA). The YWPA was formed in 1969 in response to the growing concern over the deterioration of water quality and the increased incidence of water pollution-related damage to farming and fishing activities in the river basin. In the initial period

(1969-74), activities undertaken by the YWPA were mainly directed at seeking more stringent control over water polluters through (a) petitions to the government agencies concerned at both the national and prefectural levels; (b) repeated demonstration against the polluters; and (c) reporting of the law-violating firms to the police, for subsequent action to be taken.

The second stage of the YWPA's movement (1975-78) can be characterized by the successful formation of a number of local community-based environmental groups, which have eventually been integrated in the supporting system of the YWPA's basinwide movement. Strenuous efforts were also made by the YWPA to establish positive interrelations between the upstream and downstream communities through intensified interaction under the slogan "the river basin is a community sharing a common destiny." In parallel with these activities, the YWPA succeeded, in 1978, in establishing an institutional system (known as the "Yahagi method" of river basin management) whereby each proponent of development projects in the basin is required to undertake an environmental impact assessment (EIA) and consult with the YWPA prior to submitting an application to the prefectural government for a development permit.

In the period from 1978 up to the present, the YWPA concentrated its efforts on the provision of technical guidance and assistance to the project implementors in order to ensure that development activities in the basin are planned and implemented in an environmentally sound manner. The guidance and assistance thus extended have been viewed favourably and have gradually led to the creation of a social environment conducive to further promoting cooperation among all the organizations concerned towards the realization of an orderly development of the river basin.

Following Naito's presentation, Harashima described the technical aspects of the "Yahagi method" and summarized the lessons learnt from the YWPA's environmental movement.

The main thrust of the "Yahagi method" lies in the coordination of land development activities in ways appropriate to the river basin environment. This is achieved through frequent consultation between the YWPA and project proponents during the plan formulation phase on the basis of the results of EIA as well as during the project implementation phase based on the information obtained by environmental monitoring.

He identified two major factors that have contributed to the success of the YWPA's movement. First, the ideal pursued by the YWPA as well as the pragmatic activities promoted under the YWPA's strong leadership have been widely accepted by the residents of the basin. Second, the accumulated organizational resources and technical know-how within the YWPA for promoting water quality management has enabled the YWPA to play an intermediary role in coordinating and resolving conflicting interests in terms of land and water uses from a basinwide perspective.

Harashima concluded his presentation by stating that although there are many issues still to be addressed in the Yahagi river basin, the experience of the YWPA, it was hoped, would be of some relevance to the river basins of developing countries facing similar problems.

Comprehensive Development of Kasumigaura Lake and its Environmental Management

by the Kasumigaura Study Team: Koji Muraoka and Hideo Harasawa

The presentation of the case study report on Kasumigaura Lake was divided into two sections: (a) A review of the water resources development and management project undertaken in the Kasumigaura Lake basin, by Muraoka; and (b) an analysis of the environmental effects of the construction of a backflow control gate in the lake, by Harasawa.

After a brief explanation of the physical conditions of the lake basin, Muraoka described the salient characteristics of the multi-purpose water resources development and management project implemented in the lake basin. The project, launched in 1959, involved the construction of a water flow regulating gate at the outlet of the lake, which was designed to facilitate flood control while preventing seawater intrusion during drought years so as to ensure a stable water supply for agricultural uses. With the siting of a large-scale industrial development project near the lake in 1962, however, the scope of the water resource development project was expanded to provide water for industrial purposes as well.

In parallel with the period of rapid economic growth in Japan in the 1960s and the early 1970s, rapid changes also took place in the basin with a sharp population increase coupled with the diversification of the regional economy. As a consequence, the water quality in the lake deteriorated, particularly after the complete closure of the water control gate in 1974.

Following Muraoka's presentation, Harasawa focused on: (a) the socioeconomic changes that have taken place in the basin; and (b) the water resources management issues which have emerged after the desalinization of the lake water.

One of the remarkable changes that have taken place in the lake basin is the sharp increase of water extraction from the lake for nonagricultural uses. This trend continued until the 1973 oil crisis when factory managers were forced, by the prevailing economic circumstances, to curtail production while introducing less energy and water consuming production methods.

The rapid population growth coupled with the development of hog raising in the basin had a significant impact on the lake water quality as the wastewater was discharged without treatment. The scattered nature of settlements which have developed in the basin is considered to have augmented the difficulty in installing centralized wastewater treatment facilities.

The closure of the backflow control gate, which was decided in 1974 in response to the strong demand by farmers, has given rise to a variety of environmental effects on the lake water, which in turn (it is speculated) have accelerated the process of eutrophication. The social implications of the changes in the lake water quality are many and varied: (a) The cost for domestic water supply has increased due to the fact that costly facilities (both in terms of investment and operation and maintenance costs) have had to be installed in order to produce potable water; (b) dramatic changes

have taken place in fish species in the lake (largely decreases in high commercial value fish, and increases in low value fish) coupled with a drastic reduction in fish catch; (c) the outdoor recreational value of the lake has significantly declined due primarily to the closure of beaches for swimming.

Referring to the experience in the construction and operation of the backflow control gate in the lake, Harasawa concluded his presentation by stressing the need to undertake, at an early stage of project planning, a full fledged assessment of the conflicts in water use and management that are most likely emerge among competing users as a result of water resources development schemes.

A Historical Review of Resource Conservation and Exploitation of Lake Biwa Environments

by Koichi Imai, Tatsuya Shingai, Yoji Ito, Toshiaki Kagatsume, Takashi Otsuka, Shigekazu Ichiki, Masahisa Nakamura, Michio Akiyama and Motokazu Ando

The presentation was divided into two parts. The first reviewed the evolution of policy measures adopted for the environmental management of Japan's largest lake, Lake Biwa (situated in Shiga Prefecture) in relation to the changes that have taken place in the national, as well as prefectural, socioeconomic conditions over the 120 years since the Meiji Restoration in 1868.

Four major phases were identified: (a) The era of construction of large-scale water use and flood control facilities (1868-1930); (b) the era of water resource development for hydroelectric power generation and food production (1931-50); (c) the era of sophistication of water uses (1951-70) to meet the increasing water demand from the urban and industrial sectors; and (d) the era of environmental protection (1971-83) to manage the lake water quality with special emphasis on the control of eutrophication which emerged as a consequence of increased discharge of wastewater containing nitrogen and phosphorus. In addition to the above, in the light of the future prospects visualized on the basis of various planning studies undertaken by the prefectural government, the years to come may be characterized as the era of environmental enhancement with a policy orientation to the promotion of the coexistence of man and nature through the active involvement of local communities in the neighbourhood environment enhancement activities together with the promotion of appropriate land-use planning.

The second part of the presentation elaborated on some key policy actions that have been taken to promote environmental management and development of the Lake Biwa Basin. Environmental policy actions highlighted include: (a) The development of an administrative framework in ways responsive to the changing needs and requirements of water quality management; (b) the implementation of locally adaptable eutrophication control measures; (c) the development of environmental preservation measures in connection with the enactment of the Lake Biwa Eutrophication Prevention Ordinance; and (d) the adoption of a comprehensive environmental management plan for the lake basin.

Policy actions taken in the field of development were elaborated with special reference to the Lake Biwa Comprehensive Development Programme. The programme, initiated in 1972, consists of: (a) Measures designed to protect water quality and the natural environment of Lake Biwa; (b) flood control measures to eliminate flood damage along the lake shore areas; and (c) measures to promote efficient use of water resources with a view to ensuring an appropriate supply of water to a total population of 13 million in the Osaka metropolitan region.

Finally, the issue of upstream-downstream community relationships was discussed with focus on the Yodo River Control Project. The project is considered the forerunner of today's Lake Biwa Comprehensive Development Programme which reflected the new orientation to watershed management.

7. CASE STUDIES FROM DEVELOPING COUNTRIES

The Lobo-Broa Ecosystem Study and Reservoirs in Brazil

by Jose G. Tundisi, T. Matsumura-Tundisi, Kozo Hino, and M. C. Calijuri

Tundisi's presentation covered three areas: (a) Environmental effects of reservoir construction in Brazil; (b) effects of land-use changes in the watershed on the hydrological system and associated ecosystems; and (c) research and education activities in the Lobo-Broa reservoir watershed.

Brazil is a country of reservoirs. They constitute an important ecosystem in the hydrological regime and provide a central focus of river basin management. The northeast region of Brazil has a hundred-year history of building a series of small-scale reservoirs for water supply purposes. In the south and southeast regions, reservoir construction began about fifty years ago largely for the purpose of generating hydroelectric power generation. In recent years, development of a series of large-scale reservoirs has been initiated in the Amazon basin to meet the rapidly increasing energy demand.

The ecological consequences of river impoundment identified include: (a) Inundation of valuable agricultural land; (b) impairing of fish migration; (c) loss of terrestrial vegetation and fauna; (d) changes in the aquatic fauna and flora; (e) hydrological changes in the river downstream; (f) interference on the sediment transport regimes; (g) the spreading of water borne diseases by producing a favourable environment for vectors; (h) the loss of the cultural and historical heritage; (i) the social effects on the local population including displacement; (j) changes in economic activities and traditional land uses and practices.

In the last thirty years, Sao Paulo State has experienced rapid economic growth as a result of industrialization. This has given rise to a number of environmental problems, such as rapid deforestation, destruction of the basin environment through the construction of extensive road networks and large-scale reservoirs, and deterioration of water quality and eutrophication.

In response to these problems, the action research project in the Lobo-Broa reservoir area, originally initiated in 1971 as a field research project for university students, has now been expanded to cover a wide

range of activities, such as the collection of data on reservoir ecosystems through regular monitoring activities, water quality research, water resources management action programme, and an environmental education project. The action programme for water resource management aims at maintaining the water quality of the reservoir so as to preserve its potential value for fish production and recreational activities. The programme is implemented through close collaboration with the local community. At the same time, the programme is designed to increase environmental awareness among the local people through a network of schoolteachers. Tundisi concluded his presentation with a remark stressing the need for establishing effective training programmes for water resources managers and planners.

Following Tundisi's presentation, Hino summarized the environmental studies being undertaken by the Eletronorte as integral parts of the programme for hydroelectric power development in the Amazon region. The studies cover: (a) Limnological research and water quality monitoring in the reservoirs; (b) environmental impacts on the fauna and flora, from hydroelectric power development projects; (c) environmental education for promoting public awareness of the linkages between natural resource exploitation and environmental management; and (d) socioeconomic and cultural impacts of development projects.

Environmental Management of the Saguling Dam Project by Edy Brotoisworo

Brotoisworo summarized his paper, focusing on three major points: (a) The national policy for energy development; (b) the major environmental and social impacts of the Saguling dam project; and (c) the policy responses to the problem of involuntary resettlement.

As an integral part of the national policy for energy development in Indonesia, the diversification of the sources of electricity supply has been pursued since the mid-1970s. Priority has been given to the exploitation of hydroelectric power in Java where major metropolises of the country are located. A number of dam construction projects were therefore planned and implemented by the national electric power development company, one of which is the Saguling dam situated in West Java.

According to the series of environmental impact assessment studies undertaken as a part of the Saguling dam project planning, major environmental impacts identified and assessed include: (a) Displacement of local population and other associated social and economic losses such as the disintegration of local communities and loss of fertile agricultural land; (b) increased incidence of water borne diseases; (c) water contamination; and (d) development of aquatic weeds in the reservoir. The study also examined the effects of increased population pressures on the catchment area of the reservoir.

Since the project was located in a densely populated area, a large number of households were affected by the project (about 3,000 households had to be displaced while another 7,000 households lost all or part of their livelihood bases, such as farmland and/or places of work due to inundation). The policy responses to the affected local population are,

however, said to have been implemented in a haphazard manner as they were not properly integrated in the project plan. While the project proponent, the national electric power development company, was responsible only for the construction of dam and other related facilities, necessary measures for the affected people were entirely left to be undertaken by the provincial government.

The most serious issue to emerge as a result of this displacement was a further increase in the risk of soil erosion in the catchment areas of the Saguling reservoir. A large number of displaced people opted for resettling in the upstream mountainous areas, thus augmenting the already extremely high population pressures on the land. One of the consequences of this process has been the increased rates of soil erosion. It is, therefore, speculated that the rates of siltation in the reservoir might have become much greater than those originally estimated, thus reducing the effective water storage capacity of the reservoir.

Finally, Brotoisworo described some strategic measures being taken to assist the displaced population. These measures are designed to generate income-earning opportunities through promoting non-land-based or less-land-consuming productive activities such as freshwater aquaculture, sericulture, and agro-based industries. Reviewing the lessons learned from the Saguling dam project, he stressed that there is an urgent need to create an institutional framework conducive to ensuring effective participation and coordination of all agencies and organizations concerned at the national, regional, and local levels in formulating and implementing large-scale projects such as the Saguling dam project, in order to minimize their negative effects on the local community and also to maximize the benefits accruing from these projects.

Management, Development and Utilization of Water Resources in Dianchi Basin, Yunnan Province, China
by Liu Hongliang, Liu Yusheng and Zhang Jiqiang

After briefly explaining the physical and socioeconomic features of the Dianchi basin, Zhang focused his presentation on the water resources management issues in the basin, and then on the priority areas of concern to which research efforts are directed.

With the development of industry and agriculture coupled with the rapid population growth in the basin over the last thirty years, the volume of water consumption has substantially increased. One of the serious consequences to have emerged as a result of this is the frequent incidence of acute water shortages in the drought years, affecting not only the productive activities in the basin but also the day-to-day life of the people. A persistent, complex policy issue which has ensued from this phenomenon has been how to resolve the conflict over the allocation of water between different uses. As policy priority in terms of water allocation has so far been given to the industrial sector, it has been the farming communities who have been somewhat compelled to seek alternative sources of water for irrigation purposes.

The second issue identified was concerned with the ecological effects of reclamation works undertaken in the lake. With the aim of increasing

food production, from the late 1950s to the mid-1960s an extensive lake area was reclaimed. This led to the destruction of aquatic ecosystems, which, in turn, resulted in a sharp decline in fish production.

The third issue highlighted in the paper was concerned with the consequences of deforestation and its associated problem of increased siltation in the lake. With the rapid expansion of agricultural land in the lake catchment areas, it is estimated that the volume of silt discharge has increased by 40 per cent over the last thirty years. The silt deposited in the lake combined with the reclamation has greatly reduced the water storage capacity of the lake.

The fourth issue presented was concerned with the problems of water contamination. It was reported that the lake basin community is facing two serious problems in this regard: (a) The accelerated process of eutrophication; and (b) water contamination from toxic substances such as arsenic, lead, cadmium, and phenol. While some countermeasures are being implemented, including the introduction of a penalty system pertaining to wastewater discharge and the construction of sewage treatment facilities, it is reported that there is a conflict between the municipal and provincial governments in terms of the policy areas to which priority is to be given.

Finally, Zhang described the ongoing research project designed to formulate policy measures for achieving the rational use and protection of water resources of the Dianchi lake basin. He also indicated that some projects designed to enhance the water supply capacity of the basin are currently under consideration.

Water Quality Management Issues in Relation to Industrial Location and Land Use in the Kenyan-side Catchment Area of Lake Victoria

by S. M. Machooka, D. Mshila, M. Omondi, and L. Nyongesa
(presented by Kenneth M. Mavuti)

Mavuti, being a representative from Kenya, kindly volunteered to present the case study report on behalf of the authors who were unable to join the workshop.

The first part of the presentation focused on a locational description of Lake Victoria which is shared by Kenya, Tanzania, and Uganda. In view of this internationally shared feature of the lake, an argument on the approach to be adopted by the case study was raised. The focus of analysis, it was suggested, should not be confined to the Kenyan side only, but also include the neighbouring countries and the downstream areas through which the River Nile drains. The concrete and rational water resources management of Lake Victoria cannot be achieved without the participation of all the countries concerned. In addition, the downstream Nile countries who are recipients of the lake water should be considered.

It was also argued that the peripheral waters and wetlands around the lake should be given adequate attention. The various river systems and their sub-basins as well as the types of activities being undertaken, and are proposed to be undertaken, may have significant environmental

consequences. Problems such as salinity, soil erosion, and water contamination were identified.

For purposes of comparison, the major water resources development programme being implemented in the Tana river basin was highlighted. The series of dams constructed primarily for hydropower generation and irrigation purposes, though producing a wide variety of benefits to the basin, have also generated a number of unforeseen environmental effects. Major problems identified include water reduction, water contamination by agricultural run-off, degradation of flora and fauna, spread of water-borne diseases such as malaria and intestinal problems. The hydropower development project has had substantial social impacts on the local community, including the displacement of people and the socioeconomic problems associated with the resettlement in the poorer lands. Although an extensive environmental impact assessment was undertaken, no monitoring or follow-up activities were made.

The case of the Tana dams can be regarded as being one of the representative examples revealing the issue of equity and developmental conflicts associated with water resources development. For purposes of preparing training materials and comparative information, an in-depth study on the experience of the Tana river basin was recommended.

Towards the end of the presentation, illustrations on the physical characteristics of Lake Victoria and the Winam Gulf as well as some selected water quality measurements were presented in order to highlight the differences in water quality between the open waters of Lake Victoria and the semi-closed system of Winam Gulf.

Basin Approach to Water Resource Management: A Case of the Laguna Lake
by Enrique P. Pacardo, Benjamin J. Bartolome, Floro R. Francisco,
Ma. Victoria O. Espaldon, Joel D. Lamanilao, Socorro L. Patindol,
and Dolora N. Nepomceno

After presenting a brief summary of the locational and socioeconomic characteristics of the Laguna Lake Basin, Pacardo described a number of water resource use conflicts that have emerged in the basin: (a) Conflicts between traditional small-scale fishermen and large-scale fishpen operators; (b) Conflicts between fisheries interests and metropolitan industrial interests; (c) Conflicts between agricultural interests and water quality requirements; and (d) Flooding problems due to the installation of a multi-purpose hydraulic control structure.

The overall development and management of the lake basin rests with the Laguna Lake Development Authority (LLDA), established in 1966. As an integral part of the LLDA's programme, a number of water resource management projects have so far been implemented in the basin, including a hydraulic control structure, a floodway project, irrigation systems, a hydroelectricity power generation project, and fisheries development.

In presenting the impact study of these projects, Pacardo dwelt to some length on the fisheries development project to elucidate its socioeconomic and political implications. The fisheries development project was originally identified in the late 1960s as an appropriate scenario to

promote the development of the lake basin. In accordance with the proposed development scenario, financial assistance was extended by the World Bank and other international funding agencies to promote aquaculture on the basis of the newly invented fishpen technology. The introduction of this new aquaculture technology in the lake however has given rise to such environmental effects as the decline of indigenous fish species and the decline of snail production upon which local duck raisers were dependent. The socioeconomic consequence was the relative displacement of local fishermen by the city-based fishpen aquaculturists.

As a policy response to the social tensions created by the haphazard development of fishpen aquaculture in the lake, Pacardo highlighted the recent reform undertaken after the new government came into place in 1986. The main thrust of the reform was to rationalize the use of lake water for fish production by demolishing illegally operated fishpens in line with the principles of social justice, ecology, and the protection of the rights of subsistence fishermen.

In parallel with the widespread development of fishpen aquaculture, the lake water quality has gradually deteriorated due primarily to the increased discharge of untreated wastewater from the rapidly growing urban and industrial sectors. The process of eutrophication has also been accelerated with intensified adverse effects on fishery activities in the lake. The policy responses to the problem of water quality deterioration in the lake basin have however remained ineffective.

Finally, commenting on the complex water resource management issues in the lake basin, Pacardo noted that the fishpen conflict, which eventually became one of the serious political issues in the region, had provided a useful lesson for decision makers, and stressed the need to initiate institutional changes so as to strengthen the management capabilities of the government agencies concerned.

Environmental and Social Effects of the Proposed Salinity Barrier Project in the Songkhla Lake
by Surin Setamanit and Sunthorn Soththibandhu

The presentation by Surin Setamanit focused on: (a) The physical and socioeconomic features of the Songkhla lake basin; (b) the outline of the proposed salinity barrier project; (c) the environmental and social effects which are likely to emerge as a result of the project implementation.

The Songkhla lake basin, situated on the southern Thai border with Malaysia, has been given policy priority for regional development as one of the growth centres in the context of the national development policy framework. This led to the conduct of a regional development planning study in 1984/5. The planning study is claimed to be unique in that conscious efforts were made to integrate environmental concerns in the formulation of the basinwide economic development plan.

One of the priority projects identified by the planning study was the salinity barrier project. Songkhla Lake, being connected with the Gulf of Siam, is a coastal lagoon lake with a salinity gradient. The northern interior part of the lake is largely freshwater, but seasonally and in

years of low rainfall, can become saline. The proposed project was designed to build a barrier in the lake to prevent the intrusion of saline water so as to supply freshwater for irrigating the coastal agricultural areas.

Three issues have been identified with the proposed salinity barrier project. The first issue is where to locate the barrier. Through a prefeasibility study conducted as an integral part of the basin planning study, one location was identified purely on techno-economic grounds. The location thus chosen was however not acceptable to local community primarily because of the fact that the extent of irrigable area is limited.

The second issue was concerned with the ecological effects of the proposed project. As the area of brackish water in the lake serves as an important fish breeding ground, an apprehension has emerged among the local people that the desalinization of the lake by the proposed barrier may adversely affect the lake ecosystem and would accelerate the deterioration of the lake water quality.

The third issue concerned the justification of the proposed project from the national macroeconomic perspective. The project is designed to provide additional water for the poverty-stricken, rain-fed rice growing areas with a view to stabilizing rice production rather than to achieve an increase in the yield. Hence, the large investment required in the proposed project may not be justified from the viewpoint of economic efficiency.

Apart from the points raised above, Surin gave a detailed account of environmental effects that may emerge as a consequence of implementing the proposed salinity barrier and irrigation project, including (a) eutrophication due to increased use of fertilizer; (b) negative effects on fisheries due to salinity changes; (c) adverse impacts on the bird sanctuary due to the change of lake ecosystems as a result of salinity change; and (d) the deterioration of the lake's aesthetic appeal which would necessarily lead to a decrease in its tourism potential.

Following Surin's presentation, Sunthorn Sotthibandhu introduced the attempt initiated by the Prince of Songkhla University to establish an information system for the development and management of the Songkhla Lake Basin.

8. SPECIAL PAPERS

The Status of Lake Kariba by C. H. D. Magadza

Magadza described the major tasks involved with the management of Lake Kariba which was created on the Zambezi River for the purpose of generating hydroelectric power for both Zambia and Zimbabwe.

Two major management regimes are identified. The primary management regime relates to the lake's principal function of hydroelectric generation, consisting of (a) lake-level regulation in relation to incoming flood input; (b) operation and maintenance of power generation machinery; and (c) maintenance of the dam wall structure. Ecological implications of these management tasks were elaborated.

The secondary management regime relates to the lake's natural resources that have no direct bearing on its primary use of hydroelectric generation. This include: (a) Management of aquatic weeds; (b) management of fisheries resources; (c) management of wildlife resources; and (d) management of human needs.

The current management instrument of Lake Kariba is the Zambezi River Authority. This organization is mandated however only to manage the primary functions of the lake. In response to the growing need to adopt a comprehensive approach to the management of the lake and its environment, the Zambezi Action Plan was agreed upon by eight countries concerned with the Zambezi Basin, which aims at promoting, among other things, (a) training of national experts in environmental sciences in order to create a focus of environmental awareness in the region; (b) a sustained programme of extension education to various sectors of administration and user communities of the Zambezi valley watershed for continual innovation in resource use; (c) the establishment of an effective regional committee to coordinate the implementation of sound management of the watershed resources.

Ecosystem of Lake Baikal

by G. I. Galazy

Galazy commenced his presentation by outlining the main features of the Lake Baikal ecosystem, highlighting, (a) ion composition of the lake water; (b) organic substance in the water mass; (c) oxygen content; (d) the composition of biogenic elements; (e) water temperatures at various depths; (f) the diversity of organisms; (g) fish varieties found in the lake.

Summarizing the presentation, Galazy indicated that the ecosystem of Lake Baikal is neither homogeneous nor stationary but highly dynamic. The subsystems of Lake Baikal, which differ from each other according to their primary link in the trophic chain, require various approaches to be taken in resolving the lake's management problems. In order to prevent further changes in the quality of the complex ecosystem of Lake Baikal, in 1987 the government declared its intention to implement the necessary measures to protect the lake, including the closure, by 1993, of pulp production plants situated in the vicinity of the lake.

ANNEXES

OUTLINE OF THE RESEARCH PROJECT ON
RIVER/LAKE BASIN APPROACHES TO
WATER RESOURCES MANAGEMENT (1987/88-1989/90)

1. Background

This project draws from the findings of a previous UNCRD research project (RES/530/85), the results of which served as a major input into the Expert Group Workshop on Environmental Planning and Management for Local and Regional Development: Focus on Training Aspects Derived from Studies of Inland Water Management, held jointly by UNCRD, ILEC, and UNEP in Otsu and Nagoya, Japan, in November 1986. The workshop discussed technical and institutional aspects of environmental planning and management with particular focus on inland waters and river/lake basins in developing countries, and identified therefrom training needs and guidelines for developing training programmes. Additionally, the workshop raised several issues which were relevant for the development of this project. They include, among others, the following:

- (1) The need for a basinwide perspective in dealing with environmental problems and water resources management issues;
- (2) The need for adopting an ecosystem approach to water resources management, together with a broader perspective over, and greater sensitivity to, the complex policy issues stemming from social, economic, cultural, and political backgrounds of the developing countries;
- (3) The need to strengthen policy analysis capabilities among environmental planners and natural resources managers; and
- (4) The need to explore ways and means by which institutional capability can be augmented, in order to ensure concerted efforts among agencies and institutions involved in environmental and natural resources management.

2. The Problem

The availability of uncontaminated water is the single most important factor determining both productive activities and the quality of human life. Hence, developing countries have given special attention to water resources development and management in order to promote economic development and meet the demand of rapidly increasing populations. The range of water-based requirements is quite wide, including agriculture, industrial and domestic needs, energy, fisheries, transportation, flood control, and recreation. Therefore, an integrated planning approach has increasingly been adopted and elaborated with the aim of achieving interrelated goals and objectives of water resources development and management.

As the pace of development accelerates in developing countries, however, many river/lake basins have become increasingly susceptible to various pressures and forces which tend to give rise to a number of water

management issues that cannot be dealt with solely in the context of specific water related programmes and projects, but need to be addressed on a basinwide scale. There are a number of such issues, but the following three issue domains seem to deserve special attention from the viewpoint of river basin planning and management (further elaboration of the issue domains is given in annex 1):

Issue domain I: Environmental and social effects of water resources development programmes and projects (e.g. forced resettlement, spread of water-borne diseases, spread of aquatic weeds, disruption of freshwater fishing resulting from the construction of dams and reservoirs);

Issue domain II: Environmental and social conflicts arising from water-land use interfaces (e.g. water quality deterioration by upstream land-use activities, deterioration of watershed ecological functions through indiscriminate land-use activities resulting in increased floods, drought and sedimentation in the downstream area, upstream-downstream social conflict); and

Issue domain III: Access to, or allocation of, water resources--efficiency vs. equity (e.g. water allocation in irrigation projects, urban /industrial bias in water allocation, water rights, fishing rights, etc.) irrigation projects;

Because of the increasing complexities of socioeconomic processes and in view of the fact that the pressures to make optimum use of available water resources for the benefit of society as a whole will inevitably intensify in the developing countries in the future, there will be no getting away from the need to search for a more effective river/lake basin planning and management system capable of integrating both the functional and territorial dimensions of water use and management into the process of river/lake basin development. The former dimension must harmonize the objectives of economic development and social justice, while the latter must ensure both optimum distribution of human activities and the ecological integrity of entire basins.

3. Objective

The purpose of this project is to obtain a holistic understanding of the structure of issues and problems associated with water resources development and management in developing countries and explore opportunities and constraints in dealing with these problems and issues in the context of river/lake basin planning. The focus of the study is on various country experiences in responding to emerging policy issues in the field of water resources management and river/lake basin planning. More specifically, this research project will adopt a three-tiered structure for investigation. The aims of the respective tiers are as follows:

- (1) Analyse empirically the major factors, forces, and mechanisms causing water resources management problems and issues with special focus on the issue domains mentioned earlier and their consequences for the basin community (Tier I: Understanding of the problem structure and causal linkages);

- (2) Review and evaluate the past and current government responses (policy and institutional frameworks, programmes, and projects) to the water management issues in terms of their relevance and effectiveness (Tier II: Evaluation of the past and current government responses);
- (3) Seek implementable suggestions for integrating environmental and social considerations into the process of water resources management and river/lake basin planning (Tier III: Delineation of alternative/complementary actions).

4. Approach of Study

The study envisaged under this project is primarily exploratory in nature and both deductive and inductive approaches are to be used. Two types of research studies will be carried out:

Type I will consist of resource papers which would provide the conceptual frameworks relevant to this project, focusing on such specific topics as (1) river/lake basin planning and management: policy issues, objectives, and approaches; (2) Policy analysis in water resources development planning; (3) environmental and social impact assessment of water resources development projects; and (4) institutional analysis in river basin planning and management. In order to substantiate the conceptual frameworks, each resource paper is expected to include empirical case studies.

Type II will consist of in-depth case studies on specific river/lake basins(sub-basins) of selected countries which will be carried out over a period of three years(1987/88-1989/90)

The case studies in the first year(1987) will concentrate on the understanding of the problem structure and causal linkages (Tier I) with special focus on the three issue domains mentioned in Section 2. Major areas of investigation will be as follows:

- (a) Background information: National plan policy and setting in the field of water resources development and river/lake basin planning; 'socio-ecological' profile of the basin; major issues and problems of water resources management.
- (b) Analysis of issue domain I (environmental and social effects of water resources development projects--WRDPs): Background information and profile of selected WRDPs; analysis of the project plans; types and magnitude of the effects; consequences of the effects on the local communities and the basin as a whole; countermeasures taken.
- (c) Analysis of issue domain II (environmental and social conflicts arising from water-land use interfaces): Land-use profile of the basin; identification of major land-use activities creating conflicts; 'socio-ecological' analysis; local perception and responses to the conflicts; government responses to the conflicts.

- (d) Analysis of issue domain III (access to water resources--efficiency vs. equity): Socioeconomic classification of the basin population according to the use and access to water resources; formal and informal institutions for water resources allocation; social and economic effects of the existing water allocation patterns; major problems and issues; government responses.

The case studies in the second year (1988) will attempt to review and evaluate past and present government responses to the problems and issues (Tier II) identified and analysed in the first year's study. Main areas of investigation for the respective issue domain may be outlined as follows: (a) Policy framework--objectives, strategies, policy tools and instruments, implementation; (b) legal and institutional frameworks--legislation, ministries and agencies involved and their linkages, decision-making processes and procedures, institutional devices for coordination--vertical and horizontal; (c) institutional analysis--authorities and responsibilities, planning and implementation capabilities, linkages and conflicts with other agencies; (d) programmes and projects--objectives, strategies, beneficiaries, effectiveness, and relevance to the emerging issues; (e) government-local community relationship and community participation; (f) identification of gaps and limitations in the existing policy and institutional frameworks in responding to the three issue domains covered by this study.

The case studies planned for the third year (1989) will attempt, on the basis of the findings and results of the first and second year's studies, to delineate alternative or complementary actions which, according to the study team's assessment and judgement, are necessary and feasible to rectify the existing policy and institutional frameworks and help facilitate government to more effectively respond to the water resources management issue domains. An attempt will also be made to evaluate the proposed actions on the basis of realistic criteria to be derived during the course of this study.

5. Organization of the Study

Relevant experts both in developed and developing countries will be commissioned to prepare resource papers on selected topics.

In order to carry out the envisaged case studies on a sustained basis, collaborative arrangements will be made between UNCRD and an appropriate institution (e.g. a university, research institution or public agency) in each of the countries where case studies are to be undertaken, with the following considerations:

- (1) A study team will be formed in each of the countries. Each locally based study team will comprise of: One Senior Coordinator; one Task Force Leader; and a Task Force, comprising of several young researchers (e.g. graduate students from universities or young researchers from research institutes);
- (2) These teams, together with the coordinating staff from UNCRD, will be responsible for conducting investigation;

- (3) Each study team is expected to initiate and maintain close contact with relevant government agencies, in order to ensure that the findings of the case study will be of use for ongoing programmes and projects. (This implies that case study locations in each country be selected from among those river/lake basins(sub-basins) where efforts are being made to carry out basinwide planning studies or to implement programmes and projects for river basin management.)

6. Expected Output

Tier I: The results from the basic investigation into gaining an understanding of the 'socio-ecological' dynamics of the case study basins are intended to provide an input into formation of background materials on the state of issues and problems relative to water resources development and management in the context of river/lake basin planning in developing countries. It is hoped that this will contribute towards building up an indigenous information base for reference by regional planners and environmental managers as well as university students.

Tiers II and III: The second year's studies on past and current government responses to water management issues, coupled with the third year's policy analysis, are intended to lead to the compilation of cross-country experiences in improving the approaches and practices of water resources development and management in a river/lake basin context. The outcome of the research project will also be used as the basis for producing training materials useful to water resources managers, regional planners, and administrators in making better decisions on the use and management of water resources for achieving national, regional, and local goals.

7. Presentation of Study Findings

As an integral part of this project, a seminar-cum-workshop will be held each year for three years (1988-90), in order to facilitate exchange among the participating experts and researchers of actual experiences and knowledge gained through this research project and promote mutual understanding and cross-fertilization among them.

- (1) First workshop, February 1988, Otsu and Nagoya, Japan: The Task Force Leaders, together with selected experts and researchers including the Senior Coordinators and the resource paper writers, will meet in order to: (a) review and consolidate the preliminary findings of the Tier I investigation; and (b) discuss and finalize the study framework and fieldwork formats for Tier II study.

- (2) Second workshop, January 1989, Bangkok and Hat Yai, Thailand: (a) review and compile the findings of Tiers I and II investigations; (b) discuss and evolve a methodology for programme and project evaluation; and (c) discuss and finalize the study format for Tier III.

- (3) Third workshop, 1990: (a) review and compile the findings of Tier III investigation; (b) discuss and evolve a framework for policy analysis

in water resources development and management in the context of river/lake basin planning; and (c) discuss the follow-up of the project.

Annex 1: Water Resources Management Issues to be Dealt With in the Context of River/Lake Basin Planning and Management: An Illustration

(1) Environmental and Social Effects of Water Resources Development Programmes and Projects:

As revealed by many country experiences, the past planning approach for water resources development has tended to concentrate on major construction projects such as dams and reservoirs, with little consideration being given to environmental and social effects on the basin communities. Modification of a river system by construction of a man-made lake, coupled with the impoundment of a large extent of land above the dam, causes a variety of other changes in the river basin environment. Although benefits accruing from water resources schemes are many and in many cases substantial, a whole series of problems are associated with the benefits, including forced resettlement and its associated problems of adoption to environmentally different sites on the part of the displaced population, the aggravation and spread of water-borne diseases, the spread of aquatic weeds resulting in disruption of freshwater fisheries. In view of the adverse environmental and social effects of river basin development projects, increasing emphasis is now placed on preventive planning based on environmental impact assessment. This approach may contribute to the reduction of the majority of ecologically adverse effects, but many policy issues are yet to be resolved, such as the problem of forced resettlement and the question of whether a large-scale water resources development scheme is more meaningful and beneficial to the society as a whole as compared to a series of well-linked small-scale schemes.

(2) Environmental and Social Problems Arising from Conflicting Water-Land Uses:

Although a river/lake basin forms a convenient unit for water resources development and management, the increasing use of land and water resources in the basins has pointed to potential conflicts, for instance, between the upstream and downstream areas or between different sectors. In most cases conflict situations arise because the development of river/lake basins proceeds haphazardly with little consideration for the interactions among various activities and/or with little regard to their impact on the river/lake environment. The major categories of such conflicts which need to be addressed from a basin perspective may be seen in terms of upstream vs. downstream conflicts as exemplified below:

- * Deterioration of watershed ecological functions owing to removal of forest cover through logging, land settlement, and spontaneous expansion of agricultural land resulting in increased floods, drought and sedimentation in the downstream areas;
- * Excessive water extraction due to the upstream land-use activities

resulting in water shortages in the downstream areas;

- * Increased pressure to construct dams and reservoirs upstream for the benefit of downstream communities, giving rise to adverse social effects on the upstream communities;
- * Contamination of water through upstream land use activities affecting downstream activities;

The conflicts illustrated above are often aggravated in those basins where rapid population growth is taking place simultaneously with the transformation of rural society on one hand, and industrialization and urbanization on the other, since these processes induce rapid changes in land use, which in turn affect the quantity and quality of water. These conflicts point to the need for a basinwide planning system capable of managing and optimizing various water land-use interfaces.

(3) Access to, and Allocation of Water Resources among Competing Users and Uses: Efficiency vs. Equity

Water resources are not distributed evenly in space and time, resulting in abundance and shortage. Uneven distribution of water resources can also be seen between different social groups. River basin planning almost always involves some form of allocation of water resources. The main criterion in the allocation of water resources has so far been economic efficiency. In many river basin development programmes, therefore, water resources have tended to be diverted to those areas where maximum benefits can be obtained with minimum investment, or to those social groups who have access to capital and other means of production to derive maximum benefits from the allocated water resources. A typical example of the former can be found in irrigation projects, while examples of the latter may be seen in the allocation of water use rights for inland fisheries. This economic efficiency criterion in water resources allocation has in many cases tended to reinforce the existing structure of socioeconomic inequalities prevalent in many developing countries.

Ineffectiveness of river basin planning in addressing major social and economic issues in third world countries may perhaps be attributed to the mainstream of economic development thinking in these countries which has so far been characterized by the strong pursuit of economic growth with the assumption that redistribution of the benefits accruing therefrom will be automatically taken care of through the "trickle-down effect."

Annex 2: Social Problems Associated With Reservoir Impoundment Resettlement:
Checklist

1. Loss of agricultural land
2. Loss of homes, villages, religious and cultural sites
3. Loss of other community facilities (schools, health centres, etc.)

4. Resource difficulties related to break-up of social units and families
5. Inadequate notification to evacuees prior to inundation, and misleading information on resettlement sites and facilities
6. Resettlement site selection without studies of soil conditions, agricultural potential, water needs and supply, disease or transportation requirements
7. Political constraints on land otherwise potentially available for consideration as resettlement sites
8. Tendency towards selecting government forest reserve lands for resettlement, leading to loss of valuable watershed protection and timber production
9. Inadequate and hasty studies of the particular characteristics and needs of people to be resettled, and programmes for their retraining: A very common flaw has been lack of opportunity for evacuees to express their needs and desires to the planners responsible
10. Lack of funds, planning capability and trained personnel to implement and manage a successful resettlement programme
11. Lack of funds, planning capability and personnel to retain evacuees and provide education concerning the needs, dangers, and opportunities of their new environment
12. Difficulties involved in having to move people from fertile lowland agricultural areas to poorer quality upland sites, including:
 - (a) Lower agricultural production associated with less productive soils and unfamiliar land use practices;
 - (b) Exposure to new disease environments and intensification of existing diseases, particularly following a rise in population density;
 - (c) Reduced crop diversity and loss of river fisheries, contributing to nutritional impoverishment;
 - (d) Lack of potable household and irrigation water; and
 - (5) Fewer potential cash crops and loss of income.
13. Inadequate compensation of evacuees for losses, sometimes based on faulty land valuation
14. Spontaneous colonization of areas in the reservoir catchment zone causing accelerated erosion and lake sedimentation
15. Competition for land occupied by previous settlers--usually upland shifting agriculturalists or lowland farmers--with resulting pressure on carrying capacity

16. Competition for cultivable land and for reservoir fishing opportunities from migrants from distant parts who may be in a stronger position to launch new enterprises
17. Failure to develop all possible means of enabling evacuees to share in the benefits from the reservoir
18. Inadequate attention to population growth rates in resettlement areas and provision of birth control advice and assistance
19. Lack of research on possible new fisheries, livestock, or crops which might be useful on resettlement sites, particularly in upland areas
20. Failure by planners and responsible agencies to investigate, fund and develop a range of viable options on which the people to be resettled are consulted and from which they may choose, such as, for example:
 - (a) Relocation and retraining in urban areas;
 - (2) Full-time fishing and aquaculture;
 - (3) Relocation in new irrigated areas (if any) served by the reservoir;
 - (4) Sufficient compensation, on an individual basis, to cover purchase of good land elsewhere; or
 - (5) Sufficient compensation to cover such purchase communally.

Source: R. F. Dasman, et al, Ecological Principles for Economic Development, (London: John Wiley), 1973, pp.219-20.

OPENING ADDRESS

Hidehiko Sazanami, Director
United Nations Centre for Regional Development

Dr. Kira, Dr. Golubev, Distinguished Experts, Colleagues, Ladies and Gentlemen:

It is an honour for me to welcome you all to Japan and to the Expert Group Workshop on River/Lake Basin Approaches to Environmentally Sound Management of Water Resources. We are indeed most grateful that despite your very busy schedules, you have been able to accept our invitation to take part in this Workshop, by preparing the topic papers and case study reports to be presented here, and by sharing your dedicated efforts and extensive experiences in our common areas of concern.

Background of the Workshop

First of all, I would like to briefly explain the background to this Workshop. In November 1986, UNCRD, in collaboration with ILEC and UNEP, organized an expert group workshop on environmental planning and management for local and regional development: focus on training aspects derived from studies of inland water resources management. The workshop discussed technical and institutional aspects of environmental planning and management with particular focus on inland waters and river/lake basins, and identified, therefrom, manpower development needs in the developing countries as well as guidelines for developing training programmes. The results of the workshop have been compiled in a report and summary of proceedings, a copy of which has been provided to each of you, for your reference.

The workshop also identified several issues of particular importance to which more attention should be directed in the effort to further the cause of environmentally sound management of water resources. They include, among others:

- (1) The need for a basinwide perspective in dealing with environmental problems and water resources management issues;
- (2) The need for adopting an ecosystem approach to water resources management, together with a broader perspective over, and greater sensitivity to, the complex policy issues stemming from social, economic, cultural, and political backgrounds of the developing countries;
- (3) The need to strengthen policy analysis capabilities among environmental planners and natural resources managers; and
- (4) The need to explore ways and means by which institutional capability can be augmented, in order to ensure concerted efforts among agencies and institutions responsible for environmental and natural resources management.

It was in response to these observations that UNCRD, ILEC, and UNEP jointly launched a three-year project in early 1987 with a view to assisting the efforts of developing countries in strengthening their national capabilities to promote environmentally sound management of water resources in a river/lake basin context. As an integral part of this project, we have commissioned a series of topic papers on specific themes related to water resources management. We have also requested the collaborating institutions in selected countries, including Japan, to prepare case study reports focusing on region-specific issues and problems of water resources management.

Purpose and Organization of the Workshop

The Workshop which we are commencing this morning therefore marks the final phase of the first year's activity of the newly launched UNCRD/ILEC/UNEP project. The main objectives of the workshop are:

- (1) To review key concepts and approaches for ensuring effective incorporation of environmental and social aspects into the water resources management process, including the allocation of water in the context of efficiency, equity, and other social goals and objectives;
- (2) To examine, by way of a case study approach focusing on specific regions, water resources management issues and problems that need to be addressed from a river/lake basin perspective; and
- (3) To discuss and delineate the ways in which the resource papers and case study reports to be presented and discussed at the workshop could be consolidated into a structured body of information useful to water resources managers, planners, and administrators in making better decisions relating to the use and management of water resources in achieving national, regional, and local goals.

As evidenced by many recent experiences both in developed and developing countries, a number of river and lake basins have become increasingly susceptible to various pressures and forces which tend to give rise to a number of water management issues that cannot be dealt with solely in the context of specific water-related programmes and projects, but need to be addressed through planning and management on a basinwide scale.

Although there are a number of such issues, we have chosen three major issue domains on which we will concentrate our research focus. The first issue domain is concerned with environmental and social consequences of water development schemes, including disruption of hydrological regimes, spread of specific water-borne diseases, and enforced resettlement and its associated social issues.

The second issue domain focuses on those environmental and social problems resulting from the inadequacy or the lack of effective coordination between upstream watershed management and land-use planning on the one hand, and water resources planning and management on the other. This includes such problems as water quality deterioration resulting from upstream land-use activities affecting downstream water users,

deterioration of watershed ecological functions by indiscriminate land-use activities resulting in increased sedimentation, floods, and drought in the downstream area, and social conflicts arising from upstream-downstream linkages.

The third issue domain is concerned with the problems associated with the allocation of water among competing sectors, regions, and social groups including such institutional issues as water and fishing rights.

It is our understanding that a river/lake basin provides a territorial framework in which these water resources management issues should be considered. It also appears essential to create, on a basinwide scale, an institutional framework conducive to promoting concerted efforts to improve the practices of water resources management among all parties concerned, including local communities in the basin.

Ladies and gentlemen,

The papers and reports before us contain extensive information on the concerns, problems, and approaches to water resources management. The challenge before us is to transform the essence of these various contributions into a framework for action which can be of practical relevance to the developing countries. We sincerely hope that this Workshop will provide an opportunity not only for discussion and mutual learning but also generating recommendations that can be transferred into policy action.

Last but not least, I would like to take this opportunity to express our sincere gratitude and appreciation to ILEC and UNEP for making the necessary collaborative efforts with our Centre in the task of convening this Workshop. Furthermore, our special thanks are due to the Shiga Prefectural Government for all the encouraging support and the warm hospitality accorded to us.

Finally, I can assure you that we, the organizers of the Workshop, will try our best to assist you in achieving the Workshop objectives and also make your stay a pleasant and memorable one. Once again I thank you very much for accepting the invitation to work together with us in this Workshop, and wish you all success in your deliberations. I will follow the proceedings with the utmost interest. With these words, I declare the Workshop open.

Thank you.

OPENING ADDRESS

Tatuo Kira, Chairperson
Scientific Committee of the ILEC Foundation

Dr. Sazanami, Prof. Golubev, Honourable Guests, Distinguished experts,
Dear participants, Ladies and Gentlemen,

I have the privilege of addressing you this morning as the representative of the Scientific Committee of the International Lake Environment Committee, are of the organizers of this Workshop. In this capacity, I would like, first of all, to thank all of you for joining us here, mostly after long flights from distant parts of the world, to take part in this Workshop by presenting resource papers and case study reports and by sharing your valuable experiences with other participants in the discussions. I am also sincerely grateful for our cosponsors, UNCRD and UNEP, for their great efforts in putting this three-year workshop project on to a successful course.

Since the International Lake Environment Committee (ILEC) is still in its infancy when compared with UNEP or UNCRD, please allow me, ladies and gentlemen, to make a brief introduction of this nongovernmental organization. Its origin dates back to 1984, when the first Conference on Conservation and Management of World Lake Environment was held here in Otsu, sponsored by the Government of Shiga Prefecture and attended by 2,500 scientists, administrators, and concerned citizens.

In the keynote address of at the beginning of this Conference, Dr. Mostafa K. Tolba, Executive Director of UNEP, appealed for the creation of an international committee to further the spirit of the Conference that aimed at the rational management of world lakes and their resources. In response to this thoughtful proposal, ILEC was founded in February 1986 with strong support from UNEP, Ex-governor Takemura of Shiga Prefecture and his Government, and the concerned ministries of the Japanese Government. This is why ILEC is located on the shores of Lake Biwa and the first half of this Workshop is being held here.

Taking this opportunity, I would like to express our sincerest gratitude to the Governor Mr. Inaba and the Prefectural Government for the continued support to ILEC and also for the generous help to this Workshop including the mobilization of his staff and the use of this Prefectural Lake Biwa Research Institute.

I am also serving as the Director of this Institute and, for this reason, am particularly glad to offer this auditorium for the Workshop, because this Institute was the first in Japan to declare, as its objective a holistic, basinwide approach to lake management. Needless to say, the basinwide perspective is indispensable for the environmentally sound management of any inland bodies of water, but nevertheless, concrete methodologies for this approach in dealing with actual lake management issues have not yet been established. I eagerly hope that this Workshop will be an important step to attaining this goal.

Among the three objectives of this Workshop, mentioned already by UNCRD Director Sazanami, the third one is closely related to the training component of ILEC's project "Promotion of Environmentally Sound Management of Lakes", which we have jointly launched with UNEP in line with that organization's Programme, Environmentally Sound Management of Inland Waters, abbreviated to the EMINWA Programme, on which Dr. Golubev will speak shortly. In this project, we plan to produce a set of training materials on environmentally sound management of lakes, and these will be one of the major components of the integrated training materials of the EMINWA Programme, which includes training in lake, river, and ground aquifer management.

The resource papers and case study reports to be presented at this Workshop will be an important input to the preparation of training materials. Audiovisual materials used during this Workshop will also serve as an indispensable part of the training material presentation. After the third Workshop, scheduled in 1989, the materials will be integrated into the final version of training materials specifically tailored to meet the needs of water resources managers, planners, and administrators in developing countries.

BRIEF EXPLANATION OF THE PROGRAMME

Ladies and Gentlemen, finally, I would like to remind you of the outline of the first half of this Workshop.

As you see in the programme, the secretariat has taken the liberty of assigning some of you to serve as chairpersons, discussants and/or rapporteurs. Your kind cooperation is greatly appreciated in order for the Workshop to be both efficient and fruitful.

Today and tomorrow will be devoted to the presentation of resource papers.

Presentation and discussion of Japanese Case study reports is scheduled for the third day, Wednesday.

Thursday is a Japanese National holiday and will be devoted to group discussions in the meeting rooms of Biwako Hotel. Workshop participants are requested to divide into three groups for intensive review and deliberation of the issues emerging from the presentations and discussions of the foregoing three days. The chairperson of each group, is kindly requested to prepare a summary of group discussion in collaboration with the rapporteur and group members, and submit it to the secretariat. For suggested topics of discussions, please refer to the programme.

On Friday, following a special lecture in the morning session, a field visit will be made to Nango Weir on the Seta River, which regulates Lake Biwa's water level and outflow from the lake, and to Mt. Tanakami to observe the sustained efforts at, and the present status of, erosion control on the mountain slopes.

On Saturday morning, a plenary session of Part One will be organized, where chairpersons and/or rapporteurs are requested to present the major

findings from the group discussion. This will be followed by open discussion.

I am very pleased to tell you, besides this workshop programme, the staff of this Institute is given opportunities in the Tuesday afternoon, Friday morning and Saturday afternoon, to introduce the ongoing research projects. This Institute was established in 1982 with the aim of providing both citizens and the Prefectural Government with the proper scientific information necessary for decision making and to carry out basic investigations. Observing some of the problems of the lake and its catchment area, I hope these presentations will be of some use to the Workshop deliberations.

On Sunday morning, we will move to Nagoya by chartered bus. In the Nagoya portion of the Workshop next week, presentation of case study papers from other countries, panel discussion, field visits and group discussions are planned. The details will be announced at the beginning of next week in Nagoya.

In closing I would like to again express my heartfelt thanks for your active participation in this Workshop. I believe that the output from the Workshop will successfully delineate the framework of the Second Workshop, which is tentatively planned to be held in Bangkok within a period of one year.

Thank you.

OPENING ADDRESS

Genady N. Golubev, Assistant Executive Director
United Nations Environment Programme

Mr. Chairman, ladies and gentlemen,

It is a pleasure for me to welcome you to Otsu on behalf of the Executive Director on the occasion of the first UNEP/ILEC/UNCRD Workshop on the River/Lake Basin Approach to Environmentally Sound Management of Water Resources.

Water is an infinitely renewable resource and the projected global water demand is unlikely to exceed the potential global supply for a long time to come. The importance of water resources will increase each year as agriculture, industry and other users impose ever greater demands for water. By the year 2000 we might need between two to three times as much water as in 1980. In spite of this, through careful management, everybody may get enough, though if we carry on as we do now, at least 30 countries will experience a scarcity of water.

However, it is misleading to consider water demand and supply at the global level as water problems are inherently local, a locality being a river basin, a country, or part of it. In a number of places there is already an acute water shortage. Fortunately, we have plenty of technical options for solving water problems. More perplexing, yet even more important, is the political dimension.

Of 200 major rivers in the world, almost three quarters flow through two countries and the rest through three or more. Already there are disputes among nations and at least a dozen conflicts are water-related and we can expect that this will increase. Ladies and gentlemen, we can address this challenge through a cooperative spirit. From a technical point of view, environmentally sound water resources management is the only way to boost the quantity and quality of the world's water resources.

A river or lake basin represents a natural unit for management of a resource that recognizes none of the national boundaries. River and lake basins have to be treated therefore, as single units. Activities in one part of a basin can have far-reaching impacts in another part. The river or lake basin, like most natural resources is often a shared resource and needs to be managed in a spirit of cooperation.

We are all aware that this can be difficult when river basins cross political boundaries. The potential for conflict is enormous. But, even more important, the potential for collaboration is also there and must be exploited.

UNEP is promoting the integrated and basinwide approach for river and lake basin management through our EMINWA programme [EMINWA stands for Environmentally Sound Management of Inland Waters].

When trying to introduce this concept to developing countries the United Nations Environment Programme realized that a major obstacle for those countries was a serious lack of trained people. We are therefore most grateful to our partners, ILEC and UNCRD, for assisting us in this workshop to develop a twofold approach. This workshop will directly result in trained personnel, the participants of this workshop, but will go a step further and develop training materials on lake management. This workshop is a follow-up to the UNEP/ILEC/UNCRD Joint Expert Group Workshop on Environmental Planning and Management for Local and Regional Development, which was held here in Otsu and Nagoya in November 1986. An important result of that workshop was the Guidelines for Developing Training Programmes on Environmental Planning and Management for Local and Regional Development, which were focused on inland waters and upon which we based the approach taken for this workshop.

Ladies and gentlemen,

It is UNEP's policy to work through multipliers like you who are attending this workshop, in the framework of our education and training programme. With our limited resources we can only educate and train a relatively small number of people. Once you have increased your knowledge and experience through your attendance at this workshop, it could be desirable if you could organize national training courses for the staff under your supervision when you return home. The training materials to be developed in the course of this workshop will be of assistance to you in this essential work.

Our intention is that the training materials will not be in the form of a text book but more of a user-friendly type, especially designed for those who are not teachers themselves but are willing to train their staff. We are proud that the speakers at this workshop are well-known experts and I am grateful that they have found the time to come here and share their experience.

Let me conclude my remarks by thanking ILEC and UNCRD for their assistance which I am sure will help to make this workshop a real success.

OPENING ADDRESS

Yuji Kurokawa, Director
International Affairs Division
Environment Agency, Japan

Ladies and gentlemen,

I would like to express my congratulations on the opening of this special workshop for the environmentally sound management of lake and river basins.

Lakes and rivers have been of vital importance for fisheries, transport, drinking water supply, agriculture, industry, hydropower and so on. Many towns have been created along lakeshores and river basins as trading posts. Traditionally, each river basin used to be orderly managed as an economic and social unit, set apart from administrative borders, with agreements or unwritten laws to assure appropriate use of water. This traditional system was broken by the increase of industrial activity and modern transportation methods by sea and road, instead of by inland waterways. This development pattern has caused a concentration of industries and population in larger cities located at the estuaries, on the sea coast, and on the lake shore. While on the other hand, development in upstream basins has lagged behind. Such unbalanced growth among regions has greatly aggravated environmental problems.

The Japanese climate is comparatively good. The average rainfall is 1750 mm per annum with mild evaporation, however we still have water shortages in the summer and water quality problems in some regions. Sixty per cent of the total population inhabit only 2.2 per cent of the total land area as a result of post-war urbanization. Water resources have been developed for ricefield irrigation for 2500 years, however industrialization has changed that trend. Urban water demand for households, offices, and factories is now one-third of the total 90 billion cubic meters consumed annually. This demand will increase by 2 per cent per annum, even if the use of recycled water is considered, and will surpass 40 per cent by the year 2000. We already utilize 25 per cent of our potential water resources of 300 billion m³, and further development will be difficult. Japan operates 53 water purification facilities, and 37 desalination plants on small islands. Upstream inhabitants request financial assistance for rural development in exchange for further development of water resources. Depletion of ground water, on which they depend for 30 per cent of their urban water supply, has caused subsidence and salinity. Drainage of inadequately disposed wastewater has contaminated water quality, especially in lakes and bays where pollutants concentrate. The government has created many laws which address such environmental problems, including the Clean Lakes Law of 1984.

Let me now briefly explain the Japanese contribution to other countries. Our government is committed to enhancing economic opportunities steadily despite a large budget deficit. Official development aid for fiscal year 1988 is likely to be US\$ 10 billion to the sharp appreciation

of the yen, making Japan the largest donor country, surpassing the United States. Our agency advocates consideration of the environment in aid projects, and is preparing a policy scheme on global environmental problems according to the UN General Assembly decision of December 1987 on the report of the World Commission on the Environment and Development. In addition, we are cooperating through the Japan International Cooperation Agency (JICA), with Paraguay in the protection of Lake Ipacarai and Lake Dönting.

Now I would like to take this opportunity to make a brief statement on the sponsors of this workshop.

The United Nations Environment Programme has been the focal point of global cooperation in environmental protection. UNEP initiated the Zambezi Action Plan as a model for the Environmentally Sound Management of Inland Waters Programme. The Zambezi River flows through eight countries, and its 100,000 m³ of water sustains 20 million people. I appreciate UNEP's activities in catalysing the United Nations' system-wide efforts and international cooperation in programmes in various parts of the world, including this workshop.

The International Lake Environment Committee is a non-profit organization which has been granted the status of "public service corporation." It is one of the few Japanese public service corporations with a predominantly international orientation. As the participation of NGOs is very helpful in enhancing environmental protection, the activities of ILEC and the support of the Shiga Prefectural Government, which experienced the bitter pollution problems of Lake Biwa, are of much significance.

The United Nations Centre for Regional Development, I believe, is the oldest United Nations organization in Japan. Incidentally, it was established in the same year as our agency -- 1971. Regional and community development are essential elements of water resources management. Sustainable development and environmental protection are inseparable. UNCRD is adding an indispensable perspective to this workshop.

The main significance of this workshop is that the elements of environment, regional and community development, and international cooperation will be integrated in the exchange of views for sound policies and strategies, thanks to the cosponsorship of the three organizations. I hope the eleven days of this workshop will produce fruitful results for all participants.

Thank you.

CONGRATULATORY ADDRESS

Sigeaki Akutagawa, Director General
Department of Civil Life and Environment
Shiga Prefectural Government

Distinguished Experts, Ladies and Gentlemen:

I have the honour to welcome you all to Otsu on behalf of the Shiga prefectural people.

Shiga prefecture is endowed with a rich natural environment. The largest lake in Japan, Lake Biwa, is situated in the centre of our prefecture. Lake Biwa, besides supporting our daily life and industrial activities by way of supplying water resources, has a wide variety of values and functions for pleasure resorts, outdoor sports, and scientific research. Lake Biwa is our most important asset and from it we have greatly benefited. It is therefore regarded as the symbol representing the nature of Shiga prefecture.

The prefectural people have traditionally had a strong interest in the preservation of water quality and other environmental aspects of the lake, and hence we have been carrying out a variety of programmes and projects designed to promote environmentally sound management of the lake.

It is our strong desire to contribute to the international community, particularly in promoting exchange of people and information, by way of making full use of our experiences. It is in this connection that we have cooperated in the establishment and management of the International Lake Environment Committee.

In addition to its beautiful nature, Shiga prefecture has a great number of historic and cultural heritages such as Japanese gardens, Shinto shrines, castles, and religious sculpture. This is due to the fact that Otsu, where this meeting is being held and Shigaraki, which is located close to the erosion control work project site which you are going to visit during the field excursion on Friday, were the sites of the Japanese capital, about one thousand three hundred years ago. Therefore, if the identity of Shiga prefecture is to be expressed in a single phrase, we should say that Shiga is the "country of lake and history."

I wish you all to take this opportunity to get to know Shiga. For those who do not have enough time, please try to come back again and I am sure our people will receive you with open arms.

Finally, it is our sincere hope that this workshop will be fruitful and meaningful to everyone.

Thank you.

OPENING ADDRESS FOR PART II OF THE WORKSHOP

Hidehiko Sazanami, Director
United Nations Centre for Regional Development

Distinguished Experts, Colleagues, Friends, Ladies and Gentlemen:

It is a great pleasure and privilege to welcome you all to Nagoya and to the United Nations Centre for Regional Development. For Dr. White, Dr. Jorgensen, and Dr. Galaziy, I would like to extend a special welcome and would also like to express my sincere thanks for accepting our invitation to take part in the Expert Group Workshop in spite of your very busy schedules.

From this morning we are resuming the sessions of the second part of the Workshop. Let me first take this opportunity to express our sincere gratitude and appreciation for your valuable contributions which made the first part of the Workshop very successful. The papers presented, together with the ensuing deliberations, have clarified to a large extent some of the key issues in environmentally sound management of water resources in a river/lake basin context. I am most grateful to all of you for your commitment and kind cooperation in making this Workshop a productive and rewarding experience for all of us. I sincerely hope that the same spirit of commitment and cooperation will be sustained throughout this week as well.

Now let me briefly introduce you to our Centre, UNCRD. The Centre is a global training and research institution concerned with promoting local and regional planning and development. It was formally established in Nagoya in 1971 through a fund-in-trust agreement between the United Nations and the Government of Japan. As an integral part of the United Nations programme on technical cooperation for development, UNCRD is mandated to assist the developing countries in strengthening their national capabilities in local and regional planning and development. To this end, UNCRD has a wide range of activities which are organized into four areas of concern: Training, Research, Information Dissemination and Exchange, and Advisory Services.

Every year, we offer an International Course on Regional Development Planning. UNCRD's research projects deal with themes and issues which are of particular interest to developing countries for promoting local and regional development. The current priority areas of research at UNCRD include Local Social Development Planning, Metropolitan Development and Management, Information Systems for Urban and Regional Planning, and Regional Development Planning for Disaster Prevention. The main theme of the current Workshop, environmental planning and management for regional development with special focus on water resources, is a major area to which we at UNCRD attach particular significance.

Ladies and Gentlemen:

In this second part of the Workshop we will review and discuss, by way of a case study approach focusing on specific river/lake basins of selected countries, water resources management issues and problems that need to be addressed from a basinwide perspective.

As was discussed last week, a river/lake basin serves as a convenient territorial unit for water resources development and management. Increasing use of land and water resources in the basins however has pointed to the potential conflicts, for instance, between the upstream and downstream areas or between different sectors of the basin community. In most cases conflict situations arise because the development of river/lake basins are promoted with little consideration for the interaction among various activities and/or with little regard to their impact on the overall basin environment.

The conflicts are often aggravated in those basins where rapid population growth is taking place simultaneously with the transformation of rural society on the one hand, and industrialization on the other, which in turn affects the quantity of water in terms of the spatial distribution of water over time, as well as the quality of water. These conflicts point to the need for a basinwide institutional framework capable of managing and optimizing various water-land uses.

Due to the differing physical, social, economic, cultural and political conditions in developing countries, there can be no universal approaches or solutions for these problems. Countries confronted with different water resources management issues require different policies and programmes for water resources management.

In order to better appreciate the country-specific situations in the field of water resources development and management, we have requested the collaborating institutions to prepare case studies. These case studies attempt to analyse the problem structure and causal linkages among factors and forces responsible for water resources management problems and issues with special focus on the following questions:

- (1) What are the crucial water resources management issues and problems the river/lake basin under study is facing?
- (2) What factors and forces have been, or are likely to be, responsible for the emergence of the issues and problems? Who are the main actors involved?
- (3) What are the salient characteristics of the human interaction with the biophysical environment and water resources in the upstream and downstream areas of the river/lake basin under study?
- (4) What are the major impacts, effects, and consequences for the basin community? Who are the most affected? How have they responded, or are they responding, to the impacts, effects, and consequences?
- (5) What actions in terms of planning and implementation have been undertaken by the government in order to respond to the water resources management issues and problems?

(6) To what extent have the government responses been successful?

We believe that these and other questions are crucial in enhancing our understanding of the situation with regard to water resources development and management. Indeed, these questions are crucial components of local and regional development planning. We hope that through our joint efforts, we shall be able to explore and identify effective approaches and solutions to the problems of water resources management in the context of sustainable local and regional development.

Finally, I assure you again that we will try our best to assist you in accomplishing the tasks before you and also to contribute in making your stay a valuable one. With these words, I am pleased to declare open the second part of this Expert Group Workshop.

Thank you all, once again.

CLOSING SPEECH

Hidehiko Sazanami, Director
United Nations Centre for Regional Development

Distinguished Experts, Friends, Colleagues, Ladies and Gentlemen,

First of all, let me take this opportunity to thank you for your valuable contribution to the Expert Group Workshop.

Resource papers presented and discussed last week have clarified some key issues in promoting river/lake basin approaches to environmentally sound management of water resources. Case study reports from selected countries have highlighted the state-of-the-art and some specific issues and problems associated with water resources management. We very much appreciate the efforts of resource paper writers and case study team members.

I am grateful to all of you for frankly discussing issues and problems of our common concern. We have just been presented with reports of the group discussions which have covered a number of topics, and which, I am quite sure, are very relevant not only to our UNCRD-ILEC-UNEP joint project but also to the activities of the respective institutions you are from.

In seeking an environmentally compatible path to development, a broad perspective of the issues is important. A strong public awareness and government commitment are also essential to promote river/lake basin approaches to environmentally sound management of water resources.

The earnestness and enthusiasm, with which the issues and problems were presented and discussed at the Workshop have convinced me that, with your continued cooperation, we can sustain the momentum we have built up over the last two weeks. We, at UNCRD, pledge to make every effort to further promote our joint project.

In closing my remarks, I wish to thank you all again for your strong support and goodwill and look forward to your continued encouragement and cooperation in the years to come.

Thank you very much.

Expert Group Workshop on River/Lake Basin Approaches to
Environmentally Sound Management of Water Resources

Otsu and Nagoya, Japan
8-19 February 1988

PROGRAMME

Venue

Part I (8-13 February 1988): Lake Biwa Research Institute
Otsu, Shiga Prefecture
Part II (15-19 February 1988): United Nations Centre for
Regional Development,
Nagoya

Sponsored by:

United Nations Centre for Regional Development (UNCRD)
International Lake Environment Committee Foundation (ILEC Foundation)
United Nations Environment Programme (UNEP)

Notes

The secretariat has taken the liberty of formulating the programme as well as assigning workshop participants to serve as chairpersons, discussants and/or rapporteurs. In order for the workshop to be both efficient and fruitful, your kind cooperation, particularly in the following, is greatly appreciated:

- (1) Apart from group discussion sessions and round-up discussion sessions, each plenary session in general consists of two presentations with one discussant each to be followed by open discussion;
- (2) Each speaker is kindly requested to restrict his/her presentation to a time allotment of **no more than 40 minutes** and to highlight the major thrusts of his/her paper;
- (3) Each speaker is encouraged to utilize **visual aids** such as OHP or slides. Transparency sheets and colour pens are available at the workshop secretariat;
- (4) Each discussant is kindly requested to restrict his/her presentation to a time allotment of **no more than 10 minutes**;
- (5) Each speaker/discussant is kindly requested to prepare a **summary of his/her presentation/discussion (no more than 1,200 words)** and submit it to the workshop secretariat for typing by the beginning of the first session on the following day; and
- (6) Each rapporteur is kindly requested to prepare a **rapporteur's report** and submit it to the workshop secretariate for typing by the beginning of the first session on the following day.

Bus Service

Bus service between the Biwako Hotel and the Lake Biwa Research Institute (LBRI) will be available as follows:

	Lv. Hotel for LBRI	Lv. LBRI for Hotel
Mon. 8 Feb.	8:20	15:10
Tue. 9 Feb.	8:20	16:50
Wed. 10 Feb.	8:00	17:00
Thu. 11 Feb.	Group discussion will take place at the Hotel	
Fri. 12 Feb.	8:20	-----
Sat. 13 Feb.	----	-----

Part I: Key Concepts and Approaches to Water Resources Management

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Monday, 8 February 1988 Venue: LBRI

9:00- 9:30 Opening Session

MC: H. Kotani
Opening Address: H. Sazanami, Director, UNCRD
Opening Address: T. Kira, Chairperson, ILEC Scientific
Committee
Opening Address: G. N. Golubev, Assistant Executive
Director, UNEP
Congratulatory
Speech: Y. Kurokawa, Director, International
Affairs Division, Environment Agency
Congratulatory
Speech: S. Akutagawa, Director General, Civil
Life and Environmental Department,
Government of Shiga Prefecture

(9:30-10:00 Coffee/tea break)

10:00-12:20 Session 1: Environmentally Sound Management of Water Resources

Chairperson: T. Kira
Rapporteur: R. Newels
Topic: Sustainable Management of Water Resource:
A Basinwide Approach
Speaker: G. N. Golubev
Topic: Sustainable Water Development for
Developing Countries
Speaker: A. K. Biswas
Discussant: J. G. Tundisi

12:20-13:40 Lunch break

13:40-15:00 Session 2: Water Resources Management in a River/Lake Basin Context

Chairperson: H. Sazanami
Rapporteur: F. R. Francisco
Topic: Water Resources Management in a
River/Lake Basin Context: A Conceptual
Framework with Examples from Developing
Countries
Speaker: M. M. Hufschmidt
Discussant: K. Takeuchi

18:30-20:00 Reception at Biwako Hotel
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Tuesday, 9 February 1988 Venue: LBRI

9:00-12:00 Session 3: Environmental Considerations in the Development Process

Chairperson: N. Ginsburg
Rapporteur: D. S. McCauley

Topic: Environmental Effects of Metropolitan
Growth on Water Resources
Speaker: R. L. Ludwig
Discussant: K. Muraoka

(10:20-10:40 Coffee/tea break)

Topic: Integration of Environmental
Considerations into Regional Development
Planning: Focus on Water Resources
Development and Management
Speaker: C. E. Bauer
Discussant: K. Nakagami

12:00-13:30 Lunch break

13:30-16:00 Session 4: Scientific Approaches to Water Resources Management

Chairperson: M. Hashimoto
Rapporteur: R. Newels

Topic: Monitoring and Measurable Indices for
Water Resources
Speaker: T. Goda
Discussant: K. M. Mavuti

(14:50-15:10 Coffee/tea break)

Topic: Hazards and Health Risks from Lakes
Speaker: H. Löffler
Discussant: T. Morioka

(16:00-16:10 Break)

16:10-16:40 Introduction to LBRI Research Projects (I)

Speaker: K. Fushimi

Wednesday, 10 February 1988 Venue: LBRI

8:30-12:30 Session 5: Japanese Experience in Water Resources Management

Chairperson: J. G. Tundisi
Rapporteur: W. Pratoomvieng

Topic: Consideration of Management Systems and
Concensus-Forming in River Basin
Management: the Development of the
"Yahagi River Method"

Speakers: R. Naito and R. Harashima
Discussant: D. S. McCauley

(10:20-10:40 Coffee/tea break)

Topic: Comprehensive Development of Kasumigaura
Lake and its Environmental Management

Speakers: K. Muraoka and H. Harasawa
Discussant: P. E. Pacardo

12:30-13:30 Lunch break

**13:30-17:00 Session 5: Japanese Experience in Water Resources Management
(continued)**

Chairperson: S. Setamanit
Rapporteur: F. R. Francisco

Topic: Lake Biwa Case Study Report of First Year
-- A Historical Review of Resource
Conservation and Exploitation of Lake
Biwa --

Speakers: K. Imai and M. Nakamura
Discussant: S. Sotthibandhu

(15:20-15:40 Coffee/tea break)

Topic: A Soft Approach to Watershed Management:
Case Histories in Japan with Special
Focus on the Transferability of the
Japanese Experience

Speaker: Y. Shimazu
Discussant: A. K. Biswas

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Thursday, 11 February 1988 Venue: Biwako Hotel
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9:00-16:00 Group Discussion

Group I:

Chairperson: M. M. Hufschmidt
Rapporteur: D. S. McCauley

Group II:

Chairperson: A. K. Biswas
Rapporteur: E. Brotoisworo
W. Pratoomvieng

Group III:

Chairperson: M. Hashimoto
Rapporteur: J. G. Tundisi

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Suggested Topics for Discussion

- (1) Need for river/lake basin approaches to water resources development and management;
- (2) Integration of environmental and social concerns into water resources development and management: focus on methodological aspects; and
- (3) Manpower development in the field of water resources management.

Format of Group Discussions

- (1) Workshop participants will be divided into 3 groups for intensive review and deliberation of the issues which have emerged from the presentations and discussions of the previous three days, from 8 to 10 February;
- (2) The chairperson of each group, in collaboration with the rapporteur and group members, is kindly requested to prepare a summary of group discussion and submit it to the workshop secretariat for typing before we leave for field visit on Friday, 12 February; and
- (3) At the plenary session scheduled to be held on Saturday morning, 13 February, each chairperson and/or rapportuer will present the major findings from the group discussion. This is followed by open discussion.

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Friday, 12 February 1988 Venue: LBRI
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9:00-10:00 Special Lecture Session

Moderator: M. Nakamura

Topic: Ecological Principles of Watershed Management
-- With Emphasis on Eutrophication Control --

Speaker: T. Kira

(10:00-10:20 Coffee/tea break)

10:20-12:00 Introduction to LBRI Research Projects (II)

1. Ecological Significance of Lake Shore Systems

1-1 Nutrient Removal by Lagoons around Lake Biwa
Speakers: A. Kurata and T. Kira

1-2 Purification Mechanisms in Sandy Beaches
Speaker: T. Nakajima

2. Interlinkages of Pollution Load Run-off Studies in Lake Biwa
Speaker: H. Fushimi

12:00-13:15 Lunch break

13:15-16:30 Field Visit: Lake Biwa and its Watershed Management

13:15 Lv. Lake Biwa Research Institute

13:30-14:45 Lake Biwa Works Office

- Briefing on the Setagawa weir
- Film show: "A Hundred Years of Sabo and Flood Control Works in the Lake Biwa-Yodo River Basin"
- Observation of the Setagawa weir control system
- Observation of sabo works

14:45 Lv. Lake Biwa Works Office

15:15-15:45 Observation of anti-flood afforestation and sabo works at Tanakamiyama (Sasama-ga-dake)

16:30 Ar. Hotel

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Saturday, 13 February 1988 Venue: LBRI
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9:00-11:00 Session 6: Reporting of the Results of Group Discussion and Round-up Discussion

Chairperson: C. E. Bauer
Rapporteur: P. E. Pacardo

(11:00-11:20 Coffee/tea break)

11:20-12:30 Presentation of African Cases

Topic: Lake Chad
Speaker: M. Sam

Topic: The Status of Lake Kariba
Speaker: C. H. D. Magadza

12:30-13:30 Lunch Break

13:30-15:30 Introduction to LBRI Research Projects (III)

1. Lake Biwa Dynamical Experiment
Speaker: M. Kumagai
2. Cultural Approaches to Environmental Studies
Speaker: Y. Kada
3. Computerized Data Base Systems: The Shiga Prefectural Environmental Atlas
Speaker: Y. Onishi
4. Future Prospects of LBRI
Speaker: T. Kira

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Sunday, 14 February 1988

9:00-12:00 Move to Nagoya by chartered bus
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Part II: Case Study Reports from Developing Countries

Venue: UNCRD, Nagoya

Monday, 15 February 1988

9:30-9:45 Opening Speech H. Sazanami, Director, UNCRD

9:45-12:45 **Session 7: Country Case Studies**

Chairperson: T. Goda
Rapporteur: W. Pratoomvieng

Topic: The Lobo-Broa Ecosystem Study and
 Reservoirs in Brazil
Speakers: J. G. Tundisi and K. Hino
Discussant: C. E. Bauer

(11:05-11:25 Coffee/tea break)

Topic: Environmental Management of the Saguling
 Dam Project
Speaker: E. Brotoisworo
Discussant: M. Nakamura

12:45-14:00 Lunch break

14:00-15:20 **Session 7: Country Case Studies (continued)**

Chairperson: G. F. White
Rapporteur: F. R. Francisco

Topic: Management, Development and Utilization
 of Water Resources in Dian-chi Basin,
 Yunnan Province, China
Speakers: Liu Hongliang, Liu Yeshen, and
 Zhang Jiqiang
Discussant: H. Loffler

(15:20-15:40 Coffee/tea break)

15:40-17:00 Topic: Water Quality Management Issues in
 Relation to Industrial Location and Land
 Use in the Kenyan-side Catchment Area of
 Lake Victoria
Speaker: K. M. Mavuti
Discussant: A. Toda

17:30-18:30 **Reception**

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Tuesday, 16 February 1988

9:30-12:30 Session 7: Country Case Studies (continued)

Chairperson: S. E. Jorgensen
Rapporteur: C. H. D. Magadza

Topic: Basin Approach to Water Resource
Management: A Case of the Laguna Lake,
Philippines

Speakers: E. P. Pacardo and F. Francisco
Discussant: A. Fernandez

(10:50-11:10 Coffee/tea break)

11:10-12:30 Topic: Environmental and Social Effects of the
Proposed Salinity Barrier Project in the
Songkla Lake

Speakers: S. Setamanit and S. Sotthibandhu
Discussant: H. Harasawa

12:30-14:00 Lunch break

14:00:16:30 Round-up Discussion

Theme: Major Issues and Prospects of Water
Resources Management in a River/ Lake
Basin Context in Developing Countries

Speakers: G. F. White
S. E. Jørgensen

Rapporteur: D. S. McCauley

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Wednesday, 17 February 1988

9:30-16:30 Group Discussion

Group I

Chairperson: G. F. White
Rapporteur: D. S. McCauley

Group II

Chairperson: R. L. Ludwig
Rapporteur: M. Nakamura

Group III

Chairperson: J. G. Tundisi
Rapporteur: C. H. D. Magadza

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Thursday, 18 February 1988

8:30-19:30 Field Visit: Yahagi River Basin

- 8:30 Lv. Hotel
- 10:15-11:00 Land development (golf course) project site at Nakadachi, Asume Town
- 12:00-14:00 Lunch at the Visitors' Center of Toyota Motor Corporation
Observation of an industrial waste water treatment plant
- 14:10-14:20 Headwork and intake gate of the Meiji Irrigation System
- 15:20-16:00 Okazaki Park and Okazaki Castle located at the confluence of Yahagi River and Tomoe River
- 16:30-18:00 Reception hosted by the local community in the Yahagi River Basin at "Hasshou" of Meitetsu Okazaki Hotel (0564-23-3111)
- 19:30 Arrive at Nagoya Dai-ichi Hotel

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Friday, 19 February 1988

10:30-11:10 Special Presentation

Chairperson: C. E. Bauer
Rapporteur: R. Newels

Topic: Ecosystem of Lake Baikal
Speaker: G. I. Galazy

11:20-12:40 Presentation of workshop reports

Group I
Group II
Group III

12:40-13:00 Closing of the Expert Group Workshop

Closing speech: T. Kira
Closing speech: H. Sazanami

LIST OF PAPERS

1. Genady N. Golubev Sustainable Management of Water Resource:
A BasinWide Approach
2. Asit K. Biswas Sustainable Water Development for Developing
Countries
3. Maynard M. Hufschmidt Water Resources Management in a River/Lake
David S. McCauley Basin Context: A Conceptual Framework with
Examples from Developing Countries
4. Richard L. Ludwig Environmental Effects of Metropolitan Growth
on Water Resources
5. Conrado E. Bauer Integration of Environmental Considerations
into Regional Development Planning: Focus on
Water Resources Development and Management
6. Takeshi Goda Monitoring and Measurable Indices for Water
Resource
7. Bindu N. Lohani Environment Impacts Analysis of Water
Resources Project
8. Heinz Löffler Hazards and Health Risks from Lakes
9. Masahisa Nakamura Policy Analysis Perspectives in Environmental
Planning and Management in Developing
Countries: Planning Issues and Viewpoints on
the Development of Wastewater Systems---
Learning from the Japanese Experience
10. "Yagagi River Method"
Study Team Consideration of Management Systems and
Renzo Naito Consensus-Forming in River Basin Management
Masamitsu Sugimoto --The Development of the "Yahagi River Method"
Ryoji Harashima
11. Kasumigaura Study Team Comprehensive Development of Lake Kasumigaura
and its Environmental Management:
Part I: Social Surroundings of the Lake
Part II: Various Changes through the Transfer
from Brackish Water to Fresh Water
12. Koichi Imai Lake Biwa Case Study Report of 1st Year
Tatsuya Shingai -- A Historical Review of Resource
Yoji Ito Conservation and Exploitation of Lake Biwa
Toshiaki Kagatsume Environments
Takashi Otsuka
Shigekazu Ichiki
Masahisa Nakamura
Michio Akiyama
Motokazu Ando

13. Yasuo Shimazu A Soft Approach to Watershed Management: Case Histories in Japan with Special Focus on the Transferability of the Japanese Experience
14. Tatu Kira Ecological Principles of Watershed Management --With Emphasis on Eutrophication Control--
15. C. H. D. Magadza The Status of Lake Kariba
16. Jose G. Tundisi The Lobo-Broa Ecosystem Study and Reservoirs in Brazil
T. Matumura-Tundisi
Kozo Hino
M. C. Calijuri
17. Kozo Hino Eletronorte: Environmental Studies and Experiences Developed in the Amazon Region
18. Herman Haeruman Case Study of Saguling Dam / Citarum and Its Upstream Area
Tina Artini
Sudariyono
Wiwiek Wikoyah
Arief Yuwono
Dodi Poetranto
19. Edy Brotoisworo Environmental Management of the Saguling HEPP Project
20. Liu Hongliang Management, Development and Utilization of Water Resources in Dianchi Basin, Yunnan Province, China
21. S. M. Machooka Water Quality Management Issues in Relation to Industrial Location and Land Use in the Kenyan-side Catchment Area of Lake Victoria
D. Mshila
M. Omondi
L. Nyongesa
22. Enrique P. Pacardo Basin Approach to Water Resource Management: A Case of the Laguna Lake
Benjamin J. Bartolome
Floro R. Francisco
Ma. Victoria O. Espaldon
Joel D. Lamanilao
Socorro L. Patindol
Dolora N. Nepomceno
23. Surin Setamanit Environmental and Social Effects of the Proposed Salinity Barrier Project in the Songkhla Lake
24. G. I. Galazy Ecosystem of Lake Baikal

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Nakajima, Takuo	Senior Researcher
Kada, Yukiko (Ms.)	Senior Researcher
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