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NEWSLETTER

INTERNATIONAL LAKE ENVIRONMENT COMMITTEE FOUNDATION

—For Better Lake Management—

This Newsletter is also available in Japanese.

USSR CIP/UNEP/ILEC INTERNATIONAL TRAINING COURSE ON LAKE MANAGEMENT FOR SPECIALISTS FROM LAKE CHAD BASIN

The Lake Chad Basin Management Training course organized by the USSR State Committee for Environmental Protection and the United Nations Environment Programme in association with USSR Academy of Sciences and the International Lake Environment Committee was held in Irkutsk and Leningrad, USSR, from August 29 to September 10, 1989. The eleven participants of the course were specialists of water resources management from Chad, Niger, Nigeria and Cameroon.

Centrally located in the African continent, Lake Chad is shared by Chad, Niger, Nigeria and Cameroon. Due to prolonged drought, the lake, which until the 1960s occupied an area of up to 25,000 sq. km, has since been reduced to an area one-tenth that size leaving the northern half of the lake completely dry. In view of the drastic and alarming changes in the environmental conditions of the basin, UNEP has been promoting projects aimed at the rehabilitation of the lake basin, within the framework of EMINWA project.

The course, which spanned 13 days, was divided into two sessions, and included a cruise of Lake Baykal, as well as a visit to a breakwater construction site in the Baltic Sea.

The first session of training course was carried out in the Limnological Institute, USSR Academy of Sciences located in Listvyanka, a small village on the shore of Lake Baikal, 70 km away from the city of Irkutsk. In the opening ceremony, Dr. Sololov, representing the Centre for International Project(CIP) gave a welcoming address, followed by Dr. El-Habr from UNEP, and Dr. A. Kurata from ILEC. The course was chaired by Drs. L.V. Sokolov and A.V. Leonov, and the official language were English, French and Russian.

At the end of session, plans for the establishment of Baikal International Centre for Fundamental Ecological Research were presented by Dr. Kusner, Jr. S., Deputy Director of Limnological Institute, USSR Academy of Sciences. The Centre will be open for cooperative studies of Lake Baikal problems by scientists from USSR as well as the rest of the world. All present were supportive of the planned research centre.

The second session was held at Hotel Morskaya on the shore of the Baltic Sea in Leningrad.

In the second session, lectures were given, primarily by scientists of Leningrad Limnological Institute, USSR Academy of Sciences.

During the course, questions from participants to the lecturers focused in particular on the problems of African lakes and practical investigation or management methods and counter-measures. Because of the very active response of participants, discussion was often quite prolonged.

A plan to divert water from Congo River to the Lake Chad basin was introduced at the end of the course by Prof. G.N. Golubev. In response, participants pointed out that many difficult multinational problems could be forseen. In order to overcome the conflicts of interest of the countries concerned and execute such a project, the merits and demerits need to be thoroughly analyzed from both natural science and socio-economic viewpoints. Furthermore, the knowledge accumulated through experience in diversion projects throughout the world would need to be provided in fuller detail.

At the end of the course, participants briefly reported on the water resources and the socio-economic conditions of their own countries. At the closing, certificates of the course were presented to each participant.

Lecturers and the titles of their lectures are as follows:

First session

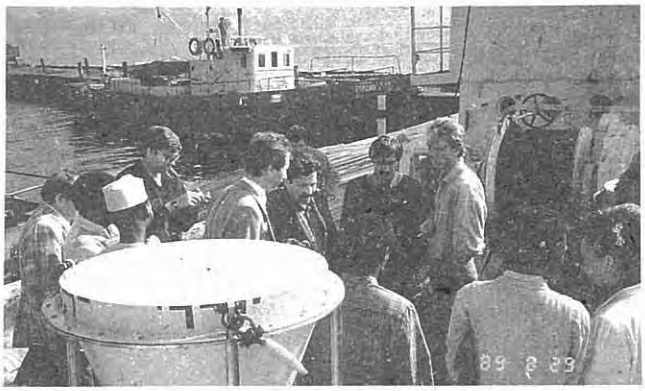
Kozhova, O.M. : "The Lake Baykal Ecosystem"

Mazepova, G.F. : "The Lake Baykal Fauna"

Kurata, A.(ILEC): "Peculiarities and Problems of African Lakes in Comparative Analysis with World-wide Different Lakes"

Chebanov, M.S. : "The System Analysis for the Water Regime of Delta Lakes"

Kusner, Jr. S. : "The Hydrodynamics Models of



Seminar on the ship

Lakes: Theory and Case Studies"

Naumenko, M. A.: "The Frontal Zones in the Large Lakes"

Fialkov, B. A. :"The Geomorphology and the Underwater World of the Lake Baykal"

Ladeishikov, N, P.: "The Climate and Lakes"

Kurata, A. : "A Case Study of Lake Shore Management in Lake Biwa"

Leonov, A. V. : "The Simulation Mathematical Modeling of the Transformation of Phosphorus Compounds in the Freshwater Shallow Ecosystems"

El-Habr, H. (UNEP) : "Approach in the Overall Basin Development: Preparation of Action Plan"

Glushko, E. V. : "The Cosmic Monitoring of the Dynamics of the Desertification in the Flowless Hollow at the Arid Zones (for Aral District as an Example)"

Second session

Petrova, N. A. : "The Main Principles of the Limnology"

Slepukhina, G.D.: "The Lake Zoobenthos and its Role in the Limnological Studies"

Ryangin, S. V. : "Lake Surface Temperature in Depending on Lake Latitude and Lake Altitude above Sea Level"

Koplan-Diks, I. S.: "Antrophogenic Redistribution of Organic and Biorganic Matter from Terrestrial Ecosystems to Water Ecosystems: State, Negative Consequences, Ways of Solution"

Drabkova, V.G. : The Antrophogenic Eutrophication of Lakes"

Trifonova, I.S. : "The Phytoplankton as the Indicator of Lake Eutrophication"

Alimov, A.F. : "Main Results of Studies in the Field of Biological Productivity of Freshwater Ecosystems"

Kondratyev, S.A.: "The Experience of the Watershed Mathematical Modeling"

Filatov,N.N. : "Hydrodynamical Models of Lakes: Theory and Case Studies"

Pozdniakov, D.V.: "The Study of Water Environment by the Method of Active Optical Distance Sound"

Tolokontsev, N.P. : "The Toxiological and Hygiencal Aspects of the Lake and Reservoir Pollution by the Dangerous Compounds"

Levchenko, A.B.: "The Biotechnological Analysis of the Ecological Systems and the Development of the Technology for Increasing of the Ecological Emergency"

Arefiev, A.V. : "Measuremental Systems for Limnological Studies"

Golubev, G.N. (ILEC) : "The World Experience in the Solution of Large-Scale Water Transport Problems (in relation with similar problem for Lake Chad)"

The lists of participants as follows:

Irivboje, O.	Director, Water Resources Divison, Commission du Bassin du Lac Tchad
Diguera, B.	Director, Forestry and Fishery Division, Commission du Bassin du Lac Tchad
Mey, M.	Agro-pastoralist, Commission du Bassin du Lac Tchad
Koumbaye,B.	Ministere du Tourisme, Ndjamena, Chad
Musa, S.N.	Assistant Chief, Irrigation Engineer, Upper Benue River Basin Development Authority, Yola, Nigeria
Ahmed, G.	Assistant Chief, Irrigation Engineer, Upper Benue River Basin Development Authority, Maiduguri, Nigeria
Roger, N.	Chief Bureau des Programmes, Yaounde, Cameroon
Gideon, M.	Assistant Chief, Hydrogeologist Delegation Provinciale Mines, Eau et Energie, Garoua, Cameroon
Bolomiki, M.	Chief Service de L'Hydraulique Rurale, Direction du Genie Rural, Minister Agriculture, Yaounde, Cameroon
Yacouba, B.	Director of Water Resources, Niamey, Niger
Salhatou, H.	Director, Department du Plan, Diffa, Niger

TRAINING COURSE ON LAKE WATER QUALITY MANAGEMENT

As one of ILEC's projects, water resources management workshop/seminars for participants from developing countries have been held since 1987. Thus far, ILEC has developed training materials in the environmental policy field, training modules, etc.

In cooperation with EMINWA project (UNEP), this training course approaches, from a technical standpoint, water quality measurement as it relates to the protection of water quality in lakes. In addition, ILEC's promotion of this training course is strengthened by the support from the Japanese government, in cooperation with UNEP, FAO, and others.

INFORMATION ON THE TRAINING COURSE

Rationale: Lakes are very important as freshwater sources of drinking water, water for farming, fishery, and recreation. These days, in many countries,the value of lake water and the environments around lakes are degraded by inappropriate development. Such development is interfering with social welfare as a result. Especially in developing countries, the authorities attempt to protect lakes as resources, but because of the lack of experience and techniques in the field of environmental protection, the measures devised to deal with these problems are insufficient. This course aims to provide basic knowledge about lake management as well as teach water measurement techniques and operation of measurement equipment, to staff in charge of lake water quality management in developing countries, in order to aid their attempts at water quality protection.

Aims: The purpose of this training course is to provide technical experts (middle-management) with the knowhow needed for lake water quality management, and with basic knowledge about lake water quality management as well as in-the-field water quality measurement technique and operation of measurement equipment.

Objectives: By the end of the training course period, participants will:

(1) acquire basic knowledge on lake water quality management,
(2) learn basic techniques on lake water quality analysis,
(3) accumulate the knowledge needed for successful standard precision analysis,
(4) learn how to properly operate water quality measurement equipment,
(5) learn basic skills relating to laboratory maintenance,
(6) accumulate the expertise needed to properly set lake water quality monitoring points, and
(7) learn lake water quality simulation techniques

Duration: From January 8 to March 16, 1990

Training Institutions: This training course will be coordinated by International Lake Environment Committee Foundation (ILEC) in collaboration with the following institutions and organizations:

(1) National Institute for Environmental Studies (Japan)
(2) Lake Biwa Research Institute
(3) Shiga Prefectural Institute of Public Health and Environmental Science
(4) Japan Environmental Technology Association
(5) Environment Agency of Japan

〈Curriculum〉

The following major subjects will be covered in the seminar:

(1) Presentation and discussion on Country Reports [2 days]

Participants are requested to present a Country Reports.

(2) Lectures and practical training on lake-water management [32 days]
   a. Problems and Issues of Lake/Reservoir Management
   b. Fundamentals of Chemical/Biological Analysis of Water/Sediment
   c. Maintenance of Laboratory Facilities for Water Quality Analysis
   d. Water Sampling and Analysis
   e. Computer Simulation for Water Quality Management of Lakes /Reservoirs
(3) Field Trip [9 days]
   Participants are scheduled to make field trip to visit institutions for environmental studies and several sites of water monitoring projects.
(4) Report writing, presentation, and revision [5 days]
   All participants should complete a report on water monitoring planning based on lectures and field trips by the end of the training course.

CURRICULUM

DATES	SUBJECTS
January 8	Opening and Orientation
9–10	Problems and Issues of Lake and Reservoir, Management and Country Report (I) (Lecture/Presentation)
11–17	Fundamentals of Chemical/Biological Analysis of Water/Sediment (Lecture)
18–24	Maintenance of Laboratory Facilities for Water Quality Analysis (I) (Lecture/Practical Training)
25–7 (Feb.)	Water Sampling and Analysis (Practical Training: Field Survey and Laboratory Work)
February 8–14	Study Tour Lakes, Research Institutes and Manufacturing Firms of Monitoring Facilities (Field Visit/Practical Training)
15–16	Problems and Issues of Lake and Reservoir Management(II) (Lecture)
19–23	Maintenance of Laboratory Facilities for Water Quality Analysis(II) (Lecture/Practical training)
26–2 (Mar.)	Computer Simulation for Water Quality Management on Lakes/ Reservoirs and Use of Water Quality Data (Lecture/Practical Training)
March 5–9	Discussion (Report Writing/Discussion for Evaluation)
12–15	Water-related Culture in Japan (Study Tour)
16	Closing

〈Methodology〉

The training course will be conducted in the form of lectures, discussions, practical training, field trips, etc.

〈Language〉

The training course will be generally conducted in English. All reading materials/information for the course are also written in English.

〈Certificate〉

Participants who have successfully completed the course will be awarded a certificate by ILEC.

* Nomination of applicants and nominee's application are in progress by financially supporting organizations and ILEC.

3rd Workshop/Seminar on River/Lake Basin Approaches to Environmentally Sound Management of Water Resources

The 3rd Expert Group Workshop/Seminar on River/Lake Basin Approaches to Environmentally Sound Management of Water Resources will be held under the joint sponsorship of the ILEC, the United Nations Center for Regional Development (UNCRD) and the United Nations Environment Programme (UNEP), from February 12 to 22 1990, in Otsu and Nagoya, Japan.

This series of workshops is designed as follows:

—to identify and analyze water resource management problems that need to be addressed from lake/river basin basin perspectives.(1st Workshop, 1989)
—to review and analyze the past and present policy responses to the water resources management problems delineated in the 1st year. (2nd Workshop, 1988)
—to identify and delineate strategies as well as ways and means required to improve the policy responses to the water resources management problem area. (3rd Workshop, 1990)

The purpose of the 3rd Workshop is: (1) to review the findings of the third-year case studies and related resource papers undertaken by collaborating institutions and experts; (2) to examine strategies and approaches to water resources development and management in river/lake basin context with special focus on strategies and means required to improve policy responses; (3) to discuss the framework on which results of this 3-year joint project sponsored by ILEC, UNCRD and UNEP are finalized; (4) to suggest, on the basis of the workshop deliberations, follow-up activities of this 3-year joint project that can be adopted by developing countries and related organizations for promoting environmentally sound management of water resources.

The Workshop/Seminar will be organized into two sections.

Workshop Section: Strategies and means of river/lake basin approaches to environmentally sound management of water resources (12-17 February, at Lake Biwa Research Institute in Otsu): Presentation and discussion of resource papers and case study reports from Japan and developing countries; group discussion and summary of findings and policy implications; and field visit.

Seminar Section: Lecture and discussion on the subject of practical application of the findings and results derived from this 3-year joint project; field visit (19-22 February at UNCRD in Nagoya)

Participants of the workshop will include resource paper writers, representatives of the case study team from six countries(Brazil, China, Indonesia, Kenya, Philippines and Thailand), senior administrators and planners involved in water resources management in the developing countries, and members of ILEC, UNCRD and UNEP concerned.

PILOT PROJECT ON LAKE ENVIRONMENTAL EDUCATION

1. Project Outline

Background

It is widely accepted that the acceleration of the destruction of the natural environment as a result of rapid economic development cannot be ignored. Although environmental education is quite advanced in some nations, the call for environmental education in both developed and developing countries is now being heard.

Many of the environmental problems emerging today, such as the destruction of tropical rainforests and global warming are world-wide problems and can be resolved if approached as such. Similarly, many of the problems found in the world's lakes, such as acidification, eutrophication, and ecological destruction caused by soil erosion must be dealt with at the national level, a drainage-basin wide (often international) level, and from the individual level as well. It is therefore clear that the role of lake environmental education is becoming very important.

Objectives

ILEC is initiating a three-year pilot project on lake environmental education (L.E.E.) in three countries beginning April 1989.

Long-term objective

To establish environmental education in the school curriculum, to increase young people's consciousness regarding environmental problems, and to prepare them to assume responsibility for protection of the lake environment in the future.

Short-term objective

To develop a curriculum for primary and junior high school levels, and through testing this curriculum in the class room, to increase student interest and understanding of environmental problems and to teach the importance of individual initiative.

Outputs

Outputs of this project will be as follows:

(1) Increase of environmental consciousness among targeted primary and junior high school students,
(2) Continuing extra-curricular activities by the targeted pupils,
(3) Model lake environmental education curricular,
(4) Teaching materials of lake environmental, education,
(5) Exchange of environmental information among pupils between different countries,
(6) Evaluation reports on the pilot projects in each country,
(7) Curriculum guidelines of lake environmental education on practical basis

The environmental education curricula developed in each of the pilot countries will be made available to their respective education systems for use in the classroom. Furthermore, the results of the project will be evaluated and provided to other countries through international organizations.

ILEC is responsible for selecting the pilot countries for the project, selecting an executive administrator for each country, and assisting economically. Japan, Denmark and Brazil have been selected as pilot countries and the project programs of Japan and Denmark are already underway. The executive administrators are responsible for implementing and maintaining the program in their respective countries, which includes gaining the cooperation of the target schools. Target schools will incorporate the project into their education program and approach it as their own school project. ILEC will be responsible for coordinating a survey of the effectiveness of each school's program and will collect and summarize the results. ILEC will also form a committee of specialists to develop guidelines for a lake environmental education curriculum.

Workplan

April-August,	1989	Settling the institutional framework in pilot countries. (Applied in Brazil in 1990)
September-December		Collecting and exchanging information
January-March,	1990	Developing curriculum
March-June		Experimental classroom implementation
September		Presentation of the evaluation report
February,	1991	Proposal of curriculum guidelines (ILEC)
July-December		Questionnaire evaluation (ILEC)
March,	1992	Final curriculum guidelines (ILEC)

Executive administrators of each country project are as follows:

Denmark	Prof. Sven E. Jørgensen (ILEC Scientific Committee member)
Brazil	Prof. Jóse G. Tundisi (ILEC Scientific Committee member)
Japan	Prof. Tatuo Kira (ILEC Scientific Committee member)

2. The Outline of Pilot Project on Lake Environmental Education: Japan's Case

This pilot project aims to examine possible teaching methods and techniques integrating environmental science into the education program; and to produce teaching materials and curriculum for primary school and/or junior high school pupils. The primary object of study will be the Lake Biwa basin and its river system.

Subjects of Japan's case will be as follows.

(1) Monitoring of acid rain
(2) Observation and survey of eutrophication in rivers which receive domestic waste water.
(3) Joint training to promote pupils participation in the above items, (1) & (2) (pupils experience and mastery of water quality analysis).
(4) Inquiry into pupils' recognition of, and concern for environmental problems.
(5) Development of computer graphic technique for supporting analysis of lake basin environmental condition, and results of their application.
(6) Environmental information exchange among collaborating schools via a personal computer network.

(7) Environmental culture exchange between pilot countries by corresponding, drawing posters/ pictures and describing essays of their impression.

Outputs of Japan's case will be as follows:

(1) Enhanced knowledge by school pupils of the lake ecosystem and lake environmental problems, which will support the adoption of environmentally sound activities in their daily lives.
(2) Enhancement of the local educated manpower in the field of Lake Environmental Education (L.E.E.)
(3) Teaching materials and L.E.E. curriculum prepared for the execution of this pilot project.
(4) Report on the evaluation of this project.

The program will be implemented in four participating schools in Shiga Prefecture between 1989 and the end of 1990.

Institutional Framework in Japan

Shiga Project L.E.E. Executive Committee

Researcher from Shiga Univ.	1
Administrator from Shiga Prefectural Government (Environment Division and Board of Education)	2
Administrator from local government (Board of Education)	2
Principals from four collaborating schools (Public school)	4

Working Group

Researcher from Shiga Univ.	1
Technical Staff from Shiga Board of Education	2
Teachers from four collaborating schools	4
Technical Staff from other public schools	2

4 Collaborating Schools

Kohoku Junior High School and Odani Primary School (Northern Basin)
West-Ritto Junior High School and Daiho Primary School (Southern Basin)

* Executive Committee draws up 1) a working plan for this project and 2) the Japan case report, based upon the school reports.
* Working Group serves as a task force for implementing the workplan, and summarize the results at the four schools into the school reports.
* Participating schools will cooperate in the implementation of the workplan.

BRAIN-STORMING MEETING WITH DR. NAY HTUN

The first brain-storming meeting between Japanese experts and Dr. Nay Htun, Director of UNEP Regional Office for Asia and the Pacific, was held at the International House of Japan in Tokyo on 9 September 1989.

In view of the situation that UNEP activities have not been well known to Japanese scientists and NGOs, this rather informal meeting was arranged to produce useful inputs into UNEP's activities in Asia and the Pacific Region. Together with the Association for Promotion of International Cooperation(APIC), ILEC supported the meeting as one of few NGOs in Japan working with UNEP.

Nine experts covered most of the areas UNEP has been working on: wildlife conservation, human settlement, water resources, marine pollution, forestry, remote sensing and land utilization. Discussion was made on the image of UNEP from the viewpoint of Japanese scientists, suggestions to UNEP on its activities, possible cooperation and joint projects between UNEP and the Japanese academic world.

Participants were: Nay Htun, Hiroyoshi Higuchi (Director, Research Center, Wildbird Society of Japan); Hiroshi Matsumoto(Executive Director, APIC); Mikiyasu Nakayama(Associate Professor, Faculty of Agriculture, Utsunomiya Universty); Shuzo Nishioka (Head, Environmental Management Section, National Institute for Environmental Studies); Hiroaki Ochiai(Professor, Toba National Collage of Maritime Technology); Kazuhiko Ochiai(Professor, Dept. of Forest Resources, Ehime University); Rosenqvist Ake(Institute of Insustrial Science, University of Tokyo); Motokazu Ando (ILEC Secretariat).

APO-SPONSORED TRAINING COURSE

A training course, "Protection Against Environmental Damage caused by Industrial Pollution", sponsored by Asian Productivity Organization with support from the Japan Ministry of Trade and Industry was conducted by Japan Productivity Center from May 28 to June 24, 1989.

The object of the course was to teach methods and techniques of protecting against the social and environmental effects of industrial pollution.

A portion of the course was held in Otsu, under the direction of ILEC and Shiga Prefecture. During that portion, Lake Biwa's condition and water quality presentation measures were introduced, and a field study on the lake was conducted.

The Otsu portion of the course was held from June 12 to 16; and was attended by participants from Bangladesh, Fiji, Hong Kong, India, Indonesia, South korea, Malaysia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Taiwan and Thailand. A total of 19 central and regional government technicians, engineering consultants and private sector environmental engineers participated.

The content of the course included:

1) Industrial pollution problems in Shiga Prefecture
2) Management of the Lake Biwa drainge basin
3) Introduction of Lake Biwa Research Institute and its activities
4) Introduction of Shiga Prefecture's environmental administration structure
5) Introduction of grass-roots level environmental protection activity
6) Field trip to the soil erosion prevention construction site at Mt. Tanakami
7) Visit to wastewater treatment plant in an agricultural village
8) Visit to a food processing plant's wastewater treatment facilities

APO training course

LAKES OF THE WORLD

LAKE KARIBA

Historical Background

Lake Kariba lies on the Zambezi river, bordered by Zambia on the north and Zimbabwe on the south. These two countries were once members of the ill-fated Federation of Rhodesia and Nyasaland, a political configuration of the central African British colonies. The territories comprising the Federation were Northern and Southern Rhodesia and the protectorate of Nyasaland, respectively now called Zambia, Zimbabwe and Malawi.

After the constitution of the Union of South Africa, the British Government sought an administrative structure that would unite its remaining central African territories of Northern and Southern Rhodesia and Nyasaland. Consequently in the early 50's the British Government proposed the Federation of Rhodesia and Nyasaland.

The two major activities that were to be the economic backbone of the Federation were to be the exploitation of Northern Rhodesia's then vast copper resources and the white settler dominated agriculture of Southern Rhodesia, based on Nyasaland cheap labour. The capital gains benefits from this economic base would finance secondary industrial development in Southern Rhosedia and the trickle down effects would in turn benefit the less developed northern territories.

With this perspective the British Government was convinced that under the technical leadership of the white settlers in the region the political merger would result in economic complementality of the three territories to give the necessary climate for economic and political development.

In order to develop the region's industrial potential the Federal Government realized that it needed to develop the energy resources of the region. Hydroelectric power was the obvious answer and a survey of the hydroelectric potential of the area was undertaken. This survey idetified the Kafue Gorge, on the Kafue River, a tributary of the Zambezi river, as a suitable site for developing hydroelectric power generation.

However since the Kafue river was located in Northern Rhodesia, the white dominated Federal gavernment was timorous of investing in such a vital resource in a country that was bound eventually to be under a black government. Thus an alternative site that satisfied both the technical requirements of large hydroelectric power generation capability as well as allaying the apprehensions of the political interests of the white Southern Rhodesian settlers had to be found. Thus was born the Kariba Hydroelectric project, on the Zambezi River, a boundary river separating Northern Rhodesia and Southern Rhodesia.

To manage the project both in the construction and operational phase an international company, the Central African Power Corporation (CAPCO) was formed. This company was jointly owned by the participating countries, but the bulk of the company's physical assets were located in Southern Rhodesia. Thus at the break-up the Federation, CAPCO found itself owned by two mutually hostile countries, independent Zambia with a black popular government and a racially torn Rhodesia, besieged by an escalating liberation war. This situation greatly reduced CAPCO's effectiveness as the main executive agency for the hydroelectric power development on the Zambezi.

In the early 70's Zambia, which then had instituted its own agency for developing its energy requirements (the Zambia Electricity Supply Commission), unilaterally decided to develop the north bank generating capacity with deference to CAPCO, to guard against industrial blackmail by the Rhodesian rebel government.

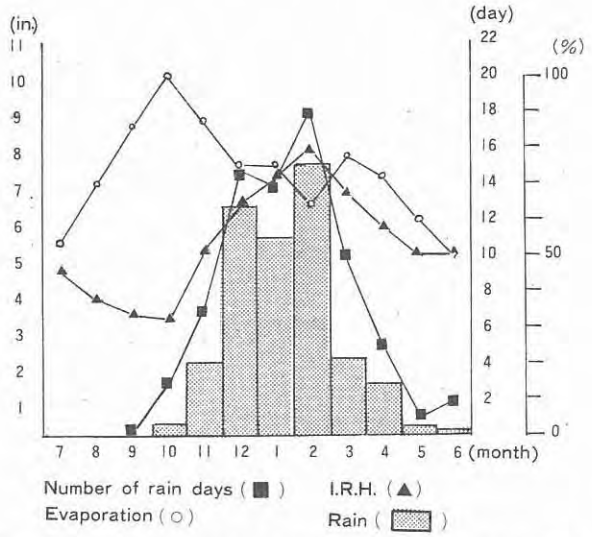
In summary, the Lake Kariba hydroelectric plant now consists of two plants independently owned by Zambia and Zimbabwe, and jointly administered through the Zambezi River Authority.

The Zambezi River Catchment

The Zambezi river is the most dominant ecological feature of southern central Africa. It encompasses an area of 1,193,500 km^2. This catchment includes a variety of climatic types from semi arid savanna through subhumid to humid montane types. It's main tributaries are the Kafue River and the Luangwa River, both in Zambia, and the Shire River from Lake Malawi, and several other streams from Zimbabwe. The main Zambezi River starts from a swamp on the border between Zambia and Zaire, at an elevation of 1400 m above sea level to travel 2,224 km to the Indian Ocean. Along this course it traverses a number of geological formations.

According to the distribution of fish species (Jubb, 1961) the Zambezi River can also be divided into three main ecological reaches demarcated by geological fractures which give rise to the impressive Victoria Falls

Lake kariva



and the Cabra Bassa gorge rapids. The three ecological zones are designated as follows:

1. The upper Zambezi, comprising the headwaters of the Zambezi River to the Victoria Falls.
2. The middle Zambezi, comprising the reach between Victoria Falls and Cabora Bassa rapids.
3. The lower Zambezi, extending from the Cabora Bassa gorge to the Indian Ocean.

The Gwembe Valley

The present Lake Kariba lies in the Gwembe valley which has been partially submerged by the lake. Like its remnant sister valley in the Mana Pools area there were a number of terraces which could be recognized, the upper terrace consisting of dry savanna woodlands, largely of Colophospermum mopane, while the lowermost terraces consisted of riverine gallery forest bounded by flood plains that were annually inundated by the Zambezi flood waters.

Climate

The Gwembe valley lies in an area of central Africa which due largely to its low elevation is semi arid. Figure summarizes the local climate of the area. It has a mean rainfall of 600 mm, mainly confined to the months of November to March, high evapotranspiration and a cool season to warm season temperature range of 22 C to 30 C. During the warm season day temperatures in excess of 40 C are not uncommon. As figure indicates, for most of the year evaporation exceeds precipitation.

C.H.D Magadza
University Lake Kariba Research Station
Extracted from "Lake Kariba-Case Study of a Man Made Lake" by Prof. C.H.D. Magadza

RECENT PUBLICATIONS

—ILEC PUBLICATIONS —

[ ]"Survey of the State of World Lakes." -Interim Report Vol.1, 1988 edited by LBRI and ILEC. US$ 70

[ ]"Guidelines of Lake Management." Vol. 1 : Principles of Lake Management, 1989 edited by S.E. Jørgensen and R.A. Vollenweider US$ 10

[ ] "Report of the UNCRD/ILEC/UNEP Expert Group Workshop on River/Lake Basin Approaches to Environmentally Sound Management of Water Resources." February 1988, Nagoya and Otsu US$4

[ ] "Report and Summary of the UNCRD/ILEC/UNEP Joint Expert Group Workshop on Environmentally Planning on Management for Local and Regional Development: Focus on Training Aspects Derived from Studies of Inland Water Management." November 1986, Nagoya and Otsu US$ 4

—OTHER PUBLICATION—

[ ] "International Journal of Water Resources Development." Vol.4, No.4 December 1989 -Special Issue: "River/Lake Basin Approaches to Environmentally Sound Water Resources Management."
Guest editors: Hidehiko Sazanami and Tatuo Kira, published by Butterworth Scientific Ltd. US$ 14

* ILEC will offer above publications free of charge to qualified applicants from developing countries. Postage and bank charges must be covered by the applicant.

* Publications mentioned above have been released and are available from the International Lake Environment Committee Foundation. All prices are exclusive of postage and bank charage. Please complete this form and send to:
ILEC Foundation Secretariat,
3-4-22 Kyomachi, Otsu, Shiga 520, Japan.

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* ILEC will accept neither credit cards nor personal check.

Guidelines of Lake Management

FORTHCOMING MEETINGS

INTERNATIONAL SEMINAR EDUCATION AND TRAINING IN WATER RESOURCES IN DEVELOPING COUNTRIES

The aim of the seminar is to assess the requirement of man-power, education and training in the water resources sector up to the year 2025 in the developing contries.

Date : 12-16 December 1989

Place : Water and Land Management Institute (WALMI), Aurangabad, Maharashtra State, INDIA

Contact : C. V. J. Varma
Organizing Secretary
International Seminar on Education & Training
Central Board of Irrigation and Power
Malcha Marg, Chanakyapuri, New Delhi-110021, INDIA
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Telex; (81)(31)66415 CBIP-N

THE SYMPOSIUM ON THE ECOLOGY OF MANGROVES AND RELATED ECOSYSTEMS

The aim of the symposium is to compare current research and to review the status of present-day knowledge on biological, chemical and physical aspects on mangroves, related ecosystems and their utilization.

Date : 24-30 September 1990

Place : The University of Nairobi; MOMBASA-KENYA

Contact : Dr. E. Martens, Department of Zoology, University of Nairobi, P.O.Box 30197, NAIROBI-KENYA.
Tel: (254)(2)43181 up to 43192,
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INFORMATION

A full time two year M. Sc. course comprising of four semester in Limnology has been offered at Bhopal University since 1980. The outline of the course is as follows:

First Year (Pure Limnology):
1st semester : General & Physical Limnology, Ecology & Biostatistics
2st semester : Limno-Chemistry, Limno-Biology
Second year (Applied Limnology)
3rd semester : Limno-Microbiology, Aquaculture
4th semester : Biochemistry & Waste Water Treatment, Public Health & Lake Management

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CALL FOR ARTICLES

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ILEC

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