RIVER AND LAKE BASIN DEVELOPMENT-ORIENTATED ECOLOGICAL CUM-ENVIRONMENTAL ISSUES FOR PRIOR CONSIDERATION

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The development of river and lake basins, especially in tropical Africa, should consider, as basic, the ecological-cum-overall-environmental conserving strategies. These aspects have to be integrated in the intended planning cycle and should be closely monitored for their proper operation at the various stages of the planning process.

The planning process itself normally consists of a series of steps or phases which are usually in the form of a cycle. This makes it easier to manoeuvre forward and even backward, as the planning process may require. For example, the first phase relates to the decision to adopt planning, and the relevant planning method(s) to apply. This has a cycle of its own, with a relatively long time-span. During this time the administrative methods and techniques are reviewed and both the education and professional organization of planners are considered afresh.

In the second phase the various appropriate agencies formulate goals and identify the planning objectives. This step also includes clarifying the ways in which development planning should relate to other forms of communal action.

The third phase considers possible courses of action with the aid of models of the overall environment, with special emphasis on ecosystem conservation. These models are used to ascertain that the selected planning system favours ecosystem-conserving development (or

eco-development) principles. Such studies should be seen to demonstrate how the planning system, as a whole, might behave as it changes through time under the influence of a variety of factors. These factors arise from private actions and both public activities and interventions.

Phase four is essentially concerned with the evaluation of phase three courses of action in order to select an operational course. This is selected by reference to assumed social values and estimated costs and benefits.

The fifth phase is to implement the plan. This step includes both direct works and continuous control of public and private proposals for change. This is to facilitate closer study of the impact on the system of proposed changes in order to observe whether or not they deflect the system from the course charted for it in the plan.

As the planning process continues it should become evident that the plan must be reviewed along with its control mechanisms, from time to time. Firstly, the plan should be reviewed in minor ways at shorter intervals and, secondly, in major ways at longer intervals. This is because we are, here, handling a probabilistic system, where changes cannot be foreseen with certainty.

During the sixth, and last phase our review should consider:

(a) specific proposals which are different from those expected;
(b) changes in the political, social and economic contexts in which the plan operates which generate new needs, desires and aspirations in community members.

In this manner, the planning process cycle returns to phase two and, periodically, also to phase one. However, if a plan is not carefully checked for its feasibility and internal consistency, it could lead to frustration and eventually disaffection with planning and

planners. Moreover, if plans are to be anything to go by, then they have to be translated into effective policy instruments, such that the plan objectives are achieved.

In other words, the principal guidelines and goals of macro-economic planning must be articulated in a series of well-coordinated and carefully designed and evaluated individual development projects. These will thereby form, the "guts" of the relevant drainage basin development plan. The micro-economic planning level should deal with the selection of individual projects.

Above all, competent planners should be able to recognise short-run problems as they arise and, be prepared to solve them without losing sight of long-run objectives. This is necessary since if short-run problems turn into crises then it will not be possible to attain the long-run objectives.

I IDENTIFICATION AND SIGNIFICANCE OF DEVELOPMENT-ORIENTATED DRAINAGE BASIN ECOLOGICAL ZONES

For purposes of river and lake basin development planning, development-based ecological analysis is absolutely vital. Such analysis emphasizes both the general distribution and, especially, the patterns of organisms. This includes both plants and animals, including man, and is thus, "human ecology".

Such patterns of life both,(a) relate to a range of scales, from organism to community and,(b) reflect the continuously changing mosaic of organisms residing in any given area, such as a drainage basin. Thus, the study of living organisms within their controlling physical, chemical and biological environments, actually investigates ecological systems, or simply, ecosystems.

An ecosystem is an ecological unit, including all its varied

organisms, which exists in reasonable equilibrium within a specific (larger) community in a given area. The varied organisms interact among themselves and with their controlling environments so that a flow of both energy and nutrients leads to clearly defined (a) nourishment structure (trophic levels) and,(b) nutrients (and materials) are exchanged between the living (biotic) and non-living (abiotic) components within the systems.

Since ecosystems exist at varying scales, a self-contained forest may be regarded as a good example of a large-scale ecosystem. A swamp, such as the Yala swamp, is here regarded as an example of an intermediate-scale ecosystem, whereas a fish pond may be regarded as a small-scale ecosystem.

The delimitation of development oriented ecological zones in river or lake basin and, hence, the demarcation of land potential, takes advantage of combinations of such ecological factors as:

(a) Surface configuration characteristics;
(b) Meteoro-climatic (or synoptic climatological) conditions; especially precipitation effectiveness or moisture index,
(c) Mosaics of organisms, particularly the plant communities, as ecological indicators for development planning;
(d) Soil conditions (fertility-based).

One of the many objectives behind demarcating development-oriented ecological zones is to facilitate regionalization of drainage basins for purposes of planning ecologically self-sustaining development. As hinted at earlier, this approach encourages conservation-based agro-forestry and related ecosystem-preserving and improving natural processes. These are often referred to collectively as eco-development. This approach also takes advantage of those eco-development characteristics which investigate and utilize tried and reliable ecological indicators (such as plants and animals).

Thus, practical over-all environmental geography (especially applied ecological geography) should be fully encouraged where human activities, such as agriculture, manufacturing and service industries are established. Utilization should be geared to the eco-development of the pertinent resources within the relevant ecological zones. This should all take place within the economically regionalized drainage basins-concerned.

II ASPECTS OF THE ENVIRONMENT FROM WHICH WE NEED PROTECTION

There are a number of overlapping adverse aspects of the environment, some of which are the result of human activity, and others not. These include:

(a) Overpopulation, including the resulting noise, poor health due to overcrowding and inadequate housing, and the population bomb;
(b) Disease vectors, communicable diseases and pests;
(c) Pollution of water resources and general eutrophication;
(d) Inappropriate disposal of faeces and waste-waters;
(e) Pollution of the atmosphere, including automobile fumes;
(f) Solid waste pollutants, including human-discarded disposable waste and other aesthetic dumping, such as unsightly posters, etc.;
(g) Contaminated food;
(h) Ionizing radiation from all sources, natural or artificial, including electromagnetic energy in the ultraviolet range, visible light, laser, adverse radio and television frequencies and micro-wave hazards, all manner of radio active substances, nuclear fission;
(i) Heat and sound pollution;
(j) All polluting natural and man-made features;
(k) Dangerous chemicals, including insecticides and aerosols;
(l) Ecological upsets of all kinds;
(m) Chemical and biological warfare;

(n) Acid and alkaline rain;
(o) All other adverse impacts of man on nature;
(p) All adverse effects of urban centres on the environment;
(q) All use of technology adverse to the environment, et cetera.

The above and many other adverse aspects of the environment should be approached from the environmental management viewpoint. However, the development of any river or lake basin is likely to be confronted with a number of the above adverse environment aspects from which protection is imperative.

BASIC CONCEPTS OF DRAINAGE BASIN ENVIRONMENTAL MANAGEMENT

"Environmental management" is the conscious and systematic effort to establish an aesthetically pleasing, economically viable and physically healthy environment. In other words, environmental management involves the modification of human activities to minimize the negative impact and, where possible, improve the quality of mankind's physical environment, particularly the air, water and terrestrial components.

Environmental management methodology can vary from partial to complete prohibition of certain activities, such as the discharge of toxic substances into the air, onto the land and into water bodies. Moreover, the prohibited human activities may range from uncontrolled public disposal of trash by individuals to large-scale daily emission of pollutant gases by industry, to the polluting emissions from the millions of air, water and land "motorists".

Since environmental management is the art and science of managing mankind's activities to minimize their effect on the natural environment, it is obviously important for our modern society. It is involved in ameliorating, or solving outright, a series of man-made problems in the

environment. These problems include water and air pollution, noise and thermal pollution, liquid and solid wastes, ionizing radiation, ultra-violet electromagnetic energy, hazardous types of laser energy and dangerous radio frequencies and micro-waves. While committed to controlling, the above man-made environmental problems, environmental management does not merely require the application of natural and social sciences. Environmental management also must include, a spark of inspired creativity. In order to achieve this, the environmental manager should not only be able to manipulate both the social institutions and appropriate technologies, but must also be seen to do this with the sensitivity of an artist, the insights of a poet and, perhaps, the moral purity and determination of a religious zealot.

In contemporary societies, problem-solving aspects of environmental management imply applying the scientific approach to specific objectives encompassing the entire dimensions of the environmental problems. In order to function best, such problem-solving must be based not only on a methodology for approaching and coping with the environmental problems. It must also be supported by a legal and governmental apparatus suitable for promoting the solutions of the problems. Thus the ecological basis of our physical environment must be fully explained in order that "cause-and-effect" relationships of man's actions can be comprehended and, to some extent, predicted.

It is vital that each class of environmental problems be treated in some detail. In this way the dimensions of problems and their resource background are adequately examined and explained in order to provide a sense of their priority. Subsequently, the appropriate technologies, relevant laws, social institutions and other resources available which may provide a more stable and high-quality envirvonment in each class of environmental problems must be fully examined.

It is also wise to use two vital tools of environmental management, namely public information and environmental education. Moreover,

in order to ascertain the continuity of the environmental management profession, there is a need to establish training opportunities for individuals seeking professional careers as environmental managers.

Amongst many other environmental management themes not listed here, one is most pertinent for our purposes. This is the theme which expresses a profound distrust for technology as it is used in our modern society. This attitude very often regards technological devices more as fetishes or symbols, rather than tools to be used with care. Thus, we are likely to forget that machines, including computers, are inanimate and merely move as controlled by external forces. Yet technology provides the material foundation of our modern society, for without modern technology, our population would starve, freeze or perish from the myriads of pests and diseases. However, while the wide use of technology is advocated, the practice should proceed with due caution based on environmentally well-informed application.

Environmental management, as a profession, has numerous predecessors, including, public administration, environmental health, sanitary or environmental engineering and urban and regional planning. However, it has in recent years developed a separate and quite distinctive identity or personality. This is especially true since public agencies have expanded the implementation of new environmental laws passed at the various government levels. What would appear to be somewhat vague still are the responsibilities of the environmental manager. The latter need to be spelt out more fully, so that they do not merely cover such natural aspects as air, noise and water pollution. There are also other important aspects of environmental management such as historical relics preservation, open space, population and wildlife management and land use. Energy, radiation, health, aesthetics, mass transportation, housing, recreation, streets and highways, education, economic development and employment, and public safety and welfare, also relate to environmental management.

The priority varies depending on whether one is dealing with the urban, rural-urban or purely rural setting. For example, a river or lake basin authority dealing with a tropical drainage basin significantly affected by some world-wide environmental situation such as the Chernobyl nuclear reactor disaster which caused radio-active dust fall out, would have its own specific priorities. Thus, one implication of this rather broad scope of environmental management is that the managerial talent trying to solve the relevant environmental problem must have equivalent breadth and special capability to synthe-size the diverse technical know-how and related materials.

In fact, one of the most complex challenges facing experi-ments in environmental management is "the translation of technical plans into ordinary layman's words that can be easily understood and used by the decision-makers". This dilemma is often aggravated by a serious shortage of trained or professional managers able to cope with environmental management problems.

The objectives of environmental management have been defined mainly by widespread public conern with a set of environmental conditions considered as "problems", such as those listed earlier under "Aspects of the Environment from which we need protection". For example, interest in drainage basins in tropical Africa has been aroused due to tangible concerns like acid or alkaline rain such as caused by the Webuye Paper Mills in the Lake Victoria Basin of Kenya. Reports of health effects from pollutants in the atmosphere and in water, includ-ing factory effluent and oil spills is another public concern, as is disappearing rural landscapes due to urban sprawl. Other existing and, potential problematic environmental conditions are somewhat vague. For example, there are speculations about the effects of possible climatic changes, such as rising temperatures due to increased carbon dioxide content of the atmosphere due to increased use of fossil fuels.

Although, there are several levels of causation, attention is normally drawn to the immediate factors. However, underlying these factors are the public values, attitudes and the politics of ecology which have resulted in and perpetuated the undesirable environmental conditions.

Environmental management, which also incorporates environmental protection, demands conscious efforts by the individuals living and working within the environment to maintain high quality conditions. Resources must be diverted from other uses to provide the necessary environmental protection. Consumer products must be re-designed and, in some cases, not produced at all in order to promote the desired environmental conditions. Habits must be changed to the same end. Moreover, expectations and living standards must be adjusted.

It is the above vital issues that must be carefully researched and adequately addressed in order to realize genuine environmental management.

IV ENVIRONMENTAL MANAGEMENT METHODOLOGY: PROBLEM-SOLVING APPROACHES

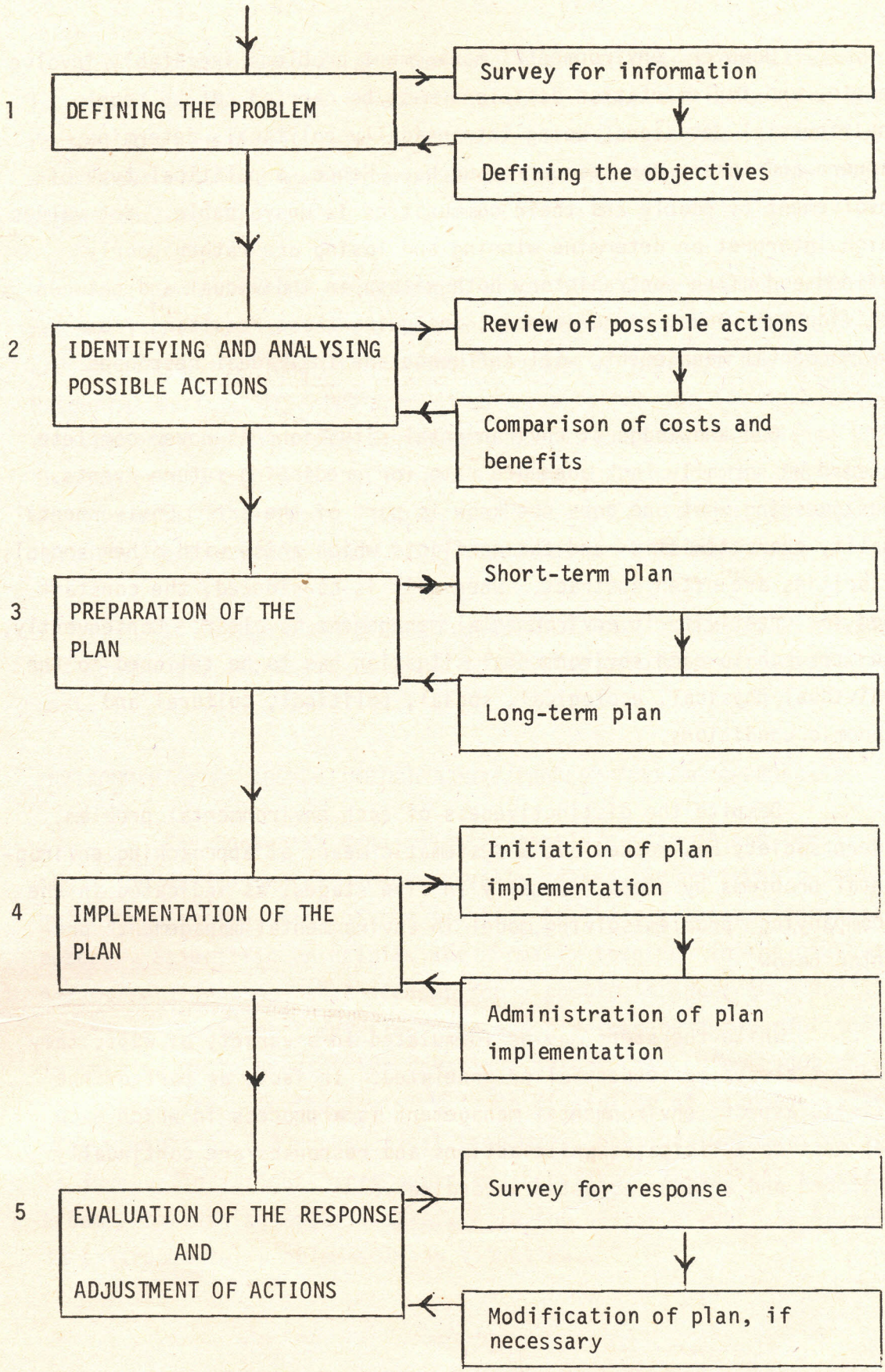
Environmental management is partly a science and partly an art. The environmental manager usually solves, or preferably prevents by prior planning, many of the problems that are of an environmental nature. Scientific principles are normally involved in the cause-and-effect relationships that account for a problem's appearance and its solution. Computer simulation, for example, can be a powerful tool in helping us to predict the behaviour of natural bodies (such as rivers and lakes, etc. In the social science discipline of economics, the field of econometrics (or mathematical economics) provides methods leading to invaluable insights into costs and benefits. In general therefore, a comprehensive scientific approach is the best procedure to be applied in environmental problem-solving situation.

However, environmental management problems inevitably involve people, and implementation decisions must be carried out by people. Environmental decisions, being intrinsically political, determine winners and losers for scarce resources. Hence, a political type of involvement by people and their communities is unavoidable. Yet values which interpret or determine winning and losing are rather poorly defined and often contradictory both within an individual and between individuals. Thus, circumstances, including those resulting from environmental management, will influence the individual responses.

Our knowledge of environmental situations is never complete because we normally lack adequate data for predicting future events. Thus guessing what one does not know is part of the art! Environmental quality characteristics and the conflicts which arise with other social priorities are often abstract. When this is considered, the constant need for creativity in environmental management is clear. Consequently, the approach to each environmental situation has to be tailored to the individual physical, ecological, social, political, cultural and economic conditions.

Despite the distinctiveness of each environmental problem, modern society has worked out a systematic means of approaching environmental problems by steps, normally in five stages, as indicated in the accompanying "problem-solving model in environmental management" presented below.

While the steps may be formulated in a variety of ways, they need not always be sequential or unrelated. In fact, as part of the artistic aspect, environmental management is a process in which each step must be anticipated while actions and responses are continually monitored and actions adjusted accordingly.



Problem-solving model in environmental management

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