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# Integrated Water Resources Development and Management[1]

Dorota Z. Haman and Donald A. Brown[2]

## THE RELEVANCE OF CHAPTER 18 OF THE AGENDA 21 FOR STATE GOVERNMENTS

PROTECTION OF THE QUALITY AND SUPPLY OF FRESHWATER RESOURCES: APPLICATION OF INTEGRATED APPROACHES TO THE DEVELOPMENT, MANAGEMENT AND USE OF WATER RESOURCES

## INTRODUCTION

In 1987, the UN World Commission on Environment and Development linked the issue of environmental protection to global environmental economic growth and development. Headed by Norwegian Prime Minister Gro Harlem Brundtland, this commission published the report Our Common Future. The Brundtland Commission report concluded that the world was threatened by extraordinarily serious global environmental problems, caused in large part by development patterns that were leaving increasing numbers of people poor. Scientific evidence demonstrated rapid destruction of air, water, species of flora and fauna, deserts, forests, and other ecosystems as well as overuse of natural resources.

It is predicted that the world population will more than double during the next century. As a result, a new development pattern is required for the entire planet that would "sustain" human development. The Brundtland Commission report thrust the concept of "sustainable development" into the mainstream of world debate, as the only manner to confront the twin problems of environmental degradation and necessary economic development.

The need for sustainable development applies to both developing as well as developed nations of the earth. The developing world needs sustainable development to avoid the environmental destruction entailed by moving billions of the poorest people on earth to basic levels of human health and dignity. The developed nations must move to sustainable development to avoid environmental catastrophe entailed by the developed world's depletion of natural resources and its destruction of air, water, and the natural environment.

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2. Dorota Z. Haman, Associate Professor, Agricultural Engineering Department; Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville FL 32611, Donald A. Brown, Pennsylvania Representative at the Earth Summit, Commonwealth of Pennsylvania, Department of Environmental Resources.

In December 1989, the General Assembly of the United Nations called for a meeting of all the nations of the Earth to confront the twin problems of environmental destruction and the necessity for sustainable development. The United Nations Conference on Environment and Development was set for June of 1992 in Rio de Janeiro, Brazil.

The Rio Earth Summit was the largest international meeting in history. During the meeting five documents were signed. The first two, the Conventions on Climate Change and Biodiversity, received most of the publicity in the United States, largely because of the role played by the United States in perceived weakening of the first and the refusal to sign the second. Other documents signed at Rio were the Rio Declaration, a non-binding set of 27 principles that deal with the rights and responsibilities of nations relating to environment and development, and Forest Principles Agreement, a nonbinding statement of principles for the sustainable management of global forests. Not widely publicized in the United States was the main substantive work of the Earth Summit, Agenda 21, the fifth document signed at Rio.

Agenda 21 is a comprehensive blueprint for global action into the 21st century designed to solve the twin problems of environmental destruction and the necessity for sustainable development. It is an 800 page document comprising four sections and 40 chapters. Agenda 21 is based on the notion that humanity has reached a defining moment in its history. The nations of the earth cannot continue present policies that deepen economic divisions between rich and poor and that are causing the continued deterioration of the ecosystems on which we depend for life on earth. If the peoples of the world are to avoid environmental catastrophe they must move to implement policies and practices of sustainable development.

Even though Agenda 21 is not binding on the signatory nations, it is expected to work as a set of normative principles that will determine appropriate international behavior in the next century. A new commission on sustainable development has been set up in the United Nations to review the efforts of the nations of the world to implement Agenda 21. In agreeing to Agenda 21, the nations of the earth have agreed to develop plans implementing Agenda 21 at the national, state, and local level. Agenda 21 calls for 2,500 specific actions.

Agenda 21 addresses the pressing problems of today and also aims at preparing the world for the challenges of the next century. It reflects a global consensus and political commitment at the highest level on development and environment cooperation. Its successful implementation is first and foremost the responsibility of governments. National strategies, plans, policies, and processes, are crucial in achieving this. International cooperation should support and supplement such national efforts. In this context, the United Nations systems has a key role to play. Other international, regional, and subregional organizations are also called upon to contribute to this effort. The broadest public participation and the active involvement of the non-governmental organizations and other groups should also be encouraged.

The program areas that constitute Agenda 21 are described in terms of the basis for action, objectives, activities, and means of implementation. Agenda 21 is a dynamic program. It will be carried out by the various actors according to the different situations, capacities, and priorities of countries and in full respect of all the principles contained in the Rio Declaration on Environment and Development. It could evolve over time in the light of changing needs and circumstances. This process marks the beginning of a new global partnership for sustainable development.

Freshwater resources are an essential component **of the earth's** hydrosphere and an indispensable part of all **terrestrial** ecosystems. The freshwater environment is characterized by the hydrological cycle, including floods, and droughts, which in some regions have become more extreme and dramatic in their consequences. Global climatic change and atmospheric pollution could also have an impact on freshwater resources and their availability and, through sea-level rise, threaten low-lying coastal areas and small **island** ecosystems.

Water is needed in all aspects of life. The general objective is to make certain that adequate supplies of water of good quality are maintained for the entire

population of this planet, while preserving the hydrological, biological, and chemical functions of ecosystems, adapting human activities within the capacity **limits** of nature and combating vectors of water-related diseases. Innovative technologies, including the improvement of indigenous technologies, are needed to fully **utilize** limited water resources and to safeguard those resources against pollution.

The widespread scarcity, gradual destruction and **aggravated pollution** of freshwater resources in many world regions, along with the progressive encroachment of incompatible activities, demand integrated water resources **planning** and management. Such integration must cover all types of interrelated freshwater bodies, including both surface water and groundwater, and duly consider water quantity and quality aspects. The multisectoral nature of water resources development in the context of socio-economic development must be recognized, as well as the multi-interest utilization of water resources for water supply and sanitation, agriculture, industry, urban development, hydropower generation, inland fisheries, transportation, recreation, low and flat lands management, and other activities. Rational water utilization schemes for the development of surface and underground water supply sources and other potential sources have to be supported by concurrent water conservation and wastage minimization measures. Priority, however, must be accorded to flood prevention and control measures, as well as sedimentation control, where required.

Transboundary water resources and their use are of great importance to riparian states. In this connection, cooperation among those States may be desirable in conformity with existing agreements and/or other relevant arrangements, taking into account the interests of all riparian states concerned.

The following program areas are proposed for the freshwater sector:

(a) Integrated water resources development and management;

(b) Water resources assessment;

(c) Protection of water resources, water quality and aquatic ecosystems;

(d) Drinking-water supply and sanitation;

(e) Water and sustainable urban development;

(f) Water for sustainable food production and rural development;

(g) Impacts of climate change on water resources.

This publication addresses only the section of Chapter 18 that deals with integrated water resources development and management. It deals with planning responsibilities at the state level and omits sections which deal only with national or international responsibilities or problems.

The original numbering system of Agenda 21 has been retained so that anyone wishing to compare this document with the full Agenda 21 may easily refer to numbered paragraphs.

## INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT

### Basis for Action

**18.6.** The extent to which water resources development **contributes** to economic productivity and social well-being **is not usually** appreciated, although all social and **economic activities** rely heavily on the supply and quality of freshwater. As populations and economic activities grow, many countries are rapidly reaching conditions of **water scarcity or** facing limits to economic development. **Water demands** are increasing rapidly, with 70-80 per cent required for irrigation, less than 20 per cent for industry and a mere 6 per cent for domestic consumption. The holistic management of freshwater as a finite and vulnerable resource, and the integration of sectoral water plans and programs within the framework of national economic and social policy, are of paramount importance for action in the 1990s and beyond. The fragmentation of responsibilities for water resources development among sectoral agencies is proving, however, to be an even greater impediment to promoting integrated water

management than had been anticipated. Effective implementation and coordination mechanisms are required.

## Objectives

**18.7.** The overall objective is to satisfy the freshwater needs of all countries for their sustainable development.

**18.8.** Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource, and a social and economic **good**, whose quantity and quality determine the nature of its utilization. To this end, water resources have to be protected, taking into account the functioning of aquatic **ecosystems** and the perenniality of the resource, in order **to satisfy** and reconcile needs for water in human **activities**. In developing and using water resources, priority has to be given to the satisfaction of basic needs and the safeguarding of ecosystems. Beyond these requirements, however, water users should be charged appropriately.

**18.9.** Integrated water resources management, including the integration of land- and water-related aspects, should be carried out at the level of the catchment basin or sub-basin. Four principal objectives should be pursued, as follows:

(a) To promote a dynamic, interactive, iterative and multisectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply, that integrates technological, socio-economic, environmental and human health considerations;

(b) To plan for the sustainable and rational **utilization**, protection, conservation, and management of water resources based on community needs and priorities within the framework of national economic development policy;

(c) To design, implement and evaluate projects and programs that are both economically efficient and socially appropriate within clearly defined strategies, **based on** an approach of full public participation, including that of women, youth, indigenous people, local communities, in water management policy-making and decision-making;

(d) To identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are a catalyst for sustainable social progress and economic growth.

**18.10.** In the case of transboundary water resources, there is a need for riparian states to formulate water resources strategies, prepare water resources action **programs** and consider, where appropriate, the **harmonization** of those strategies and action programs.

## Activities

**18.12.** All states, according to their capacity and **available** resources, and through bilateral or multilateral cooperation, including the United Nations and other relevant organizations as appropriate, could implement the following activities to improve integrated water resources management:

(b) Integration of measures for the protection and conservation of potential sources of freshwater supply, including the inventorying of water resources, with land-use planning, forest resource utilization, protection of mountain slopes and riverbanks and other relevant development and conservation activities;

(c) Development of interactive databases, forecasting models, economic planning models and methods for water management and planning, including environmental impact assessment methods;

(d) Optimization of water resources allocation under physical and socio-economic constraints;

(e) Implementation of allocation decisions through demand management, pricing mechanisms and regulatory measures;

(f) Flood and drought management, including risk analysis and environmental and social impact assessment;

(g) Promotion of schemes for rational water use through public awareness-raising, educational programs **and levying** of water tariffs and other economic instruments;

(h) Mobilization of water resources, particularly in arid and semi-arid areas;

(j) Development of new and alternative sources of water supply such as sea-water desalination, artificial groundwater recharge, use of marginal-quality water, waste-water reuse and water recycling;

(k) Integration of water (including surface and underground water resources) quantity and quality management;

(l) Promotion of water conservation through **improved** water-use efficiency and wastage minimization schemes for all users, including the development of water-saving devices;

(m) Support to water-users groups to optimize **local water** resources management;

(n) Development of public participatory **techniques** and their implementation in decision-making, particularly the enhancement of the role of women in water resources planning and management;

(o) Development and strengthening, as appropriate, of cooperation, at all levels concerned, namely:

1) At the lowest appropriate level, delegation of water resources management, generally in accordance with national legislation, including decentralization of government services to local authorities, private enterprises and communities;

(2) At the national level, integrated water resources planning and management in the framework of the national planning process and, where appropriate, establishment of independent regulation and monitoring of freshwater, based on national legislation and economic measures;

(3) At the regional level, consideration, where appropriate, of the harmonization of national strategies and action programs;

(p) Dissemination of information, including operational guidelines, and promotion of education for water users, including the consideration by the United Nations of a World Water Day.

## Means of Implementation

### Scientific and technological means

**18.14.** The development of interactive databases, forecasting methods and economic planning models appropriate to the task of managing water resources in an efficient and sustainable manner will require the application of new techniques such as geographical information systems and expert systems to gather, **assimilate**, analyze, and display multisectoral information and to optimize decision-making. In addition, the development of new and alternasources of water-supply and low-cost water technologies will require innovative **applied** research. This will involve the transfer, adaptation, and diffusion of new techniques and technology among developing countries, as well as the development of endogeneous capacity, for the purpose of being able to deal **with the** added dimension of integrating engineering, economic, environmental, and social aspects of water resources management and predicting the effects in terms of human impact.

**18.15.** Pursuant to the recognition of water as a social and economic good, the various available options for charging water users (including domestic, urban, industrial and agricultural water-user groups) have to be further evaluated and field-tested. Further development is required for economic instruments that take into account opportunity costs and environmental externalities. Field studies on the willingness to pay should be conducted in rural and urban situations.

**18.16.** Water resources development and management should be planned in an integrated manner, taking into account long-term planning needs as well as those with narrower horizons, that is to say, they should incorporate environmental, economic and social considerations based on the principle of sustainability; include the requirements of all users as well as those relating to the prevention and mitigation of water-related hazards; and constitute an integral part of the socio-economic development planning process. A prerequisite for the sustainable management of **water** as a scarce vulnerable resource is the obligation to acknowledge in all planning and development its full costs. **Planning** considerations should reflect benefits investment, environmental protection and operation costs, as well as the opportunity costs reflecting the most valuable alternative use of water. Actual charging need not necessarily burden all beneficiaries with the consequences of those considerations. Charging mechanisms should, however, reflect as far as possible both the true cost of water when used as an economic good and the ability of the communities to pay.

**18.17.** The role of water as a social, economic, and life-sustaining good should be reflected in demand management mechanisms and implemented through water conservation and reuse, resource assessment, and financial instruments.

**18.18.** The setting afresh of priorities for private and public investment strategies should take into account (a) maximum utilization of existing projects, through maintenance, rehabilitaand optimal operation; (b) new or alternative clean technologies; and (c) environmentally and socially benign hydropower.

## Human Resource Development

**18.19.** The delegation of water resources management to the lowest appropriate level necessitates educating and training water management staff at all levels and ensuring that women participate equally in the education and training programs. Particular emphasis has to be placed on the introduction of public participatechniques, including enhancement of the role of women, youth, indigenous people, and local communities. Skills related to various water management functions have to be developed by municipal government and water authorities, as well as in the private sector, local/national non-governmental organizations, cooperatives, corporations, and other water-user groups. Education of the public regarding the importance of water and its proper management is also needed.

**18.20.** To implement these principles, communities need to have adequate capacities. Those who establish the framework for water development and management at any **level**, whether international, national or local, need to ensure that the means exist to build those capacities. The means will vary from case to case. They usually include:

(a) Awareness-creation programs, including **mobilizing** commitment and support at all levels and initiating global and local action to promote such programs;

(b) Training of water managers at all levels so **that they** have an appropriate understanding of all the **elements** necessary for their decision-making;

(c) Strengthening of training capacities in developing countries;

(d) Appropriate training of the necessary professionals, including extension workers;

(e) Improvement of career structures;

(f) Sharing of appropriate knowledge and technology, both for the collection of data and for the implementation of planned development including **non-polluting** technologies and the knowledge needed to extract the best performance from the existing investment system.

## Capacity-Building

**18.21.** Institutional capacity for implementing integrated water management should be reviewed and developed when there is a clear demand. Existing administrative structures will often be quite capable of achieving local water resources management, but the need **may arise for** new institutions based upon

the perspective, for example, of river catchment areas, district development councils and local community committees. Although water is managed at various levels in the socio-political system, demand-driven management requires the development of water-related institutions at appropriate levels, taking into account the need for integration with land-use management.

**18.22.** In creating the enabling environment for lowest-appropriatemanagement, the role of government includes mobilization of financial and human resources, legislation, standard-setting and other regulatory functions, monitoring and assessment of the use of water and land resources, and creating of opportunities for public participation. International agencies and donors have an important role to play in providing support to developing countries in creating the required enabling environment for integrated water resources management. This should include, as appropriate, donor support to local levels in developing countries, including community-based institutions, non-governmental organizations and women's **groups**.