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IFAS EXTENSION

## Water for Sustainable Food Production and Rural Development<sup>1</sup>

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Adapted by: Dorota Z. Haman and Donald A. Brown<sup>2</sup>

### 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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1. This document is AE249, one of a series of the Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date April, 1994. Reviewed July, 2002. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.

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.

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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 nonbinding 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 which 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 lists only those sections of Chapter 18 that deal with water for sustainable food production and rural development. It addresses planning responsibilities at the state level. The sections which deal only with national or international responsibilities or problems are not addressed in this publication.

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.

## WATER FOR SUSTAINABLE FOOD PRODUCTION AND RURAL DEVELOPMENT

### Basis For Action

18.65. Sustainability of food production increasingly **depends** on sound and efficient water use and conservation practices consisting primarily of irrigation development and management, including water management with respect to rain-fed areas, livestock water-supply, inland fisheries, and agro-forestry. Achieving food security is a high priority in many countries, and agriculture must not only provide food for rising populations, but also save water for other uses. The challenge is to develop and apply water-saving technology and management methods and, through capacity-building, enable communities to introduce institutions and incentives for the rural population to adopt new approaches, for both rain-fed and irrigated agriculture. The rural population must also have better access to a potable water-supply and to sanitation services. It is an immense task but not an impossible one, provided appropriate policies and programs are adopted at all levels - local, national, and international. While significant expansion of the area under rain-fed **agriculture** has been achieved during the past decade, the productivity response and sustainability of irrigation systems have been constrained by problems of waterlogging and salinization. Financial and market constraints are also a common problem. Soil erosion, mismanagement, and overexploitation of natural resources and acute competition for water have all influenced the extent of poverty, hunger, and famine in the developing countries. Soil erosion

caused by overgrazing of livestock is also often responsible for the siltation of lakes. Most often, the development of irrigation schemes is supported neither by environmental impact assessments identifying hydrologic consequences within watersheds of interbasin transfers, nor by the assessment of social impacts on peoples in river valleys.

18.66. The unavailability of water supplies of suitable quality is a significant limiting factor to livestock production in many countries, and improper disposal of animal wastes can in certain circumstances result in pollution of water-supplies for both humans and animals. The drinking-water requirements of livestock vary according to species and the environment in which they are kept. It is estimated that the current global livestock drinking-water requirement is about 60 billion liters per day and based on livestock population growth estimates, this daily requirement is predicted to increase by 0.4 **billion** liters per annum in the foreseeable future.

18.67. Freshwater fisheries in lakes and streams are an important source of food and protein. Fisheries of inland waters should be managed to maximize the yield of aquatic food organisms in an environmentally sound manner. **This** requires the conservation of water quality and quantity, as well as of the functional morphology of the aquatic environment. On the other hand, fishing, and aquaculture may themselves damage the aquatic ecosystem; hence their development should conform to guidelines for impact limitation. Present levels of production from inland fisheries, from both fresh and brackish water, are about 7 million tons per year and could increase to 16 **million** tons per year by the year 2000; however, any increase in environmental stress could jeopardize this rise.

### Objectives

18.68. The key strategic principles for holistic and integrated, environmentally sound management of water resources in the rural context may be set forth as follows: (a) Water should be regarded as a finite resource having an economic value with significant social and economic implications reflecting the importance of **meeting** basic needs;

(b) Local communities must participate in all **phases of** water management, ensuring the full involvement **of women in** view of their crucial role in the practical day-to-day supply, management and use of water; (c) Water resource management must be developed **within** a comprehensive set of policies for (1) **human health**; (2) food production, preservation, and distribution; (3) disaster mitigation plans; (4) environmental protection and conservation of the natural resource base; (d) It is necessary to recognize and actively support the role of rural populations, with particular emphasis on women.

18.69. An International Action Program on Water and Sustainable Agricultural Development (IAP-WASAD) has been initiated by FAO in cooperation with other international organizations. The main objective of the Action Program is to assist developing countries in planning, developing, and managing water resources on an integrated basis to meet **present and** future needs for agricultural production, taking into account environmental considerations.

18.70. The Action Program has developed a framework for sustainable water use in the agricultural sector and identified priority areas for action at national, regional, and global levels. Quantitative targets for new irrigation development, improvement of existing irrigation schemes, and reclamation of waterlogged and salinized lands through **drainage** for 130 developing countries are estimated on the **basis** of food requirements, agro-climatic zones and availability of water and land.

18.71. FAO global projections for irrigation, drainage, and small-scale water programs by the year 2000 for 130 developing countries are as follows: (a) 15.2 million hectares of new irrigation development; (b) 12 million hectares of improvement/modernization of existing schemes; (c) 7 million hectares installed with drainage and water control facilities; and (d) 10 million hectares of small-scale water programs and conservation.

18.72. The development of new irrigation areas at the above-mentioned level may give rise to environmental concerns in so far as it implies the destruction of wetlands, water pollution, increased sedimentation, and a reduction in biodiversity.

Therefore, new irrigation schemes should be accompanied by an environmental impact assessment, depending upon the scale of the scheme, in case **significant** negative environmental impacts are expected. When considering proposals for new irrigation schemes, consideration should also be given to a more rational exploitation, and an increase in the efficiency or productivity, of any existing schemes capable of serving **the same** localities. Technologies for new irrigation **schemes should** be thoroughly evaluated, including their potential conflicts with other land uses. The active **involvement** of water-users groups is a supporting objective.

18.73. It should be ensured that rural communities of all countries, according to their capacities and available resources, and taking advantage of international cooperation as appropriate, will have access to safe water in sufficient quantities and adequate sanitation to meet their health needs and maintain the essential qualities of their local environments.

18.74. The objectives regarding water management for inland fisheries and aquaculture include conservation of water quality and water quantity requirements for optimum production and prevention of water pollution by aquacultural activities. The Action Program seeks to assist member countries in managing the fisheries of inland waters through the promotion of sustainable management of capture fisheries as well as the development of environmentally sound approaches to intensification of aquaculture.

18.75. The objectives regarding water management for livestock supply are twofold: provision of adequate amounts of drinking water and safeguarding of drinking water quality in accordance with the specific **needs of** different animal species. This entails maximum salinity tolerance levels and the absence of pathogenic organisms. No global targets can be set owing to large regional and intra-country variations.

## Activities

18.76. 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: (a) Water supply and sanitation for the unserved rural poor: (1) Establish national policies and budget priorities with regard to increasing service coverage; (2) Promote appropriate technologies; (3) Introduce suitable cost-recovery mechanisms, taking into account efficiency and equity through demand management mechanisms; (4) Promote community ownership and rights to water supply and sanitation facilities; (5) Establish monitoring and evaluation systems; (6) Strengthen the rural water supply and sanitation sector with emphasis on institutional development, efficient management, and an appropriate framework for financing of services; (7) Increase hygiene education and eliminate disease transmission foci; (8) Adopt appropriate technologies for water treatment; (9) Adopt wide-scale environmental management measures to control disease vectors; (b) Water use efficiency: (1) Increase of efficiency and productivity in agricultural water use for better utilization of limited water resources; (2) Strengthen water and soil management research under irrigation and rain-fed conditions; (3) Monitor and evaluate irrigation project performance to ensure, *inter alia*, the optimal utilization and proper maintenance of the project; (4) Support water users groups with a view to improving management performance at the local level; (5) Support the appropriate use of relatively brackish water for irrigation; (c) Waterlogging, salinity control, and drainage: (1) Introduce surface drainage in rain-fed agriculture to prevent temporary waterlogging and flooding of lowlands; (2) Introduce artificial drainage in irrigated and rain-fed agriculture; (3) Encourage conjunctive use of surface and groundwaters, including monitoring, and water-balance studies; (4) Practice drainage in irrigated areas of arid and semi-arid regions; (d) Water quality management: (1) Establish and operate cost-effective water quality monitoring systems for agricultural water uses; (2) Prevent adverse effects of agricultural activities on water quality for other social and economic activities and on wetlands, *inter alia*, through optimal

use of on-farm input and the minimization of the use of external input in agricultural activities;

(3) Establish biological, physical, and chemical water-quality criteria for agricultural water users and for marine and riverine ecosystems; (4) Minimize soil runoff and sedimentation; (5) Dispose properly of sewage from human settlements and of manure produced by intensive livestock breeding;

(6) Minimize adverse effects from agricultural chemicals by use of integrated pest management;

(7) Educate communities about the pollution-related impacts of the use of fertilizers and chemicals on water quality, food safety and human health;

(e) Water resources development programs:

(1) Develop small-scale irrigation and water supply for humans and livestock and for water and soil conservation; (2) Formulate large-scale and long-term irrigation development programs, taking into account their effects on the local level, the economy and the environment; (3) Promote local initiatives for the integrated development and management of water resources; (4) Provide adequate technical advice and support and enhancement of institutional collaboration at the local community level; (5) Promote a farming approach for land and water management that takes account of the level of education, the capacity to mobilize local communities and the ecosystem requirements of arid and semiarid regions; (6) Plan and develop multipurpose hydroelectric power schemes, making sure that environmental concerns are duly taken into account; (f) Scarce water resources management:

(1) Develop long-term strategies and practical implementation programs for agricultural water use under scarcity conditions with competing demands for water; (2) Recognize water as a social, economic and strategic good in irrigation planning and management; (3) Formulate specialized programs focused on drought preparedness, with emphasis on food scarcity and environmental safeguards; (4) Promote and enhance wastewater reuse in agriculture; (g) Water supply for livestock:

(1) Improve quality of water available to livestock, taking into account their tolerance limits; (2) Increase the quantity of water sources available to livestock, in particular those in extensive grazing systems, in order to both reduce the distance needed to travel for water and to prevent overgrazing around water sources;

(3) Prevent contamination of water sources with animal excrement in order to prevent the spread of diseases, in particular zoonosis; (4) Encourage multiple use of water supplies through promotion of integrated agro-livestock-fishery systems;

(5) Encourage water spreading schemes for increasing water retention of extensive grasslands to stimulate forage production and prevent runoff; (h) Inland fisheries: (1) Develop the sustainable management of fisheries as part of national water resources planning; (2) Study specific aspects of the hydrobiology and environmental requirements of key inland fish species in relation to varying water regimes; (3) Prevent or mitigate modification of aquatic environments by other users or rehabilitate environments subjected to such modification on behalf of the sustainable use and conservation of biological diversity of living aquatic resources; (4) Develop and disseminate environmentally sound water resources development and management methodologies for the intensification of fish yield from inland waters; (5) Establish and maintain adequate systems for the collection and interpretation of data on water quality and quantity and channel morphology related to the state and management of living aquatic resources, including fisheries;

(i) Aquaculture development: (1) Develop environmentally sound aquaculture technologies that are compatible with local, regional, and national water resources management plans and take into consideration social factors; (2) Introduce appropriate aquaculture techniques and related water development and management practices in countries not yet experienced in aquaculture; (3) Assess environmental impacts of aquaculture with specific reference to commercialized culture units and potential water pollution from processing centers; (4) Evaluate economic feasibility of aquaculture in relation to alternative use of water, taking into consideration the use of marginal-quality water and investment and operational requirements.

## Means of Implementation

### Scientific and Technological Means

18.78. There is an urgent need for countries to monitor water resources and water quality, water and land use and **crop** production; compile inventories of

type and extent of agricultural water development and of present and future contributions to sustainable agricultural development; evaluate the potential for fisheries and aquaculture development; and improve the availability and dissemination of data to planners, technicians, farmers, and fishermen. Priority requirements for research are as follows:

(a) Identification of critical areas for water-related adaptive research; (b) Strengthening of the adaptive research capacities of institutions in developing countries; (c) Enhancement of translation of water-related farming and fishing systems research results into practical and accessible technologies and provision of the support needed for their rapid adoption at the field level.

18.79. Transfer of technology, both horizontal and **vertical**, needs to be strengthened. Mechanisms to provide **credit, input** supplies, markets, appropriate pricing, and **transportation** must be developed jointly by countries and **external support** agencies. Integrated rural water-supply infrastructure, including facilities for water-related education and training and support services for **agriculture**, should be expanded for multiple uses and should assist in developing the rural economy.

### Human Resource Development

18.80. Education and training of human resources should **be actively** pursued at the national level through: (a) **assessment** of current and long-term human resources **management and** training needs; (b) establishment of a **national policy** for human resources development; and (c) initiation and implementation of training programs for staff at all levels as well as for farmers. The necessary actions are as follows: (a) Assess training needs for agricultural water management; (b) Increase formal and informal training activities; (c) Develop practical training courses for improving the ability of extension services to disseminate technologies and strengthen farmers' capabilities, with special reference to small-scale producers; (d) Train staff at all levels, including farmers, fishermen and members of local communities, with particular reference to women; (e) Increase the opportunities for career development to enhance the capabilities of administrators and officers at all levels involved in land- and water-management programs.

### Capacity-Building

18.81. The importance of a functional and coherent institutional framework at the national level to promote water and sustainable agricultural development has generally been fully recognized at present. In addition, an adequate legal framework of rules and regulations should be in place to facilitate actions on agricultural water use, drainage, water-quality management, small-scale water programs, and the functioning of water users' and fishermen's associations. Legislation specific to the **needs** of the agricultural water sector should be consistent with, and stem from, general legislation for the management of water resources. Actions should be pursued in the **following** areas: (a) Improvement of water-use policies related to **agriculture**, fisheries and rural development and of legal frameworks for implementing such policies; (b) Review, strengthening and restructuring, if required, of existing institutions in order to enhance **their** capacities in water-related activities, while recognizing the need to manage water resources at the **lowest** appropriate level; (c) Review and strengthening, where necessary, of organizational structure, functional relationships, and linkages among ministries and departments within a given ministry; (d) Provision of specific measures that require **support for** institutional strengthening, inter alia, through long-term program budgeting, staff training, incentives, mobility, equipment and coordination mechanisms; (e) Enhancement of involvement of the private **sector**, where appropriate, in human resource development and provision of infrastructure; (f) Transfer of existing and new water-use technologies by creating mechanisms for cooperation and **information** exchange among national and regional institutions.