



# Water at FAO



# Introduction

During the second half of the 20th century, agriculture responded to a twofold increase in the world's population by more than doubling food production, and this in an environment of decreasing commodity prices. During the same period, the group of developing countries increased per capita food consumption by 30 percent and nutritional situations improved accordingly. In addition, agriculture continued producing non-food crops, including cotton, rubber, beverage crops and industrial oils. However, while feeding the world and producing a diverse range of commodities in an increasingly productive way, agriculture also confirmed its position as the largest user of water on the globe. Irrigation now claims close to 70 percent of all freshwater appropriated for human use.

In the context of demographic growth, increased competition for water and improved attention to environmental issues, too often left out by agricultural policies, water for food remains a core issue that can no longer be tackled through a narrow sectoral approach. New forms of water management in agriculture, including rainfed and irrigated agriculture, watershed management, inland fisheries and aquaculture, and livestock and rangeland management are to be explored and implemented in a comprehensive way.

Farmers are at the centre of any process of change and need to be encouraged and guided, through appropriate incentives and governance practices, to conserve natural ecosystems and their biodiversity and minimize their negative impact, a goal that will only be achieved if the appropriate policies are in place. Irrigation institutions must respond to the needs of farmers, ensuring more reliable delivery of water, increasing transparency in its management and balancing efficiency and equity in access to water. This will not only require changes in attitudes, but also well targeted investments in infrastructure modernization, institutional restructuring and upgrading of the technical capacities of farmers and water managers.

The agriculture sector faces a complex challenge: producing more food of better quality while using less water per unit of output; providing rural people with resources and opportunities to live a healthy and productive life; applying clean technologies that ensure environmental sustainability; and contributing in a productive way to the local and national economy. FAO's water programme is shaped along the lines dictated by these new challenges, in order to better respond to the needs of its member countries.

# FAO's programme in water

FAO is concerned with sustainable use and conservation of water in agriculture. Its recent reform has acknowledged the need to address issues of water in a cross-sectoral way. Agricultural water use and management is understood in all its dimensions. The technical aspects of sustainable crop production, aquaculture, livestock watering, forestry and watershed management are dealt with in the framework of FAO's strategic objective "F", *Sustainable management of natural resources*, and draw on specialist skills across the organization and respective counterparts at country level and in regional organisations.

FAO's water programme is anchored with the Land and Water Division (NRL), now part of the Natural Resources Management and Environment Department (NR). Acting as focal point on water-related issues, the Division works in close collaboration with relevant Departments and units across the Organization, including forestry, fisheries and aquaculture, rural development, nutrition, etc. The Land and Water Division aims to enhance the agricultural productivity and advance the sustainable use of land and water systems, and promote equitable access to these natural resources in a context of complex agricultural transitions. It relies on a strong heritage and expertise in the fields of land and water development and management, accumulated since FAO's inception in 1945.

FAO's water activities can be classified in three main categories:

- Information and knowledge
- Policy advice
- Technical support to countries and their constituents.

## **Information and knowledge:**

FAO maintains an extensive multi-scale information base on water for use at global, national and local levels. AQUASTAT, FAO's global information system of water and agriculture, monitors and reports on water resources and agricultural water use in member countries. It also contributes extensively to the periodic issuance of the UN World Water Development Report and other major assessments. At global level, it contributes to the development of perspective studies on agriculture, food production, food security and environment services, and on the impact of global warming on future water resources and use. Its information serves as basis for decision in major international natural resources management initiatives (UN-Water, World Water Forum, etc.) and feeds into international conventions (UNCCD, UNFCCC, CSD) in which the Division is active and provides its knowledge and expertise. At national and local level, the Division assist countries and local institutions in strengthening their natural resources assessment and monitoring capacities. FAO is a knowledge centre in the fields of expertise where provides technical assistance.

## **Policy advice:**

FAO provides assistance to countries in shaping their agricultural policies, in relation to land and water management. Of specific importance is the linkage between water and agricultural policies, driven by the need for enhancement of agricultural productivity in a situation of rapidly growing water scarcity. FAO assists countries in developing targeted investment policies in agriculture that respond to the development needs of rural populations in a sustainable way.

Specific policy information tools that are deployed include:

- Assessment of demand for irrigated production;
- Transparent methods to account for agricultural water use and the generation of environmental and social externalities;
- Inventories of equipped irrigated areas and areas under other forms of water management ;
- Institutional appraisals, including assessments of operational capacity and performance of large irrigation schemes;
- Investment frameworks to guide national policy implementation.

#### **Technical assistance:**

FAO maintain a strong technical expertise in the field of water management, with special focus on enhanced agricultural productivity, poverty alleviation and environmental sustainability. Technical fields include the development of water resources through small scale irrigation and appropriate water control technologies; modernisation of large irrigation schemes, best practices for sustainable water use and conservation (including dryland management) water harvesting, integrated water-soil fertility management, and conservation agriculture approaches. Watershed management, groundwater management and multiple use of water including agriculture-aquaculture integration are also promoted in FAO projects. Expertise in environmental impact management includes wastewater treatment and reuse, drainage and salinity control. At field level, FAO has adopted the "Farmer Field School" approach, promoting a participatory approach to water management based on the principles of efficiency, equity and empowerment.

# Elements of FAO's water programme

This section presents some of the on-going activities of FAO in the field of water.

## Improving on-farm water management: producing more with less water

Improvement of on-farm water management calls for an integrated use of water conservation practices, and economic incentives to influence water use: under the circumstances of limited water supply, maximizing the crop yield per unit of land should give ways to achieving the maximum yield per unit of water use. FAO produces and maintains crop water productivity models for application at field level and for scenario analysis on impact of climate change. FAO has prepared guidelines for the planning and design of subsurface field drainage systems.

## Yield response to water

One of the fundamental data needed in food security analysis is the production that the various agricultural crops can yield under limiting water availability. One tool to estimate such yield response to water of herbaceous crops is the FAO crop-model AquaCrop. A Guideline to estimate the yield response to water of trees and vines is under development.

## Improving the performance of irrigation services

In an agriculture in constant evolution, irrigation needs to adapt to new, more stringent requirements: the supply of water within large irrigated systems needs to be much more reliable and flexible than in the past. FAO has developed a multi-language training package for modernization and rehabilitation of large scale irrigation schemes (the MASSCOTE approach) and has applied it in 20 countries.

### Integrated resources management in support of food production in rural areas

Integrated approaches to resource management (IRM) are challenging but provide significant avenues for enhancing fish production as well as the productivity of inland water bodies. In particular, opportunities exist for the enhanced integration of inland fisheries and aquaculture into agricultural development planning, especially irrigation, adding value to shared resources. Basic features of good IRM include the formation of extensive partnerships and the close involvement of local interests. It implies improved cross-sectoral cooperation among the agriculture, forestry and fisheries sub-sectors.

## Augmenting supply: the use of non-conventional waters

Reuse of drainage water is becoming increasingly important, in particular in water scarce countries. Furthermore, agriculture's use of water resources of marginal quality, such as treated wastewater and brackish water has also become an important issue, especially in the arid and semi-arid zones of water scarce countries and in rapidly growing peri-urban settings. FAO has prepared, jointly with WHO, guidelines for wastewater management, and for drainage water management in arid and semi-arid zones and is disseminating best practice through training seminars.

## Water Harvesting

Water Harvesting, including conservation agriculture techniques also has the potential to contribute substantially to increased food production by making best use of available rainfall while conserving the natural resource base and easing pressure on available resources. Water harvesting is among the techniques that have the

potential to boost rainfed agriculture, in particular in semi-arid regions of sub-Saharan Africa. Harvesting of rainfall is also relevant for urban and peri-urban agriculture.

### Integrated watershed management

FAO has a long experience in watershed management, soil and water conservation, upstream/downstream linkages, forest hydrology and sustainable mountain development. FAO and its partners have recently performed a global review of the current status, trends and challenges in watershed management. The overall objective was to design a new generation of watershed management programmes and projects. Among the findings and recommendations of the review are the recognition of the increasingly important role of new financing mechanisms, including payment for environmental services, as well as the need for a more inclusive and participatory approach in watershed management. This implies the involvement of a variety of stakeholders and a negotiation process among grassroots, technical and policy concerns.

### Aquastat

AQUASTAT is FAO's global information system on water and agriculture. First and foremost it is an online database with about 75 variables per country, whose data can be downloaded. Besides the main database it offers "Country Profiles" describing each country's peculiarities, the problems encountered in rural water management and irrigation and finally they provide a summary on perspectives in agricultural water management. All country profiles comprise standardized tables holding key data. The "Regional overviews" provide an analysis by grouping countries that are similar in terms of geographic and socio-economic conditions.

#### National investment portfolios for water in Africa

In preparation for a ministerial conference on water for agriculture and energy in Africa which took place in December 2008 in Sirte (Libya), FAO worked with government officials to compile an investment programme based on national priorities. A detailed portfolio of about 1000 investment projects was prepared for the 53 African countries, with a total budget estimated at 65 billion US dollars over twenty years. National investment briefs were prepared for each country, detailing the investment programme. The portfolio of projects will help promote accelerated investment in water for agriculture and energy on the continent, and monitor progress in achieving the continent's water-related objectives.

Aquastat offers other side-products: a) a geo-referenced database on African dams by country; b) areas equipped for irrigation by country at sub-national level; c) detailed calculations of renewable water resources by country; d) an institutions database, containing around 300 institutions presented by country in the field of agricultural water management; e) a glossary, containing definitions for around 400 terms in the field of water resources and agricultural water management; f) a database on river sediment yields, searchable by river, by country and by continent; g) a database on investment costs in irrigation, containing information on irrigation investment costs for 248 irrigation projects around the world; h) downloadable publications prepared within the framework of AQUASTAT.

Several spatial AQUASTAT datasets, such as the global map of irrigation areas, the atlas of water resources and irrigation for Africa and a selection of global maps (available as PDFs or as interactive maps), can be downloaded from the website and easily imported into GIS applications.

### **National policies: water allocation to agriculture**

Agriculture has been highly successful in capturing the bulk of the world's freshwater resources, but with little accountability. Allocation of fresh water out of agriculture to other higher utility uses – municipal supplies, environmental reserves, hydropower generation etc. is already taking place, but there is scope for these allocations to be optimised in economic and environmental terms and this challenge has to be taken up by progressive agriculture policy as much as water policy. FAO assists countries in their national water and agriculture policies to ensure efficient allocation of water while guaranteeing sustainable agricultural production.

### **Trade and the potential of virtual water**

Many countries confront the prospect of emerging water scarcity in the long term. Countries in the Middle East and North Africa have already passed the point at which more water can be applied to land and hence resorted to commercial food imports. If water becomes the scarce factor, it may be more sensible to 'import' it embodied in products in general and food in particular, especially if food is available on favourable trade terms. Therefore, efficiency gains in the global food trade in terms of water resource utilization are possible and the consequence of increasing reliance on irrigation for food production in many countries, including food exporting countries need to be well understood before such policy commitments are made. FAO works with partners in academic and government institutions to help assessing virtual water trade and identify related policy options.

### **Coping with water scarcity**

An increasing number of regions are reaching the limit at which reliable water services can be delivered. Growing scarcity and competition for water stand as a major threat to future advances in food security and poverty alleviation, especially

in rural areas. Since agriculture accounts for 70% of global freshwater withdrawals, it has the most scope for positive management responses to water scarcity. Improved management practices and technologies in irrigated and rainfed farming systems can have a significant impact on the productivity of water. Coping with water scarcity should also consider issues relating to access to water, and that environmental services and ecosystem functions cannot be treated as the residuals of all water users. The ways to cope with water scarcity are therefore conditioned by a complex set of location-specific technical barriers and social expectation.

In the Italian funded project "Coping with Water scarcity - the role of agriculture" a methodology is being developed on how to consider analytically the possible options and measures that can be adopted to cope with water scarcity. The methodology, based on the concept of the 'water audit', considers water stress at all geographical scales, from local to global, and is applicable in different countries and river basins.

### **Water and rural livelihoods**

Water represents a major constraint on agricultural productivity and rural poverty reduction. The vulnerability of rural people in developing countries remains high owing to a combination of: highly variable and erratic precipitation; poor development of hydraulic infrastructure, management and markets; non-conducive land and water governance; and a lack of access to water for domestic and productive uses.

In an attempt to help decision-makers make informed choices on where and how to invest, FAO is working with the International Fund for Agricultural Development (IFAD), research institutions like the International Water Management Institute (IWMI), and with funding from the Bill and Melinda Gates foundation (BMGF) to address the linkage between water and rural

poverty. With a specific focus on sub-Saharan Africa and South Asia, it emphasizes the need for an approach where investments in infrastructure are matched with interventions in institutions, knowledge and finance in ways that yield optimal returns in terms of poverty reduction. It analyses the extreme heterogeneity of situations facing rural people across the region and the diversity of challenges and opportunities facing different categories of rural operators, with the objective to adapt responses to these realities. It recognizes the multiple dimensions of the rural water challenge, and shows how people's livelihoods depend on reliable water sources for a wide variety of uses.

### **Water and climate change**

Climate change is expected to affect agriculture in various ways, but it is certainly through changes in the water cycle that its impact will be most widespread. Changes in precipitation patterns, crop evapotranspiration rates, river runoff and aquifer recharge will affect both rainfed and irrigated agriculture, with potentially devastating effects on poor rural farming communities. FAO studies the potential impact of climate change on agricultural systems around the world, with specific focus on water, in order to help designing

appropriate adaptation strategies. Of particular concern are vulnerable farming systems in the large river deltas, large snow-melt systems like the Ganges, Mediterranean climates, semi-arid tropics, and small islands.

### **Biofuel production: a further threat on water resources ?**

The quest for more energy autonomy and concerns over the impacts of green house gas emissions has been the main cause of the recent surge in liquid biofuel production, also favoured by high fossil fuel prices. This new situation leads to increasing interlinkage between food and energy production and possible impacts on natural resources, including land and water. Globally, biofuel currently account for about 1 percent of all water used by crops but projections show substantial increase in biofuel production. In current production conditions, it takes on average roughly 2500 litres of water to produce one litre of biofuel. In the framework of the Bioenergy Environmental Impact Analysis Programme (BIAS), FAO studies the potential impact of biofuel production on water resources and water quality in order to help countries developing fair and sustainable bioenergy production policies.



# FAO field programme in water management for agriculture

There are currently 63 on-going field projects, for a total of 105 million US\$, of which FAO Water Unit is directly responsible. Freshwater management appears also as a component in several agricultural and rural development projects that include watershed management, inland fisheries, local development, emergency recovery (Tsunami, reconstruction in Iraq and Afghanistan, rehabilitation of irrigation systems damaged by hurricanes, etc.).

Water is an essential component of FAO's National Programme on Food Security which involves 102 countries. Irrigation, drainage and water management are also a major pillar of the activities of FAO's Investment Centre charged with design and monitoring of agriculture investment projects.

## The critical role of water in achieving rural food security

Water lies at the core of sustainable development concerns and its efficient and equitable management is crucial for human survival. For more than 10 years, FAO has advocated for a better recognition of the role of water in ensuring food for all and eradicating rural poverty, constantly reminding world leaders about the strategic importance of this sector. In particular, FAO focuses its efforts on Africa, which is the continent where progresses towards the Millenium Development Goals are systematically lagging behind. It proposes a strategy in three steps: on the short term, small scale water control programmes can have an immediate impact on the livelihood of rural communities. In the medium-term, substantial efforts must be made in modernisation of large scale irrigation systems, in connexion with the development of local markets. In the future, the pressure on water may justify investments in large river basin management projects, where their role in regional development can be clearly identified. As a result of the combined efforts of FAO and its partners, water for food and agriculture are receiving more attention in donor's agendas. After a long period of decreasing investments, World Bank lending in water for agriculture is now growing again. In 2004, the European Union launched the EU Water facility for ACP countries, with an initial budget of 500 million US\$, and the African Development Bank has launched the African Water Facility with a target budget of 620 million US\$. More recently, the Commission for Africa, chaired by Tony Blair, issued a report calling for a substantial increase in productive investments in agriculture, with special attention to irrigation and related rural infrastructure.

# FAO and UN-Water

In 2003, UN-Water was officially endorsed as the new United Nations mechanism for follow-up of the water-related decisions reached at the World Summit on Sustainable Development and the Millennium Development Goals. It supports Member States in their efforts to achieve water and sanitation goals and targets. UN Water is made up of the UN agencies, programmes and funds that have a significant role in tackling global water concerns. It also includes major non-UN partners who cooperate with them in advancing progress towards the water-related goals of the Decade Water for Life and Millennium Declaration. UN-Water acts at global, regional and country level, where it seeks to enhance the coherence of actions of the UN system, while working in close collaboration with non-UN partners. Today, 26 United Nations Agencies, Funds and Programmes are members of UN-Water, and 10 international NGOs are partners.

FAO has participated in the creation of UN-Water and has been an active member since

its inception in 2003. In view of the critical role water plays in agriculture, and of the prominent role of agriculture in global water use, FAO considers inter-sectoral collaboration in the field of freshwater of utmost importance in the world's efforts to reaching all the Millennium Development Goals, in particular those related to Goal 1 "Eradicate extreme poverty and hunger" and Goal 7 "Ensure environmental sustainability". In 2006, FAO has accepted to take the lead in further developing the programmes of UN-Water, and was elected Chair of UN-Water for the period 2007- 2009. In line with the spirit of UN-Water, FAO seeks to reinforce inter-agency collaboration to better serve the member countries. At national level, it seeks practical ways to avoid duplications and contrasts in approaches to water resources management, and enhance the overall effectiveness of UN agencies in their support to governments. At international level, it focuses on better monitoring of water-related targets and issues so as to better inform global policies and decision making processes.

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