

# **Water management towards sustainable food production**

*by*

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# Introduction

In arid and semi-arid regions, particularly those of the Mediterranean, the water crisis is creeping closer. Water scarcity is threatening peace within countries and between countries, the food supply and the people's health and is increasing the poverty and famine. Such features characterizing water resources perspectives need a new convergence in thinking and water use practice and management to develop the synergies required to achieve the common goal of sustainable development.

Presently, water shortage in the Mediterranean Southern and Eastern countries has obliged those countries to increase food imports because the local agricultural sector is no longer able to produce sufficient food to fulfill the existing food gap. Food production and its perspectives are not promising in spite of the fact agriculture is by far the largest user of water: on a consumptive use basis, in fact, almost over 80% of all available water is consumed in agriculture.

In the region, most countries are working hard towards achieving water security and food security. Nowadays, this is what are challenging the countries. It is quite evident that in spite of its complexity, yet, through an appropriate water use and management, we can overcome the food shortage gap, achieving the needed food security and the food production sustainability.

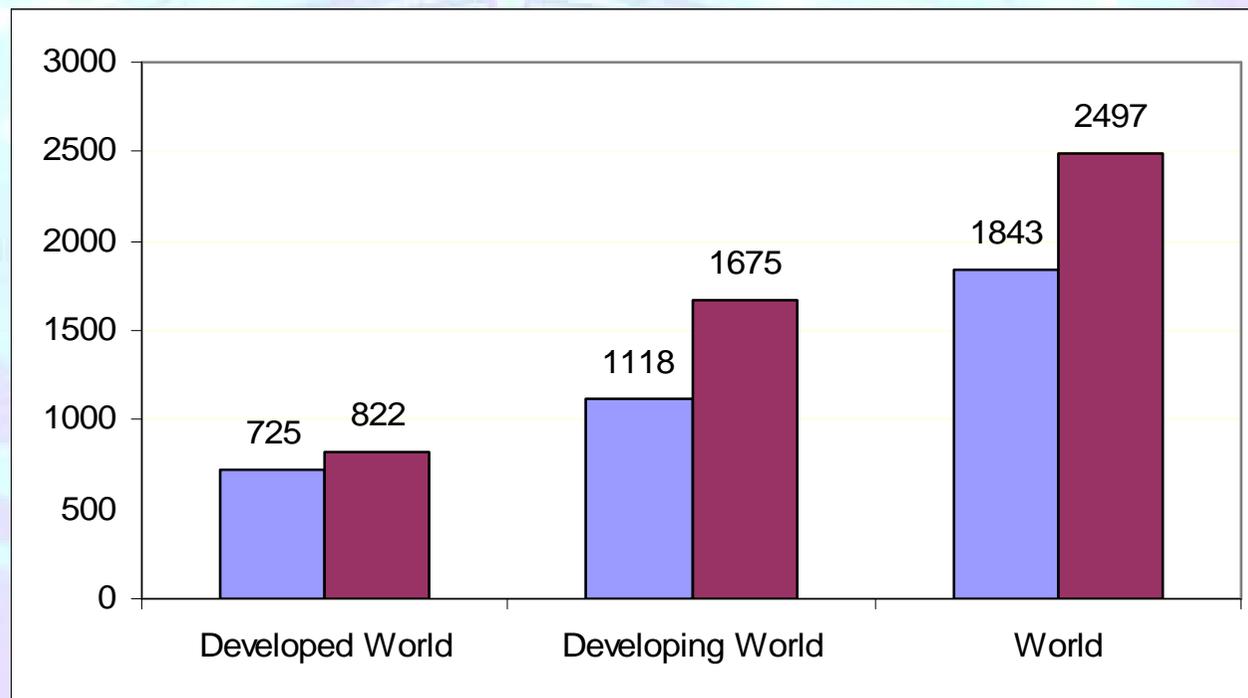
## Water and Food Production

- Between the early 1960's and mid 1990's average cereal/yields grew from 1.2 t/ha in developing countries, while total cereal production passed from 420 to 1.176 million tons per year, thanks to the green revolution.
- The world agriculture is now facing the challenge of feeding an estimated 10 billion people by the year 2050 while alleviating the pressure on agro-ecosystems.
- Further challenges are put by those who highlight it is not sufficient to produce food enough, but the quality of nutrition must be taken into account as well.

## Food shortage and increasing food demand

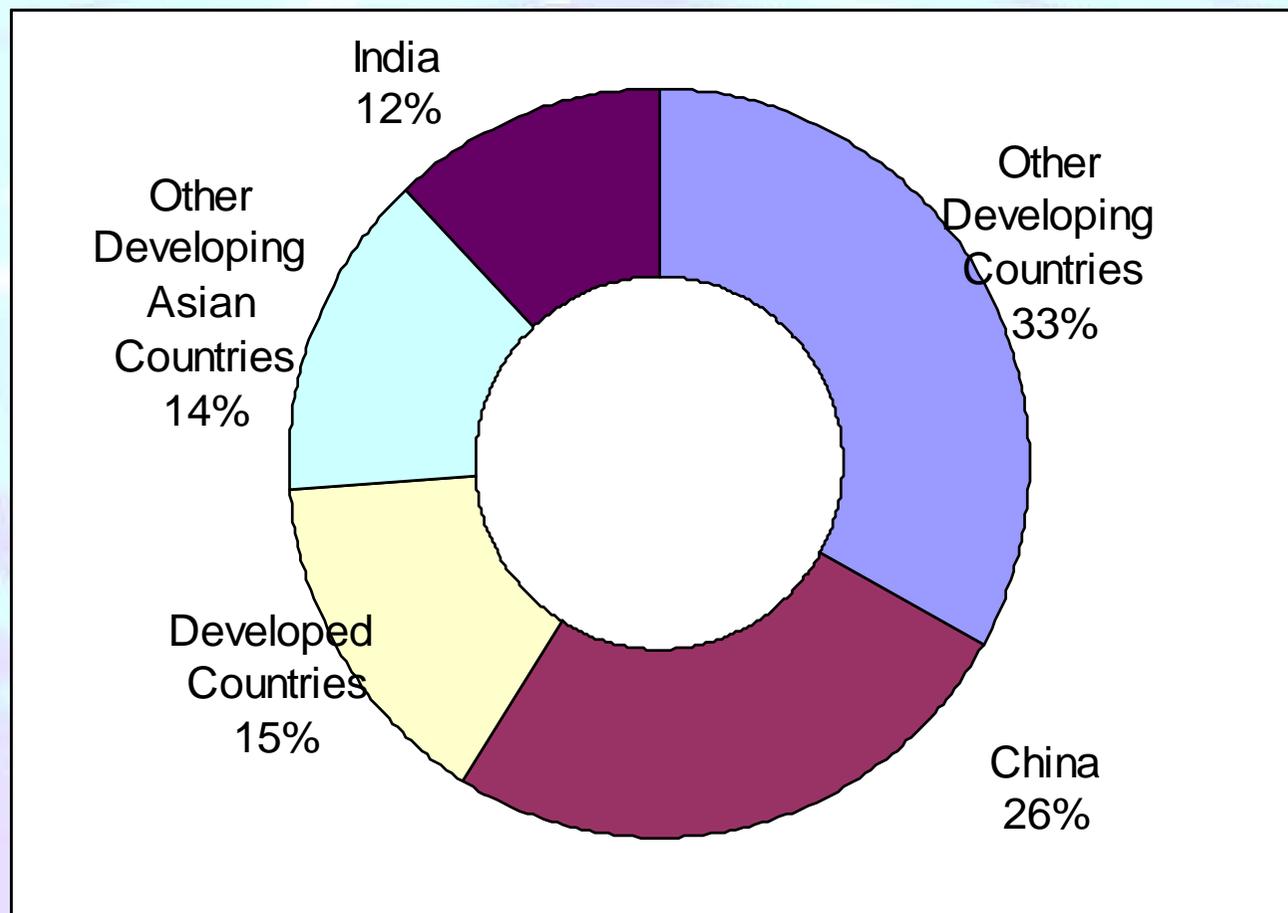
*According to FAO, by mid-1999 it is estimated that thirty-four countries in the developing world are plagued with serious food shortages.*

*The International Food Policy Research Institute (IFPRI) currently estimates that demand for cereals in developing countries will increase by nearly 50 per cent from 1997 to 2020, rising to nearly 1.7 billion metric tons*



**World Demand for Cereals, 1997 and 2020 (millions of metric tons).**

- *IFPRI expects the irrigated cereal area to increase from the 1997 total of 218 millions hectares to 248 million hectares by 2020 with an additional one million hectares in developed countries and 29 million hectares in developing ones.*



**Increased Cereal Demand, 1997-2000**

# Increasing demand for food and how to cope with

## *The Options:*

The Water Vision (2000) of the World Water Council gave the following two unattractive alternatives:

*the first*, is that through expanding the irrigated area by 30%, but, such option would likely lead to severe water shortages and serious risks of deteriorating the ecosystem;

*the second*, approach towards a reduction in the irrigated area that simply means that less water will be allocated to the agriculture sector and will result in a notable increase in the food gap, considerable food shortages and rising food prices.

The challenge is to shift from non-sustainable to sustainable agricultural development through an integrated land and water strategies, good management practices, environmentally sound technologies and better policies to support food production increases, without putting potentially disastrous stresses on land and water resources.

## **Sustainable food production system: the barriers**

- *Lack of integrated land and water resources management approach.*
- *Lack of land tenure and water rights*
- *Urbanization and inter-sectoral water allocation*
- *Valuation of water and its trade-off*
- *Poor Institutional Capacity Building*
- *Rural data assessment*

# Growing Food Demand and How To Meet

- **Water planning and management: the need for a new approach**
- **Managing water scarcity**
- **Adoption of an adequate agricultural water demand management**
- **Improvement of water use efficiency and increasing water productivity**
- **Improvement of irrigation systems and utilization of efficient technologies**
- **Sectorial water use and allocation efficiency**
- **Conjunctive use of water supplies**
- **Effective water governance**
- **Promote wide use and recycling of non conventional water resources**
- **Valuation of water and irrigation water charges**
- **Strengthening capacity building**

## **WATER PLANNING AND MANAGEMENT: THE NEED FOR A NEW APPROACH**

- **The experience gained and the lessons learned clearly emphasize that the fragmented approach we are still using in managing water resources in the agricultural sector resulting in enormous water loss will never provide the Mediterranean region with both water and food security.**
- **Traditionally, solutions were fully focusing on the supply side but, such approach is now criticized for environmental, economic and social reasons. Basic human needs for water still remain unmet and it is becoming harder and harder to find new water resources.**
- **Nowadays, many countries are changing the approaches in managing their water resources, re-directing them towards the soft path approach through developing new methods to meet the demands of growing population without requiring major new constructions or new large scale water transfer from one region to another.**

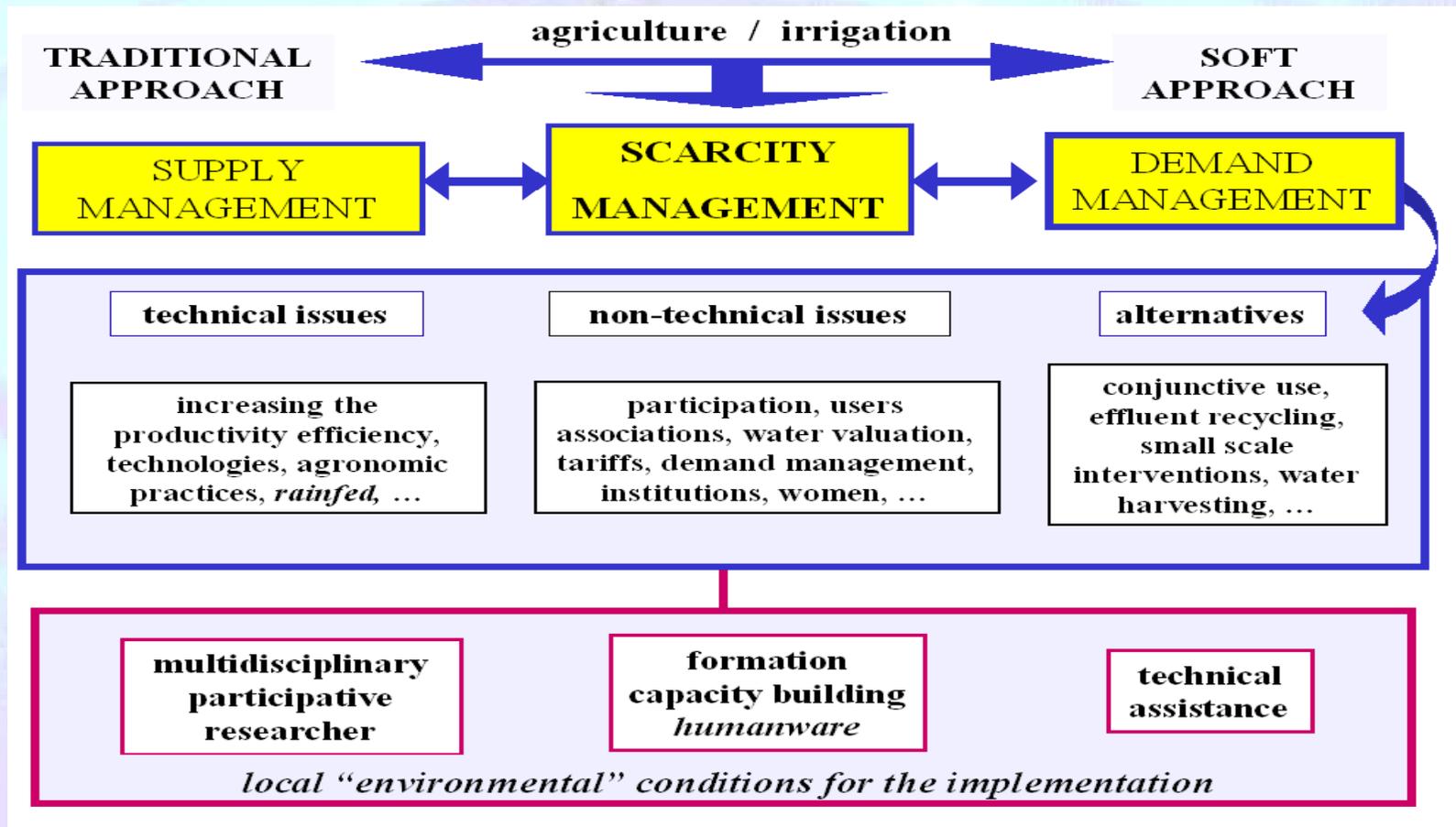


## WHAT DO WE MEAN BY CHANGES IN BOTH WATER USE AND MANAGEMENT?

- The changes do not imply to stop increasing water supply through the traditional water approach.
- New approach should be developed which permit water needs to be met with fewer resources, less ecological disruption and less cost.
- Two approaches should be followed:
  - the first, by increasing the efficiency with which current needs are met, and
  - the second by increasing the efficiency with which water is allocated among different users.

# Managing water scarcity

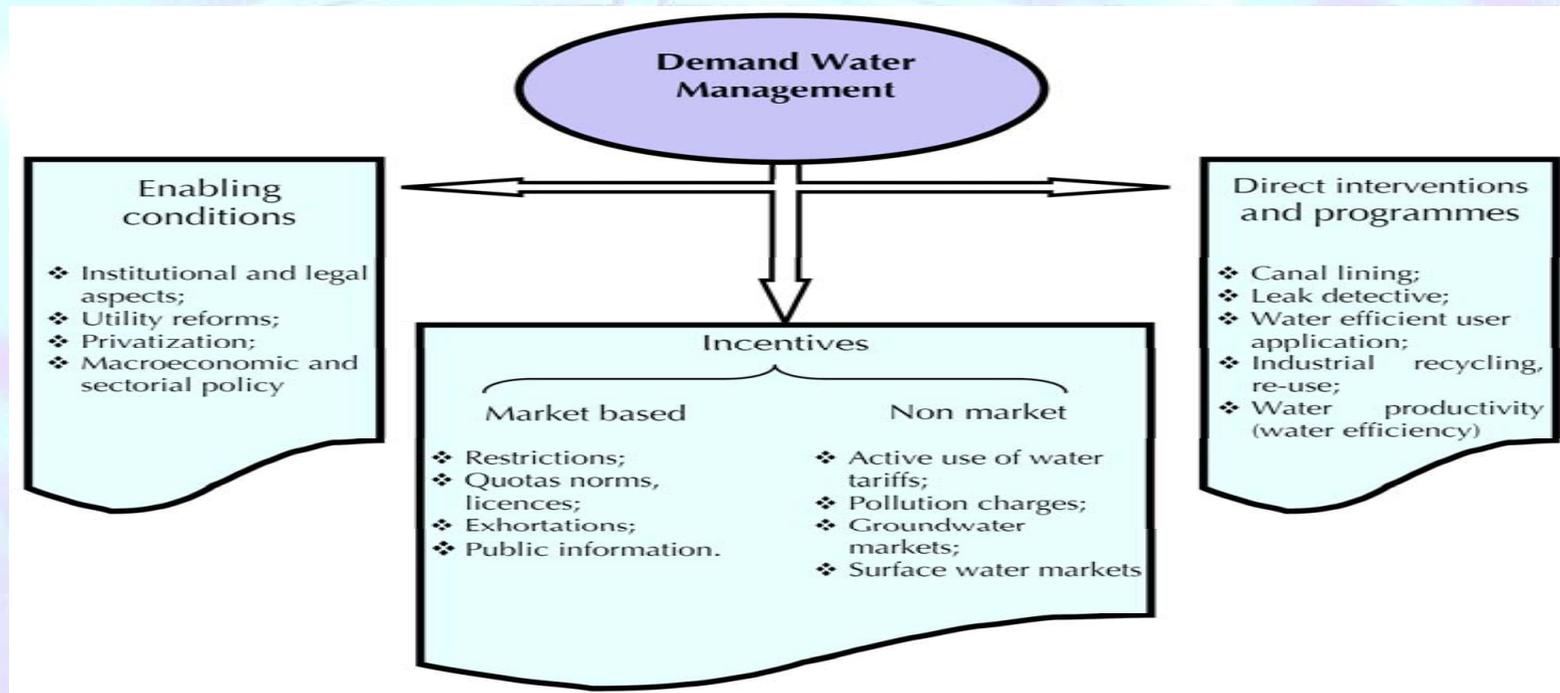
For the countries suffering from water scarcity, the water management approach to be recommended is the one that integrates the supply-oriented management with the demand-oriented one.



## Adoption of an adequate agricultural water demand management

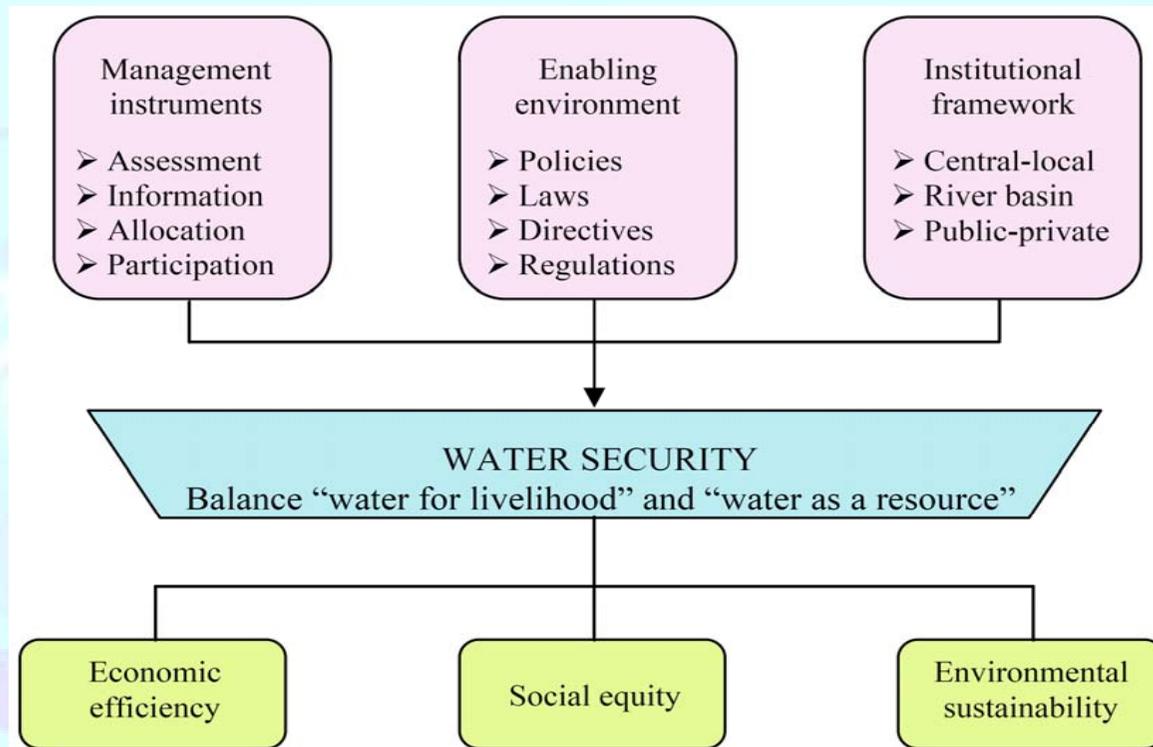
Today, and for the agriculture sector, it is well recognized that demand management is the main way of managing water resources and through its appropriate implementation the countries can move from water scarcity towards water security.

▪ Integrated water demand management to be successfully implemented requires management instruments, the establishment of the enabling environment together with an appropriate updated institutional framework



Demand water management approach: main policy measures

## Demand water management prerequisite



Demand water management prerequisite and water security balance

## **Improvement of water use efficiency and increasing water productivity**

The key principles for improving water productivity at field, farm and basin level, which apply regardless of whether the crop is grown under rainfed or irrigated conditions, are: (i) increase the marketable yield of the crop per each unit of water transpired; (ii) reduce all outflows (e.g. drainage, seepage and percolation), including evaporative outflows other than the crop stomatal transpiration; and (iii) increase the effective use of rainfall, stored water and water of marginal quality.

Improved varieties, improved soil management practices that save water through reduction in non-productive evaporation or flows to sinks in excess of environmental requirements and reallocation of water from lower to higher value uses are several means to increase the productivity of the water.

## **Improvement of irrigation systems and utilization of efficient technologies**

In many Developing Countries technology-related problems have been accumulating for long time and their adverse impact on system performance is increasing because solutions have not been found or proven effective, and maintenance has been neglected.

Modern irrigation techniques need to be carefully selected and adapted to the local physical agronomic and socio-economic development, as well as to the technical and managerial skills of local farmers. Upgrading existing irrigation schemes should, in most cases, be preceded by pilot schemes to test alternative design concepts.

## **Sectorial water use and allocation efficiency**

**There is discussion today on the adoption of the principles of allocative efficiency which lead to the utilization of water first in the economic sectors which bring the best return - that is industry and service rather than agriculture.**

**This will be an increasingly important strategy, but it has not yet entered the policies of national governments or water institutions of the developing countries in the Mediterranean region.**

**For those who consider that new water is the only solution and that the political problems of re-allocation are insurmountable, the approach of reallocation is not yet a relevant option.**

**For those who consider that serving the interests of as many effective water users as possible is the major issue, the re-allocation of water will be a major feature of their future water policies.**

**The more economically advanced a society becomes, the more it needs to question its water resource policy.**

# Conjunctive use of water supplies

The conjunctive water use is one of the approaches to be highly recommended in the developing countries and particularly those suffering from acute water shortages, hence, it implies not only the combined use of water resources of more than one type but also their exploitation through efficient management in techno-economic terms.

In most countries of the Mediterranean, the conjunctive water use is rarely or not practiced at all and in order to make the conjunctive use of water fully operational it is required that:

- policies and regulation must be in place and enforced to ensure that waters of varying quality are used in accordance with approved standards of use
- scientifically based standards of water use and standards for discharge to water systems must be prepared, confirmed and put into effect;
- regulation to enact water use standards must be flexible to allow a structured phase-in of the final standards; it is not rational to expect standards.
- a precise database is needed on the availability of each water supply, in quantity and quality, temporally (when it is available) and spatially (where it is located).

# Effective water governance

In the Mediterranean, to be able to govern the water resources effectively and to achieve better distributed governance, efforts should focus on:

- improving regulation; clearer definition of roles and relations; better allocation mechanisms to bring water distribution in line with society's changing needs; capacity building to prepare individuals and institutions and improving financing, including better use of existing budgets.
- It must be seen within border governance systems in society and must account for social changes.
- An effective water governance will require:
  - building as much as possible on existing arrangements,
  - capitalizing on opportunities and being realistic,
  - opening processes and policy-making with all stakeholders as far as practical,
  - establishing effective socio-political and administrative systems adopting an IWRM approach with transparent and participation processes that address ecological and human needs.

# Promote wide use and recycling of non-conventional water resources

## TREATED WASTEWATER

- For most arid and semi-arid countries, re-use of wastewater may have greater impact on future usable sources of water than any of the technological solutions available for increasing water supply such as water harvesting, weather modification or desalination.
- wastewater use in agriculture is justified on agronomic and economic grounds, but care must be taken to minimize adverse health and environmental impacts.
- promote wide use of wastewater in agriculture More emphasis should be given to the following:
  - find out simple efficient and economic waste treatment methods of low-cost systems.
  - modify the irrigation design, techniques and management to cope with the specific characteristics of the effluents.
  - develop rapid analytical methods for routine monitoring of effluent quality as well as that of irrigation runoff, drainage and groundwater.

# SALINE WATER

Saline water is another potential source of irrigation and its use in the agriculture sector is becoming an increasingly important issue in the Mediterranean.

Recent research development on plant breeding and selection, soil crop and water management, irrigation and drainage technologies had enhanced and promoted the use of saline water for irrigated crop production particularly in arid regions.

The use of non-conventional water resources: major constraints:

- lack of national policies and strategies in this area.
- Inadequate commitment by decision-makers.
- Long-term sustainability is in doubt.
- Lack of adequate funds for operation and maintenance; inadequate monitoring and evaluation; lack of trained manpower.
- Health and environmentally related issues are not being properly considered.

## **Valuation of water and irrigation water charges**

**Water has economic, cultural and socio-economic values. Misuse of water in agriculture is due mainly to the failure in the past to recognize water's economic value and the real cost of water.**

**It is now widely accepted that managing water as an economic good is an important tool to achieving efficient and equitable water use as well as encouraging the conservation and protection of scarce water resources.**

**For many Moslem States, it is difficult to reconcile the concept of water as an economic good and action should be directed to the use of non-price measures to encourage consumers to use water more efficiently, including the following:**

- transferring management responsibilities for operations and maintenance to user groups;**
- promoting water rights and markets.**

## **Strengthening Capacity**

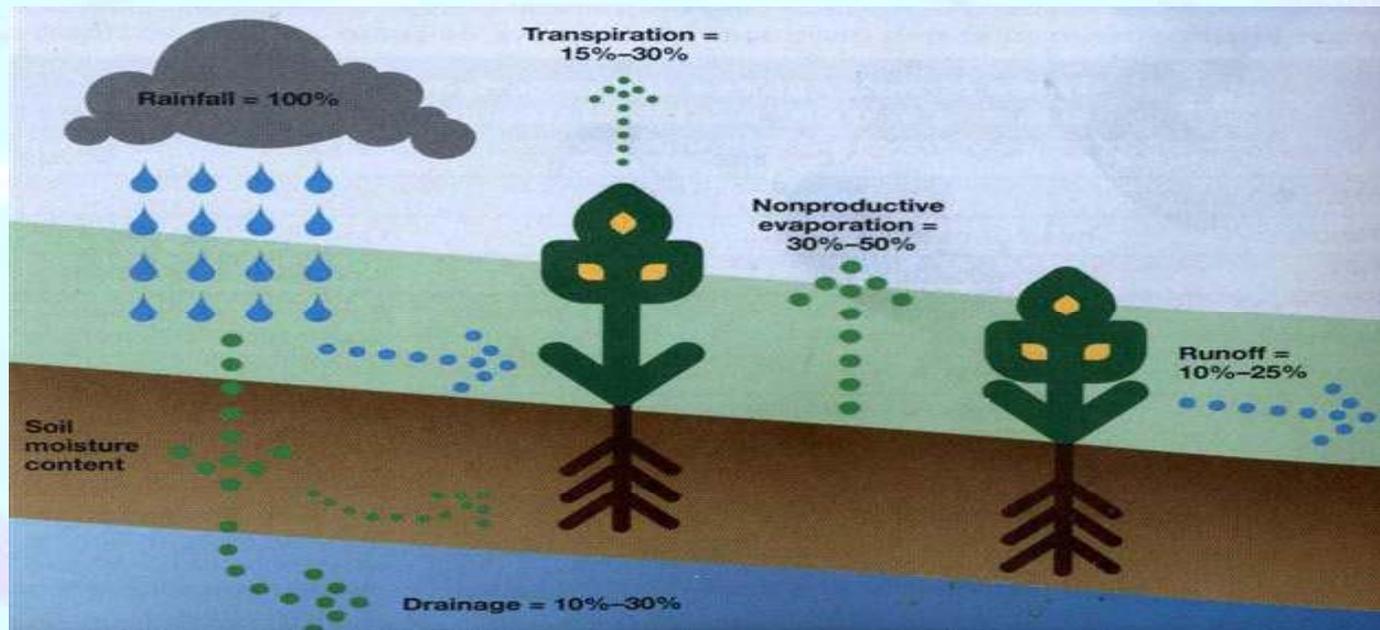
**Capacity building should be expanded and improved and interdisciplinary training of water experts should be promoted on technical aspects as well as financial and the administrative side of the institutions involved.**

**Most countries are in need to institutions with high capability to collect, analyse and elaborate information on water resources including environmental and socio-economic information.**

# Upgrading Rain-fed Agriculture

*Is the future food demands whether it will be provided by rain-fed or irrigated agriculture?*

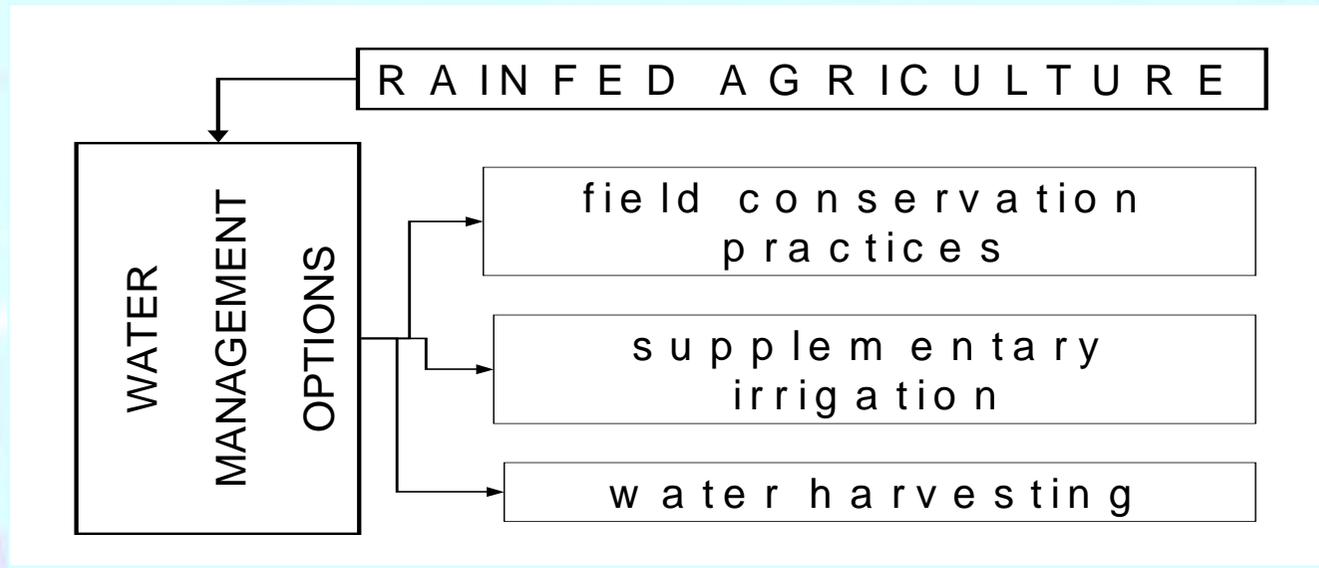
The fact that most of the world's food production does not rely of freshwater withdrawals at all and does not necessarily accelerate the naturally occurring rates of evapo-transpiration, evidently means that the bulk of food production is rain-fed not-irrigated.



*Rainfall partitioning in the semiarid tropics. Source: Water for Life, Water for Food: a comprehensive assessment of water management in agriculture (2007) (ed) D. Molden.*

- Losses in rainfall through drainage, surface runoff and non-productive evaporation is extremely high (70 up to 85 percent).
- Rainfall used productively, to produce food is of minimum values lying between 15% up to 30%.
- In arid areas as little as 10% of rainfall is consumed for food production

## Water Management Options in Rain-fed Agriculture



*Diverse options for water management in rain-fed conditions*

A high-speed photograph of a water droplet falling into a pool of water. The droplet is captured mid-fall, just above the surface, with a small splash of water below it. The impact has created a series of concentric ripples that spread outwards from the center. The background is a soft, out-of-focus light blue and white, suggesting a bright, possibly outdoor setting. The overall image has a clean, minimalist aesthetic.

**DISCUSSIONS and CONCLUDING REMARKS**

# How did we get here?

decline in food production in most arid and semi-arid regions are multifaceted and complex

low agricultural productivity due in many cases to its dependence on rain

the absence of land tenure security, rural financial institutions, market infrastructures, information systems and appropriate farmer advisory services

vulnerability of poor communities to land degradation, water scarcity and climatic variability, particularly drought

**The most common causes of inadequate food supply**

Poor Consideration the farmer associations and the leadership of farmers

We have not been very creative in introducing new technologies

The failure to translate macro-economic policies to the micro, grassroots level.

Dampened creativity and confidence in our people and decreased investment in agriculture through wrong policies

Low level of knowledge about agricultural production practices, an insufficient supply of inputs and their high cost

Ignoring the role of women in food and nutrition security

# What must be done?

The foundation of success lies in two major areas:

- *the first* : is investment in agricultural productivity growth, and
- *the second*: is investing in human resources development

We need to set up appropriate strategies for food and nutrition security that can be implemented, beside an effective decentralized management for public investment, sound public administration, wise public investment and adequate resource allocation.

## Required Actions

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graph TD; A[Required Actions] --> B[All role players and stakeholders are committed to a common vision and strategic plans to increase food production]; A --> C[Coming back to consistency either in terms of technological, institutional, infrastructural and policy requirements or in terms of different pillars within the agricultural sector];
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**All role players and stakeholders are committed to a common vision and strategic plans to increase food production**

**Coming back to consistency either in terms of technological, institutional, infrastructural and policy requirements or in terms of different pillars within the agricultural sector**

# Key Priorities for Action

Our conclusions about key priorities for actions are outlined in the following:

- first, we need better integration between food production and natural resources management (land-water and climate);
- second, we need an enabling condition that determines the roles of all the stakeholders and promotes synergies in their interaction.

For action to take place, there are some political requirements, some institutional requirements and some technical requirements.

## Politically

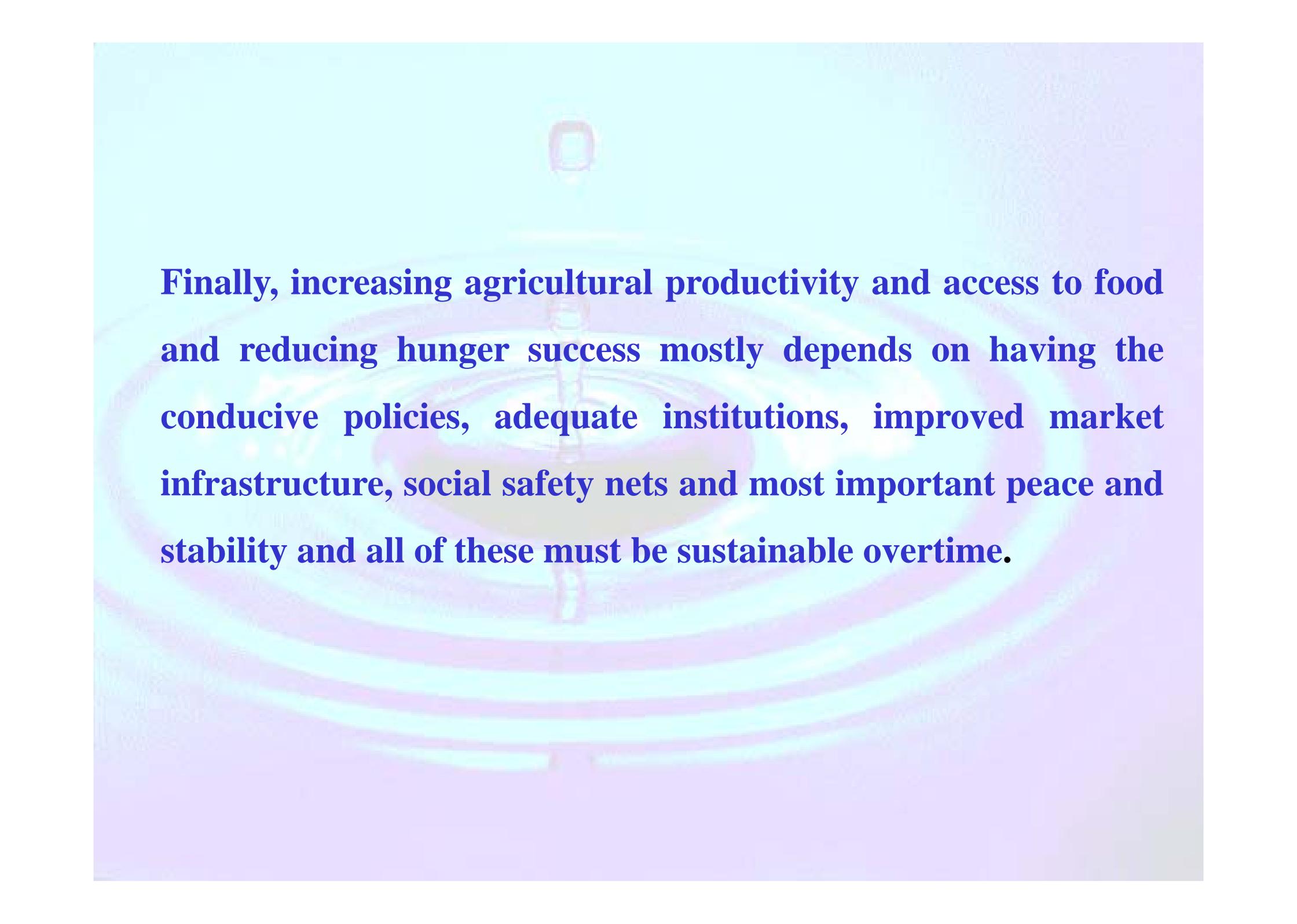
We need capacity building for better policies and more timely implementation, and to train decision-makers to make the right decisions at the right time and to create the conditions for promoting successful technological breakthroughs

## Technically

We need better linkages between research and education and better communication of research findings.

## Institutionally

We need to enhance public and private investments in material and financial infrastructure to re-emphasize decentralization and governance and having partnerships in the areas of financial commitment research, policy-makers and implementation



**Finally, increasing agricultural productivity and access to food and reducing hunger success mostly depends on having the conducive policies, adequate institutions, improved market infrastructure, social safety nets and most important peace and stability and all of these must be sustainable overtime.**

A high-speed photograph of a single water droplet falling into a pool of water. The droplet is captured mid-fall, just above the surface, with a small splash of water below it. The impact has created a series of concentric ripples that spread outwards from the center. The water is a clear, light blue color, and the background is a soft, out-of-focus light blue. The overall scene is centered and symmetrical.

**THANKS**

**FOR YOUR ATTENTION**