

# Abstracts & Case Studies

## International Conference on Policies for Water and Food Security in Dry Areas

Cairo, Egypt  
24-26 June 2013



Policy makers, researchers, development agencies, NGOs, donors, and the private sector will share ideas on how to develop more effective policies to improve food security, job creation and water management in dry areas.





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## Conference Keynote Speakers

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# Water and Food Security

## *International Conference on policies for water and food security in dry areas*

Dry areas cover more than 40% of the world's land surface and are home to 2.5 billion people, including some of the poorest on the globe. These dry areas have less than eight per cent of the world's renewable water resources and are challenged by extreme temperatures, frequent drought, land degradation and desertification.

The papers in this booklet cover the effectiveness of current and alternative water and food policy options and identify strategies to enhance land and water productivity. Food security, employment generation and livelihoods are also on the agenda.

Sound policies for food security and in particular agricultural water management are critical for national economies and particularly for dryland economies, where water resources are already scarce and declining rapidly. Climate change is also set to hit the dryland areas of the world disproportionately hard with higher temperatures and reduced rainfall.

The development of such policies requires an assessment of the current state of knowledge, the lessons learned from research and development programs in different countries, and a much better understanding of the inter-relationships between water policies, food security, employment and the wider environment. This is where the conference is delivering through dialogue, discussion and debate.

The conference addresses four thematic areas.

1/ Incentives for sustainable and efficient water allocation and management

2/ Interactions between water management, food security and employment

3/ Coping with water scarcity: water and food security nexus policy dialogue

4/Policies for enhancing food security

Key expected outcomes include new thinking on the risks and benefits of current water policies and practices; trade-offs between different policy objectives such as food security and the environment; and the effects of water policies on food security and employment in agriculture. The big question is: how best to integrate water policies into programs for sustainable development?

# Food and water security: A call for action

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The recent food price crises have crystallized the attention of national and international organizations and policy makers on food security. The statistics on food insecurity and malnutrition are alarming. Globally there are 870 million chronically hungry people and almost 200 million children today suffer from stunting due to acute malnutrition with a profoundly negative impact on future generations. It is also unacceptable that more than 100 million children under the age of five are underweight and that while malnutrition contributes to 2.6 million deaths of children. Some 1.35 billion people live in situations with prevailing food inadequacy.

Water insecurity is a related and pressing global challenge. It has been building up for decades due to increasing populations, the expansion of agriculture with increased intensity of ground water abstraction and diversion of ever more fresh water resources for farming uses. As a result, groundwater levels are used well beyond their natural recharge levels. Many regions are seeing their groundwater resources declining at alarming rates - in some places over a meter a year. In other locations, groundwater depletion has caused farmers to leave their land.

Today there are 34 countries with per capita fresh water levels below the annual figure of 1000 cubic meters which is considered the water poverty line. In the world's dry areas, water shortages have been a fact of life for centuries. In recent times the problem has been aggravated by rapid population growth and increasing urbanization. Climate change brings additional uncertainty, with a higher frequency of heat spells and droughts and increased climate variability, further worsening water scarcity. The recent slowing of global economic growth also means high unemployment, particularly among youth segments of populations. The problem is even more acute in developing countries where agriculture is a main sector of the national economy.

Despite the critical water security situation faced by many countries, a number of practical solutions to these challenges exist. Sustainable agricultural practices and technologies that can reduce crop water use, strategies and practices that increase the efficiency of water use in farming are known and can be deployed. Likewise, there are proven methods and technologies for harvesting and effectively using water in dry areas. Water use can also be monitored and its appropriate pricing applied to encourage efficient use and reduce waste. The agricultural research and development community, including the CGIAR Consortium, have developed and demonstrated a variety of techniques for more efficient and effective water use.

But even with these many solutions available, the large-scale adoption of technologies, practices and policies that can help countries reduce the threat of water insecurity is progressing very slowly. The main reason for this gap is the lack of enabling policies and low levels of the needed public and private investments to facilitate these transformations. While food price crises have focused public opinion on food security, public awareness on the issue in developed countries needs to be translated into strategies and action plans that will ensure food and water security.

Inaction is not an option. A failure to address the root causes of today's water security crisis will bring grave consequences – for low-income countries, their economic development and most importantly for the millions of smallholder farmers producing food on marginal lands.

Action is needed on a number of fronts:

- Small-scale farmers need support with information, knowledge and finance to invest in water saving technologies that can double or triple their production and incomes. These investments should be targeted in irrigated areas and in dryland farming.
- National and international efforts must be stepped-up to mobilize public and private funds for investment in water infrastructure to improve supply, reduce losses in current systems, increase food production, and reduce land and water degradation.
- Greater efforts are needed to reclaim and clean the degraded land and water resources and reduce salinization of land and pollution of water systems.
- The gap between agricultural know-how and its use in the field by producers, particularly, by millions of smallholder farmers is intolerable. Ways must be found to bridge this knowledge gap and mechanisms devised to accelerate the flow of information, knowledge and inputs to smallholder farmers.

We believe that agriculture and rural development is a wise and strategic investment that countries can make that will bring significant economic and social pay-offs. Nations must invest in water infrastructure (such as irrigation and drainage systems) and their sustained maintenance and upkeep in a way that is not totally dependent on public funds. This is essential to improve services and reduce water inequality by expanding supply to areas that are not reached today. And finally, international mechanisms should be fully deployed to facilitate the sharing of trans-boundary waters which are critical for the food security and stability of riparian countries.





# Contents

Enhancing Water Security Resilience in the Face of Climate Changes in the Arabic World.....	1
Water Shortage at Irrigation Canal Tails in Nile North Delta Region.....	2
The Yemeni experience of the Assessment of the present situation of Water User Associations and their role in community water management in Yemen.....	3
Managing precious water through need based micro-irrigation in a long duration pigeonpea under Indian Plains.....	4
Recycling and waste water as strategy of addressing water scarcity.....	5
Integrating gender into climate change response.....	6
A Conceptual Framework for Water Accounting: addressing water balance, crop rotation and economics.....	7
The impact of food and agricultural policies on groundwater use in Syria.....	8
Model exploring linkages between water, food security and employment.....	9
Impact of improved technology package on irrigated durum wheat productivity: The case of central semi-arid Tunisia.....	10
Agricultural Development Strategies in West Africa: Impact of Biophysical and Socio-economic Process.....	11
Impact of changing cropping patterns on water availability and productivity in the Nile Delta region: A multi-market model approach.....	12
Critical assessment of groundwater management instruments in Tunisia: Current and potential instruments for better regulation of groundwater abstraction.....	13
Investments in improved water management, effects on employment, livelihoods and food security.....	14
Assessment of the Efficiency of Water Irrigation Management: A Comparative Analysis of the Potentials and Challenges in Two Rural Areas in Egypt.....	15
Challenges of institutional decentralisation in wetland management of the Pangani river basin, Tanzania.....	16
Building Resilient Food Systems by Ensuring Water Security.....	17
Exploring Linkages between Water, Food Security and Employment: Results from the Linear Programming Model.....	18
<b>Country Case Studies</b>	
Grain production adaptability to climate change in China.....	19
Ensuring food security in dry land areas of Ethiopia: polices, actors and achievements.....	20
Technology and policy support for ensuring water and food security in dry areas : India's experiences.....	21
Country report by the Islamic Republic of Iran on water, soil and drought management toward maintaining food security.....	22
Water security in Jordan.....	24
Successful story of Syrian self-sufficiency in wheat.....	25
Effects of Sustainable Water Management and Innovations for Agricultural Production and Food Security in Turkey.....	27
Groundwater management for water and food security and the importance of Cooperative Irrigation Management in Turkey.....	28



# Enhancing Water Security Resilience in the Face of Climate Changes in the Arabic World

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## **Abstract**

Climate Change and food security are particularly closely linked in Arab countries due to high vulnerability to Water-related "external shocks." Arab countries are exposed to Climate Change, increasing water scarcity, and conflicts, all of which have direct and indirect impacts on people's well-being. Climate change has significant implications for water security, creating new risks and challenges and exacerbating existing vulnerabilities in the Arab Region. Climate change happens in different ways; gradual changes in precipitation and/or temperature patterns, and increased both variability and frequency of extreme events. Global warming is the main aspect of climate change.

Climate change can be detected by studying patterns of climate variability and means in the long-term. Climate change can affect all dimensions of the water security of vulnerable groups as well as different elements of food systems. This paper presents ways of enhancing the capacity of the water sector to sustainably support water and food security, incorporating the need for adaptation and the potential for mitigation into development strategies. Millennium Development Goal indicators and global country ranking is addressed. Adaptation strategies with respect to planning, information, knowledge, uncertainty, participation of stakeholders, public awareness and coordination are assessed. The paper concludes that the key adaptation strategies include a broad set of interventions ranging from activities that focus on reducing drivers of vulnerability to actions aimed at preparing to confront not yet experienced climate change impacts.

**Keywords:** Climate change, adaptation, water security, resilience, Arab region.

# Water Shortage at Irrigation Canal Tails in Nile North Delta Region

## *El-Bahr E-Sagheir Canal*

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### **Abstract**

The irrigation network is extended all over the country to deliver water to cultivated lands. Water distribution, however, is uneven. The ends of irrigation canals are suffering from shortage of water supply. Water shortage problem is one of the sever problems that face farmers in North Delta Region. However, the high salinity of cultivated soil there increases to the complexity of the problem. In this region farmers use all available types off irrigation water; fresh, mixed, and drainage.

El Bahr El Sagheir canal is one of the main canals in North Delta Region. It supplies water to 167 thousands feddans. At least one third of this area is suffering from water shortage; most of these cultivated lands are located in downstream reaches.

This paper attempts to identify the problems of El Bahr El Sagheir Canal, introduce suitable solutions to increase its hydraulic efficiency to deliver the irrigation water to downstream reach and to evaluate these solutions economically. An intensive field measurement program was applied to the study area. The results of these measurements were analyzed, the different water resources in the study area were located and identified and several non-traditional solutions were suggested to solve this problem.

**Keywords:** Irrigation network, water shortage, hydraulic efficiency, field measurements, Egypt.

# The Yemeni experience of the Assessment of the present situation of Water User Associations and their role in community water management in Yemen

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## **Abstract**

Water scarcity is considered a crucial issue in Yemen. In the past, the management of water was the mandate of the government through different public organizations and individual users. During the last 10-12 years, the government encouraged the establishment of water user associations (WUAs) and water user groups (WUGs). Several projects and policies were introduced to establish and organize the work of WUAs.

An exploratory study was conducted to assess the role/functioning of the WUAs in community water management especially at spate irrigation schemes in selected pilot areas in Yemen. The study was implemented within a period of four weeks. This included collection, review, and assessment of related documents, reports, data collection, and field visits with participatory data collection from the three targeted governorates with various stakeholders including members of WUAs, and finally data analysis and report writing.

The results of the assessment present analysis of the main interventions introduced by various organizations and projects and their roles in establishing WUAs. The functions of WUAs in the studied areas as well as their roles in community water management were also analyzed and presented in this study. The rules and regulations of establishing WUAs and organizing those in spate irrigation schemes were discussed in the study.

The main Conclusions and lessons learned were drawn with respect to the impact of the situation experienced by the country during 2011 – 2012 on the roles and activities of WUAs and their access to services and support from various organizations, the perceived understanding of farmers on the activities of the formed WUAs, and the role of WUAs in community water management.

The study finds success stories of WUAs, and recommendations focusing on short-term and long-term solutions to strengthen the roles and functions and improve the performance of WUAs in general, and in community water management especially the operation and maintenance of spate irrigation schemes in particular.

**Keywords:** Water User Associations, water use assessment, spate irrigation, community water management, Yemen.

# Managing precious water through need based micro-irrigation in a long duration pigeonpea under Indian Plains

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## Abstract

Application of location specific agronomic measures for rainfed areas has considerably augmented pulses production in Indian subtropics. Managing agro-inputs with the help of modern techniques has facilitated in enhancing pulses productivity further through improved input use efficiency. In this context, efficient management of water - a key input for sustained crop production through water saving measures like, need based micro-irrigation- is the major consideration for pulses grown mostly under rainfed. Thus, a need was felt to use precious water more judiciously, sensibly and need-based application through modern technology due to ever-increasing share demanded by urban households (domestic water supply) and industries. This is also true even in water surplus areas like Indo-Gangetic Plains.

One of the approaches for effective on-farm management of allocated precious water is the use of drip-fertigation where both water and fertilizer are applied precisely at the root zone during peak crop demand ensuring direct benefit to plants. This supplementary irrigation especially during long dry spell after rainy months could possibly alleviate moisture stress in growing crops such as long duration pigeonpea with 8-9 months maturity. Therefore, a field experiment was conducted for two years (2010-12) at Kanpur, India under Eastern Indo-Gangetic Plains (with low fertile sandy loam soil) to assess the critical stage based supplemental drip-fertigation in comparison to the standard practice (rainfed).

Three planting patterns were compared in main-plot, five drip-fertigation schedules in sub-plot were compared in a split plot - rainfed as control, drip-fertigation at only branching or pod development, and both drip and furrow irrigation at both these stages. A potential seed yield of 3708 kg/ha was realized under drip-fertigation at branching only.

A potential seed yield of 3708 kg/ha was realized under drip-fertigation at branching only. Although different planting patterns could not influence crop performance, yet a single irrigation (2 cm through 5 splits) through drip-fertigation with half of N+K fertilizer at branching (3419 kg/ha) produced significantly higher (19.6%) seed yields over rainfed pigeonpea. In addition, drip-fertigation at both stages also out-yielded significantly over improved practice (furrow irrigation) during second year (9.4%) and in pooled data (6.3%). Yield attributes such as pods/plant, 100 seed weight and harvest index showed similar trend with that of seed yield.

Lower water use, greater profile soil moisture content and water use efficiency (61.3 kg/ha-cm), higher plant NPK uptake with improved soil nutrient availability and greater net return (INR 9700/ha) were evident with drip-fertigation at both the stages. These findings could possibly be extended to large areas enabling efficient management of precious water through community sharing of micro-irrigation infrastructures through village cooperatives and welfare schemes.

**Keywords:** Micro irrigation, drip-fertigation, water management, India.

# Recycling and wastewater as strategy of addressing water scarcity

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## **Abstract**

As growing populations and their increasing economic activities demands more water, water reclamation and reuse becomes increasingly important and an indispensable component of integral water resources management to enhance water supply reliability. Nowadays, there is political and technical recognition of the importance of treated waste water in reducing the enormous gap between the increasing water demand and limited water supply, particularly in arid and semi-arid areas of developing countries. Indeed, for some water-scarce regions including the Middle East and the Mediterranean region, treated wastewater is becoming a common source for supplementary water and is already included in national master plans.

This source of water is considered promising as it is renewable, has not major limitations in terms of amounts treated, relatively cheap, rich in plant nutrients, and not affected by climate change. Deep analysis of available water resources in arid regions evidently indicate that the demand will continue to increase, raising questions about where the extra water will come from? And, what strategies are to be recommended? To avoid any environmental degradation and possible health risks, it is needed to adapt an integrated water management approach, disseminate existing knowledge, generate new knowledge and monitor and enforce standards.

It is important to strengthen the capacity of national and local hydrological research institutions and to improve their links with others dealing with environmental economic and social aspects. Failure in managing and governing the use and recycling of treated waste water should be counteracted by improving the efficiency of public administration. This improvement can be achieved through improved management, better environmental legislation and monitoring, less bureaucracy, decentralized tasks, enhanced skills of the public administration employees and adequate funding to undertake public functions. These fundamental issues are discussed in this paper.

**Keywords:** Recycling, wastewater irrigation, monitoring, capacity, institutions.

# Integrating gender into climate change response

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## Abstract

The status of gender in global national climate change policy is insufficiently addressed. The current global policy response to climate change focusing on the reduction of greenhouse gas emission remains weak on securing social and gender equity and equality, at international and domestic levels. Integrating gender and climate change at national level remains a challenge, as national governments often face difficulties integrating variety of cross cutting issues into their policies due to competing priorities for scarce resources. Indeed for many countries policy coherence on gender and climate change are poorly formulated and are always lacking.

However, some progress has been made over the past few years by some national governments, by taking an appropriate, comprehensive and gender-responsive approach. Lessons learned demonstrate that any development programs or policies addressing climate change should be grounded on the principle that neither the impact pathways nor the responses to climate change are gender-neutral, and that a gender-responsive approach is required. Adapting to climate change is not an easy process, but it is a complex one that requires a broad range of efforts, incentives, resources, commitments and active interventions through most parts of society.

Women should be at the center of adaptation programs because they are particularly vulnerable group to the impacts of disasters due to skewed power relations and inequitable cultural and social norms. At the same time women are essential for developing sustainable adaptation options due to their knowledge, multiple and simultaneous responsibilities and the significant roles they play in agriculture, food security, household livelihoods and labor productivity. Furthermore in the face of extreme events such as drought, floods and other climate related disasters, women play a key role in adaption efforts, environmental sustainability and food security. Several dynamics make adaptation more difficult for some women due to lack of access to formal education, food insecurity, limited access to recourses, exclusion from policy, institutions and decision-making, and other forms of social marginalization.

The question under discussion is how to overcome such constraints and what are the appropriate tools to be implemented for strengthening women engagement in climate change adaptation and mitigation as well as the ones to promote gender equality and gender roles including both women and men, identifying their different roles, responsibilities and capabilities. For many countries around the world, integrating a gender-responsive approach into climate change responses remains to be done. Also there is a need to have effective strategies for systematic integration of gender in their adaptation and mitigation programs, to strengthen the capacity of national and local hydrological institutions and to improve their links with the others dealing with gender mainstreaming, environmental, economic and social aspects. Those issues are discussed in this paper.

**Keywords:** Gender, integration, climate change, women, strategies .



# **A Conceptual Framework for Water Accounting: addressing water balance, crop rotation and economics**

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## **Abstract**

This paper presents a conceptual framework for water accounting where, new concepts are introduced and new indicators for describing the status of irrigation management defined. The new performance indicators are systematically tied to the very important and related issues of crop rotations, water balance and economics. The concepts and indicators in this paper are expected to be instrumental among other things in: 1) the identification of opportunities for water savings and increasing water productivity; 2) developing a better understanding of present patterns of water use and impacts of interventions. The framework can be adapted to specific farm conditions.

Using a case study of two successive rotations since 2008, in Kafr El-Sheikh- Egypt, we demonstrate how the new performance indicators can be used to develop better understanding of the reality governing current irrigation water taking into account the difference in the yield and value of different crops. Analysis results show that net inflow and depletion in the Rice-Sugar beet-Cotton- Wheat (RSCW) rotation system are 3883 mm and 2511 mm respectively which are higher than that of the corresponding figures (3765 mm and 2291 mm respectively) in Cotton-Wheat –Rice-Wheat (CWRW) rotation system.

The gross and net depletion fractions (DF) are 6.1% and 6.2% less in the CWRW compared with RSCW. Net inflow of rice was 1520 mm greater following cotton and sugar beet than wheat in RSCW and wheat in CWRW. Total outflow was higher in RSCW than CWRW (1323 vs. 1212 mm). The RSCW rotation has the highest net returns, about US\$2286 ha<sup>-1</sup> compared with US\$2003 ha<sup>-1</sup> for a CWRW rotation.

Therefore, when water is becoming a limiting factor for agriculture, a systems performance indicator rather than a crop performance indicator is needed to determine the optimum crop rotation, water allocation among those crops, and ultimate net return of the cropping system should be.

**Keywords:** Irrigation water, performance indicators, depletion fraction, crop rotation, and economics.

# The impact of food and agricultural policies on groundwater use in Syria

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## **Abstract**

The expansion of irrigation during the last three decades, using both surface water and groundwater resources, has had an important positive impact on Syria's agricultural production. It is an example of success in achieving food policy objectives but it has also introduced the challenge of groundwater sustainability.

This paper examines the trends of groundwater abstraction for irrigation and the impact of government policies, including input subsidies such as diesel fuel subsidy and procurement crop price support. Fuel subsidy is an important driving force for groundwater depletion and over-abstraction. This analysis portrays the interaction between policy signals and farmers' water use and allocation. The fast decline in groundwater resources shows the limitations of agricultural development strategy and raises the question whether groundwater in these dry environments should be considered a renewable resource.

**Keywords:** Groundwater irrigation, groundwater policy, food and agricultural policies for groundwater, Syria, drylands agriculture.

# Model exploring linkages between water, food security and employment

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## **Abstract**

Fertile land and fresh water constitute two of the most fundamental resources for food production. These resources are affected by environmental, political, economic, and technical developments. Regional impacts may transmit to the world through increased trade. Using a global forest and agricultural sector model, we quantify the impacts of increased demand for food due to population growth and increased income on potential land and water use. In particular, we investigate producer response and adaptation in terms of crop and irrigation choices, agricultural market adjustments, and changes in the values of land and water.

The issues of climate change and sustainable development have been addressed in largely separate circles in both research and policy. Nevertheless, there are strong linkages between the two in both realms. This research focused on the scientific linkages and discussed the opportunities that provide for integrating policy development, and the necessity to consider the possible trade-offs. This research suggested that integration might not only provide new opportunities, but might even be a prerequisite for successfully addressing both issues. For example, the feasibility of stabilizing greenhouse gas concentrations is dependent on the general trend in socio-economic development. Policies relating to climate change adaptation should be fully placed in the larger context of policies for technological and socio-economic developments and not viewed as an add-on to those broader policies.

As a result of optimal cultivation based on suitable food security, farm income increased by 106%, water uses decreased by about 5%, CO<sub>2</sub> emission reduced by 6%, and energy use reduced by 5%. It was noted that Lower, Middle and Upper Egypt did not lose its acreage. Egypt will be more or less operating at the optimal cultivation based on suitable food security comparison to the existing situation.

**Keywords:** Development, climate change policy, adaptation, emissions scenarios.

# Impact of improved technology package on irrigated durum wheat productivity: The case of central semi-arid Tunisia

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## Abstract

The Tunisian wheat sector is characterized by a rapid increase of the deficit between consumption and production. Half of this consumption is imported, while low yields contribute to the production while gap. The enhancement of wheat yield becomes a must for policy makers who want to reduce imports. In this context, the "Food Security in Arab Countries" project implemented by ICARDA in collaboration with the national programs promotes the identification and transfer of technological innovations that improve irrigated wheat productivity.

As a pilot area, this project is being implemented in Chebika (Central Tunisia) region, where in the last two years a new technological package of durum wheat production has been tested by many farmers of the region. The objective of our study is to identify the sources of output gains between farmers participating in the project trials and farmer's using conventional techniques. Tornqvist-Thiel index was used for the identification of the output gains generated by the technology package. Data used for the analysis were collected from 60 participating farmers during 2011-2012 cropping season, and 110 non-participating farmers. Results show that average yield differentials between participating and non-participating farmers is 48.4%. This value is composed of 9.3% gain generated from global factor productivity and 39.1% from the increase of the inputs use. It also indicates the relative importance of inputs contributing to the global factor productivity difference between enhanced technological package and conventional practices in the region.

These results are valuable for policy makers since they can be used to focus on main factors affecting the improvement of irrigated wheat productivity in central Tunisia. Identifying and removing the constraints to a large scale adoption of the new technological package, therefore, becomes critical for reducing the consumption-production gap.

**Keywords:** Technological package, Irrigated wheat, Tornqvist-Thiel index, productivity gains, Central Tunisia.

# **Agricultural Development Strategies in West Africa: Impact of Biophysical and Socio-economic Process**

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## **Abstract**

Agriculture plays a vital role in national economies and the livelihoods of the rural poor in developing countries. Strengthening rural development in these countries is essential to address the root causes of poverty. Rural development entails providing rural communities opportunities to earn sufficient income for acquiring necessary food and other basic consumer goods. In this way, countries can create a basis for the fight against poverty through sustainable agricultural development.

The present work is not neutral on all issues of sustainable development in fragile areas, but we believe that no development strategy or policy can, by itself, identify, analyze the paths of development of sensitive areas without determining the comparative advantage of each zone. In other words, the identification of feasible policies for sustainable development must begin by considering the comparative advantage of different strategies (development paths) in different situations and different geographic locations in West Africa.

It seems that there isn't a single strategy or a single development path for all sensitive areas in West Africa. Given the different situations in terms of technical and economic efficiencies, there isn't a single standard model to apply everywhere, but there are several paths of development. The diversity of situations in the various areas directs the government's decision of individual countries to an exploitation of their comparative advantages and then to investments in infrastructure and institutions.

This paper uses patterns of strategies based on the classification of the area between the physical, human, natural or social issues; this research found that the comparative advantages through these different zones and institutional innovations are capable to mobilize these investments.

Moreover, we found that the African States must assume their responsibilities and roles, which means technical and institutional innovation and base their policies on the understanding of the relationship between natural resource endowment, technological change and institutional change.

**Keywords:** Agricultural Development, Biophysical and Socio-Economic Factors, Induced Innovation, Arid and Semi Arid Zone in West Africa.

# Impact of changing cropping patterns on water availability and productivity in the Nile Delta region: A multi-market model approach

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## **Abstract**

Water resources in Egypt are becoming scarce. Surface-water resources originating from the Nile are fixed by international treaty and limited to 55.5 billion cubic meters per year and now are fully exploited, while groundwater sources are being brought into full production. Increasing population, a desire for agricultural expansion, and greater demands for potable water, together with Egypt's fixed (may be decreasing in the near future) water share from the River Nile warrants the need for improved water management and increased water productivity. A major challenge is that more than 80% of the country's water share is currently diverted to agriculture.

The Nile Delta is located in the north of Egypt, since ancient times, the Nile has deposited a highly fertile clay soil in the Delta. Along the fringes with the desert, this clay layer is just a few meters thick, but in the centre it may be up to twenty meters thick. The Nile Delta has an agricultural area of about 4 million Feddan, and it is characterized by small farm holdings with an average size of about 1-3 feddan. The main summer crops are rice, cotton, and maize (high water consumption crops). The main winter crops are wheat and alfalfa. Flood irrigation is used by subdividing the field in small checks that hold water.

In recent years, delta farmers are facing a big problem which is lack of water availability especially during the summer season. This problem affects the productivity and profitability of farming. Attempts to increase water availability and productivity in the Nile Delta have traditionally focused on conservation of water through the adoption of on-farm water saving practices and technologies such as laser leveling of the soil and sprinkler and drip irrigation systems. Less attention has been given to cultivation of alternative crops (changing cropping pattern) that not only use less water per feddan but also generate significantly higher returns, and in this way increase the value added per unit of water consumed

The main objective of this research was to study the impact of changing the Delta cropping pattern on water availability and productivity at macro level and on household net income at micro level, and give recommendations for improvement with an analysis of its efficiency. The study also aims to build several different scenarios on changing cropping pattern and its effect on water consumption and balance of trade (BOT).

To achieve these objectives, a multi-market model has been developed, and then the model has been applied to experiment with exogenous policy changes to assess their impacts on household income, and government balance of trade. Results have shown very positive results on water saving per feddan if farmers change their cropping patterns from cultivating traditional- high water consumption crops to high value lower water consumption crops such as herbs and spices and vegetables.

**Keywords:** Nile Delta water allocation policies, water saving, alternative crops, changing cropping patterns, Egypt.

# Critical assessment of groundwater management instruments in Tunisia: Current and potential instruments for better regulation of groundwater abstraction

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## Abstract

Groundwater is very important in Tunisia, where 43% of water currently used for irrigation is pumped from deep and shallow aquifers. Groundwater resources have been intensively mobilized in many parts of the country since the 1980s, leading to its rapid overexploitation. As a result there are signs of aquifer depletion in many regions. The total number of aquifers in Tunisia is around 273, from them 71 are overexploited, with an average rate of 146% of the recharge per year. In the literature, many authors attribute the overuse of the groundwater resources to the lack of appropriate governance framework, strictly enforced and monitored. Thus the objective of this paper is twofold: first, we aim to present and discuss the typology of different groundwater management instruments based on current available literature.

Some seminal works are discussed and summarized in order to provide clear idea of what we consider as "types of groundwater management instruments". In the second step, a set of performance indicators, which was used to evaluate these instruments, is developed. Once this theoretical background is established, the second objective is to analyze and discuss different instruments currently used in Tunisia for managing the groundwater resource. In this case, a SWOT analysis is carried out in order to identify the strengths, weaknesses, opportunities and threats of the groundwater governance framework in Tunisia. Results of this study show that most of the economic and regulatory instruments in Tunisia, which are used to regulate the groundwater exploitation, are applied at the local levels through Water User Associations (WUAs). This means that the impact of these policies will highly depend on the WUAs performances.

Moreover, at the national level, many decisions and policies targeting groundwater sector have been established since the 90's, however their implementation and enforcement is still very weak mainly due to non-favorable political, institutional, and social contexts. On the basis of our findings, we conclude that the remaining action for enhancing the sustainability of groundwater use in Tunisia has to rely on two main axes: the first is related to the improvement of the institutional (especially administration) performances, related to the control and monitoring of the groundwater, and to the effective enforcement of agreed regulations. The second is related to the change of the currently established ethical values of various stakeholders, especially the farmers. Strengthening ethical values through building awareness and transfer of information and knowledge that supports behavioural change at the local levels, such as salience, common understanding, trust, reciprocity and autonomy have to be incorporated together with technical, economic and regulatory issues related to the national groundwater management strategy in Tunisia.

**Keywords:** Groundwater, governance, regulation, participation, Water User Associations, Tunisia.

# Investments in improved water management, effects on employment, livelihoods and food security

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## **Abstract**

Food security is threatened by frequent droughts and dry spells. The Butana Integrated Rural Development Project is an attempt to improve on-farm water use efficiency through traditional terrace cultivation. This system lacks essential technical standards and makes it ineffective. The impacts under the present situation are poor interception, collection and distribution of surface runoff water, increased cost of terrace reconstruction and repair, soil nutrient leaching and exhaustion and low crop productivity. This situation is corrected by the use of normal survey procedures and simple contour measuring device.

About 21,400 hectares of rain-fed area have been treated with terrace for sorghum cultivation benefiting 6,427 households which represent 36% of the targeted households. Results of this intervention show that moisture is retained in soil for two months after crop harvest and crop could survive for 3 weeks in case of long dry spells. Sorghum yields have increased from 430 to 1510 kilograms per hectare under an average of 150 mm of rainfall and from 650 to 2250 kilograms per hectare under an average of 250 mm of rainfall. Simple preliminary cost benefit analysis is conducted for terrace cultivation for 2.1 hectare area. The economic impact of that intervention is that average gross margin has increased by 191% from \$200 per hectare with traditional practice to \$582 with the improved terraces.

Food self-sufficiency for the poor household of six members is estimated at 0.5 kg / person/day, with a total of 1100 kilograms per year to cover household consumption and another 1100 kilograms per year to feed a herd of 10 dairy goats. With better water management, the producers are motivated to use the catchment area for crop cultivation, and the area seriously affected by the surface run off for fodder and range plants. By intensifying production on small areas, farmers are able to save time for other purposes. Moreover, cultivation of small areas would promote optimal use of natural resources for the sustainability of poor livelihoods. Field Days were organized for reflecting production of improved terrace. These results have encouraged policy makers to ban the use of wide disc plough where it is used to cultivate large areas at the expense of natural resources.

**Keywords:** Water management, frequent droughts, water harvesting, yield increased, food security, Sudan.



# Assessment of the Efficiency of Water Irrigation Management: A Comparative Analysis of the Potentials and Challenges in Two Rural Areas in Egypt

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## Abstract

Egypt's water resources are severely constrained. This calls for increasing water use efficiency by improving irrigation management practices. The government of Egypt is committed to a long-term irrigation improvement program and large-scale projects to modernize irrigation, associating continuous flow in secondary canals and collective pumps at the tertiary level (mesqa). This technological intervention also implies social and organizational changes manifested in Water Users' Associations (WUA) which are playing a major role in decision making and the operation and maintenance of the pumps and mesqas by users themselves to assure the sustainability of the system.

This study is based on a survey of 400 farm households of the project funded by The Japan International Cooperation Agency (JICA) in two areas of Kafr-Elshake governorate of the Nile Delta. Two hundred of the respondents were selected from an area that has improved irrigation system and managed by WUAs. The other 200 respondents were selected from traditional areas using the traditional irrigation system. The study aims to explore the efficiency and effectiveness of water irrigation management in both areas of the study. It examines the extent to which the institutional structure and arrangement have an impact on the performance and sustainability of the irrigation system, as well as on farmer's livelihood.

The study examines and compares the two areas in the dynamics of managing the rules and cost of water distribution of the irrigation system. It also seeks to investigate the potential behaviour toward risk management problems and challenges facing the two systems.

The empirical results showed that the higher is the probability of operating in the irrigation system, the higher is the productivity of the farms. This effect is subject to the realization of a specific channel, which accounts for the characteristics of the farm, the irrigation system and all the constraints faced by the farms.

Several lessons learned and recommendations are introduced: (1) Continuous flow is important, the provision of sufficient irrigation water by the Ministry of irrigation to farmlands in light of nationwide reform plan inclusive of all problems. (2) Strong political support and an enabling environment to facilitate decentralization. (3) Shifting of gov't role from direct management to support services and enforce regulations. (4) Regular trainings of WUA and strong TA to raise the awareness of the replenishment, maintenance, and protection of water resources against pollution and depletion.

**Keywords:** Irrigation management, water efficiency, assessment, Egypt.

# Challenges of institutional decentralisation in wetland management of the Pangani river basin, Tanzania

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## Abstract

This paper demonstrates how theories of development and international conventions on wetlands management are translated into national policies and the consequences of its implementation faced by the local institutions. The paper presents findings from man-made wetlands in Tanzania's Pangani river basin, where institutional decentralisation of wetland resources and their associated livelihoods are managed by civil society organisations (CSOs) under common property arrangements that generate substantial household cash income and food security. Comparative research design considered three livelihood niches (irrigated agriculture, agro-pastoralism and fisheries) and examined 360 households out of which 120 respondents from each livelihood niche were sampled and interviewed. The main question addressed by this paper is the impact of donor agencies on the institutional decentralisation of wetland management to the lower levels of CSOs.

The paper combined qualitative and quantitative (Q-square) method of data analysis whereas qualitative tool for textual data analysis (Welft QDA) and descriptive statistics for quantitative data analysis were employed. The research findings revealed the existence of fragmented institutional development between the central government's wildlife sector that manages wetlands based on a 'protected area model' and CSOs under the water sector through river basin authorities that manage wetlands as common pool resources based on a 'river basin model'.

Dependence on external donor funding for both wildlife and water sectors lacks coordination and is largely subjected to power relations that have contributed to the loss of a common development focus on resource management, with water scarcity markedly pronounced in the wetland communities. Institutional development reforms on four way dynamics are suggested and discussed towards realising common development goals, as outlined in the national development vision 2025.

**Keywords:** Wetlands management, institutions; Pangani river basin; Tanzania.

# Building Resilient Food Systems by Ensuring Water Security

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## Abstract

Food security has once more become an important element of the international development agenda. In the years to come, we anticipate that climate change, higher energy prices and the global water crisis will make food harder and more expensive to produce. A number of new international initiatives on food security (e.g., New Alliance by G8) pay due attention to food production and increased nutrition, but water security is largely overlooked. We know that about 60% of the world population is projected to be living in water-scarce conditions by the year 2025; the early impacts of crisis can already be observed today.

A comprehensive approach that combines water, energy and food security as a policy nexus is critical – the segregated, sectoral approach is no longer viable. A key dimension of this security nexus is that we must improve water use efficiency in agriculture, which is not only a resilience measure but also a mitigation strategy. While improving water use efficiency could involve promoting traditional interventions such as micro- or drip irrigation and drought-tolerant cultivars, we believe that there is an enormous potential for wastewater re-use. In regions of acute water scarcity, safe wastewater re-use becomes a powerful tool in the overall management of water resources. For example, in the Middle East and North Africa region up to 13.2 km<sup>3</sup> of wastewater is generated per year but less than one third is treated for its safe and productive re-use. UNU-INWEH has partnered with a number of institutions to assess on-the-ground application of these principles of increased water use efficiency and safe wastewater reuse in Burkina Faso and Ghana.

The project will identify current water availability and use throughout the year including the use of domestic water by women for livelihood support. Such a scoping analysis will include biophysical, economic and cultural aspects of water use. Selected demonstration sites will help test the sustainability and resilience of the local food systems as well. We plan to eventually formulate a common platform at the national, regional and global levels to address water resource allocation for food production.

**Keywords:** Water security, water-use efficiency in agriculture, water and food production systems, water-energy-food security nexus, wastewater reuse for agriculture, Burkina Faso, Ghana.

# Exploring Linkages between Water, Food Security and Employment: Results from the Linear Programming Model

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## **Abstract**

Fertile land and fresh water constitute two of the most fundamental resources for food production. These resources are affected by environmental, political, economic, and technical developments. Regional impacts may transmit to the world through increased trade. Using a global forest and agricultural sector model, we quantify the impacts of increased demand for food due to population growth and increased income on potential land and water use. In particular, we investigate producer response/adaptation in terms of crop and irrigation choice, agricultural market adjustments, and changes in the values of land and water. This research focuses on the scientific linkages and discussed the opportunities that provide for integrating policy development, and the necessity to consider the possible trade-offs. Linear programming model was formulated to focus on the scientific linkages between water, food security and employment.

The research was conducted in old land in Egypt, which roughly accounted for more than 77% of total cropped area of land in Egypt. As a result of optimal cultivation based on suitable food security, farm income increased by 106%, water uses decreased by 4.6%. CO<sub>2</sub> emission reduced by 6.3%, energy reduced by 5.4%, the annual internal rate of return (IRR) became higher than the existing model for all zones. It was noted that Lower, Middle and Upper of Egypt did not reduce their cultivated acreage. Egypt will be more or less operating at the optimal cultivation based on suitable food security comparison to the existing.

**Keywords:** Sustainable development, climate change policy; adaptation, emissions scenarios.

## Grain production adaptability to climate change in China

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### Abstract

Based on the provincial data in 2009 and county-level data from 2007-2008 in China, applied the Cobb-Douglas production function, adopted quintile regression method. The article empirically estimates the contribution of improvement irrigation ratio and stable-harvesting ratio to the grain yield.

The research findings show that under other input things being equal, the contribution coefficients of increase the irrigation ratio and the stable-harvesting ratio to grain yield are statistical positive at above 5%, which prove improving irrigation conditions and adaptability to climate change are significantly and positively related to the grain yield increase; under the same condition, the contribution made by stable-harvesting ratios to the great yield is greater than that of the irrigation ratios; the lower great yield, the larger contributions made by improved irrigation ratio and stable-harvest ratio to the grain production, and vice versa, while the lowest yield county (the 10% lowest yield), the increase of grain yield by improving the irrigation conditions and stable-harvesting arable lands are the most significant, which implies that the irrigation infrastructures are quite insufficient in the lower grain yield regions and the marginal return of irrigation investment is higher. It should strengthen the irrigation investment in these areas.

**Keywords:** Climate change, food security, adaptation, China.

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## **Ensuring food security in dry land areas of Ethiopia: policies, actors and achievements**

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### **Abstract**

The paper presents the importance of dry land areas and the associated water and food security policies that are in place in Ethiopia along with the achievements and challenges. In Ethiopia, there are 18 major agro-ecological zones (AEZs) and out of them 8 are dry AEZs that are arid, semi-arid and dry sub-humid covering about 68% of the total land. Currently, the 2010 Growth and Transformation Plan – GTP of the country provides the overall development framework together with the basic policy directions of agricultural development that are utilization of human labour, proper use of agricultural land, the combining of endogenous and exogenous knowledge; focus on innovations adapted to agro-ecological zones (development corridors); and an integrated development approach.

In addition, alignments of donor support, to ensure wider scaling up of activities and to meet the resource gaps, are also considered. In recognition to the importance of dry land areas, the water and food security policies and interventions explicitly address dry land agriculture by differentiating them into sedentary dry land areas and pastoral and agro pastoral areas. In general, the priority areas of interventions are related with water and natural resource conservation and rehabilitation linked with considerable support for (i) dry land agricultural research, (ii) agricultural extension for effective technology transfer and skill development of farmers and pastoralists, (iii) natural resource, water management and irrigation promotion, (iv) promotion of commercialization and improving agricultural marketing systems along with investment in infrastructure (road, telecommunication, education etc), and (vi) implementation of food security specific programs.

As the result, considerable improvement in food security in general and water security in particular has been achieved in the last decade. The key challenges for improved performance are related to (i) the continuous challenges of the effects of climate change (drought, flood, disease and pest etc), (ii) the challenges in establishing effective technology multiplication and delivery mechanism in dry land areas due to the associated high risks, (iii) the limited agricultural technology uptake in dry land areas, (iv) the nature of long period requirement for benefits and the huge initial cost of reclamation of natural resources, and (v) lack of adequate human power with expertise.

**Keywords:** Water policies, climate change, natural resources, Food security policies, Ethiopia.

## Technology and policy support for ensuring water and food security in dry areas : India's experiences

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### Abstract

Some 78 million hectares (55%) of India's net sown areas is rainfed and it is spread across several agro-ecologies. This has a very important role in the inclusive growth, the food security, livelihoods and sustainable development in the country. The yield fatigue in major food crops like rice and wheat is already visible in the predominantly irrigated areas. Moreover, groundwater now accounts for over 60% of the total irrigated area in the country, and a looming groundwater crisis is evident in most of these areas. Climatic variability and climate change are further compounding risks and investment decisions of policy makers and farmers particularly in rainfed agriculture. Rainfed areas located in arid and dry semi arid climatic zones in India are commonly referred to as drylands. The drylands in India are characterized by high levels of land and water degradation, low and erratic rainfall, water scarcity, shallow soil depth, low soil fertility, rural poverty, small and marginal farmers, risks and distress. Agricultural activities are more diverse in drylands with crops, livestock, horticulture, agro forestry, seed spices, special attribute niche crops like cluster bean, medicinal and aromatic plants.

Integrated crop-livestock systems are the major source of livelihood to millions of small and marginal farmers particularly who largely practice subsistence agriculture. The recent technological advances and investments on land and water management by the Government of India have enabled these farmers to diversify the cropping patterns towards more profitable market oriented farming systems. A favourable policy environment at the central and state level has also helped in this shift from subsistence farming to market oriented agriculture. Convergence across the programmes and departments is accorded priority for ensuring water and food security.

The rainfed crops have shown more impressive growth rates in recent years as compared to irrigated crops like rice and wheat. To stabilize the production and productivity in such environments, the Indian Council of Agricultural Research (ICAR) has evolved a suite of technology options which are largely based on in situ and ex situ conservation of rainwater, use of short duration crop varieties, adoption of intercropping systems and small farm mechanization. Most of the development programs of the Government of India in agriculture focus on conservation of soil, rain water and efficient use of harvested rain water and /or ground water for irrigation. The ICAR has come up with location specific technologies on water harvesting which help rainfed farmers to provide one supplemental irrigation to most rainfed crops and enhance the crop yields by about 50%.

Areas with maximum rainwater harvesting potential have been mapped and technology modules for harvesting surplus runoff and recycling for life saving irrigation of crops have been developed. Likewise, technologies, institutional and policy interventions for efficient and productive use of irrigation water including multiple water uses are formulated. Conservation agriculture systems are being promoted which use water and energy efficiently. As a result of these technology and policy initiatives, the Indian farmers are enabled to cope with climatic variability, droughts and water shortages which occur frequently. The paper discusses the underlying linkages between water, climate and food security in the Indian context, the lessons learnt so far in technology applications and policy innovations with a view to share these experiences with wider constituency of practitioners from other developing countries.

**Keywords:** Water policies, climate change, food security policies, water harvesting, India.

## Country report by the Islamic Republic of Iran on water, soil and drought management toward maintaining food security

**Dr. Abdol Ali Ghaffari**

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### Abstract

Owing to its diverse ecological characteristics, Iran benefits from favorable conditions for producing vast variety of tropical, sub-tropical and alpine crops. The Islamic Republic of Iran has enormous potential and capacities and a wide range of development projects merged with sturdy efforts of farmers and producers have made Iran's agricultural ranking among the top 10 producer of 23 crops throughout the world which promises to provide enough food for 200 million people.

The agricultural sector remains one of the most important economic sectors in Iran. This sector accounts for around 18% of GDP and 22% of employment, while providing 90% of food supply, 20% of non-oil exports, and 85% of raw materials used in agro-industry. Last year Iran produced 107 million tons of agricultural products and as it has been envisaged, 118 million tons of produce will be harvested this year.

By the time being Iran is the main producer of saffron, pistachio, caviar, barberry, berries, and holds the ranking of second to tenth in producing apricot, dates, water melon, cantaloupe, cherries, apple, cucumber sheep meat, quince, almond, walnut, wool, vegetables, hops, peas, milk, tomato, grapes, onion, black cherry, kiwi, milk, spices, peach, tangerine, lime and lemon, citrus, squash, winter squash, lentil, tea, honey and persimmons. In spite of decline in world grain production and successive drought, Iran has increased 3.6 million tons of its grains production reaching to 19.5 tons in 2010. Wheat has been the main grain produced in 2010 in Iran with a 3.2 million tons surge and reaching to 13 million tons in 2010.

Islamic Republic of Iran is located in arid and semi arid zones of West Asia, with an average annual precipitation of 250 mm. The country has a total area of 165 million ha, of which around 37 million ha are arable land, 84 million ha rangelands, 13 million ha forests and the rest wastelands, deserts, mountains and lakes. 18.5 million Ha out of 37 million ha is currently under cultivation including 8.5 million ha (46%) irrigated and 10 million ha (54%) rainfed. Irrigated agriculture consumes more than 93% of total available fresh water resources.

Wheat is considered as the major crop in the Islamic Republic of Iran, where it is grown on 6.4 million hectares. Irrigated wheat covers one-third of the total wheat area in the country and accounts for more than two-thirds of the total wheat production. Iran has attained self-sufficiency in wheat production for the first time since past 40 years during the 2003-2004. This testifies the successful adoption of effective soil and crop management practices combined with improved cultivars for increasing the welfare of rural communities in dry areas of Iran through the sustainable use of land and water resources.

The participation of farmers, researchers, and extension workers in the testing, demonstration and dissemination of improved technologies has led to better awareness of the technology and to its adoption by a large number of farmers. This will ensure a sustainable increase in wheat productivity in the rainfed areas of Iran.



The Iranian policy for its agricultural sector is driven largely by the need to rely on domestic production to meet the needs of a rapidly increasing population. Agriculture sector plays a pivotal role in attaining food security, social equity and poverty alleviation in Iran in terms of timely access of all population to safe and sufficient food. Over the recent years per capita supply of energy has a growing trend in Iran providing more than required energy consumption by an average individual based on 2600 Kcal recommended daily intake.

The Islamic Republic of Iran has long developed a comprehensive network of agricultural faculties and national research institutes, and meanwhile has conducted massive number of research, training and extension activities for improving land and water resources to ensure food security, job creation and conservation of natural resources which are altogether now a successful story that can be shared with the countries of our region.

**Keywords:** Agricultural policies, water uses, self-sufficiency, food security policies, Iran.

## Water security in Jordan

*Presented by Eng. Mohammed Hiary Ministry of Agriculture*

### Abstract

The availability of water is fundamental for municipal, industrial and agricultural uses. Water deficit poses serious future threats, and play limiting factor role to suppress economic progress, and as food deficit create social troubles, and spark wars.

Limited water resources is one of the most critical problems faces Jordan; annual per capita water availability is less than 145 cubic meters far below the international poverty line of 500 cubic meters per year. 64% of all water goes to Agriculture, while the demand reaches 71%, with little contribution in gross domestic product (2.7%).

As a result of higher demand and allocations which exceed resources, the Ministry of Water and Irrigation introduced its 15 year strategy in 2007 to find solutions for water scarcity, by reconsidering priorities, reallocating water shares, treating wastewater, and desalinating brackish and sea waters. Unfortunately as the resulting polices were designed in disadvantaging the agricultural sector, the government has stopped the southern agricultural companies from planting the desert to convey Desi water to Amman. During last few years the water authority implemented Bylaw 85/2002 to close down any water wells which extract water from a deteriorating and depleted aquifer. In addition to that government decided to give the role of distributing water through farmers associations in Jordan valley to influences the planting patterns and reduces water losses.

This paper highlights Jordan's water reallocation approach, its water pricing policy, the effect of over-pumping regulations on agriculture, the role of Water User Associations, rainwater harvesting achievements, the changes in farmers behavior related to crop selection, cropping patterns, irrigation practices, and the on the competition between water policies and food security concerns to achieve water security.

**Keywords:** Water resources, water policies, farmers associations, pricing policy, Jordan.

## Successful story of Syrian self-sufficiency in wheat

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### Abstract

The Agricultural Sector has been playing an important role in Syrian economy and social development. Its role is illustrated not only by its contribution to the Gross Domestic Product (GDP) but also by its effects on the development of other related non-farming activities that are linked to backward and forward sectors such as inputs and outputs markets and processing. In fact, agriculture provides agro-industries with raw materials, and enhances the development of other sectors through the demand of non-agricultural goods and services. Furthermore, the sector plays a vital role in the achievement of national food security.

Over the last decade, the importance of the aforementioned sector can be traced as follows: its contribution to the national GDP ranged between 16% and 22% at constant prices of 2000, to the total labor force about 20%, and to the total trade about 14%.

In 2011, the total area of Syria amounted to 18.5 million hectares, out of which about 33% is cultivable, 20% uncultivable, 44% pastures and steppes, and 3% forests; the invested area, which forms about 94% of cultivable land, is around 5.7 million hectares that are divided into 24% irrigated land, 56% rain-fed land and 20% fallow land; the total area in turn is separated into five Agricultural Settlement Zones according to the annual rainfall.

In line with the development of the aforesaid sector, Syria has been taking policies to achieve food security in general and self-sufficiency of wheat in particular. Accordingly, natural resource management policies, marketing and pricing policies, agricultural supporting services policies (research and extension policies, credit and input policies) have been implemented.

The main objectives of the above-mentioned policies are to convert rain-fed areas to irrigated areas, when applicable, to shift from traditional irrigation techniques to modern ones, and to improve the efficient use of natural resources and inputs (improved seeds and fertilizers).

To implement the aforementioned policies the Government of Syria (GOS) has made the needed budget available for the Ministry of Agriculture and Agrarian Reform (MAAR). For example, the investment expenditure of the MAAR increased from SP7700 million in 2005 to SP11700 million in 2011.

As a consequence, wheat formed about 35% of the cropped area, 28% of the crop production, 20% of the value of crop production and 14% of the value of agricultural production, in 2011. The productivity of irrigated wheat increased from 3338 kg/ha in 1990 to 4624 kg/ha in 2009. This enabled the self-sufficiency ratio of wheat to increase from 69% in 1990 to 113% in 2002, 131% in 2007, and 89% in 2011. Finally, it is worth to mention that wheat production increased by 74% over the last two decades (1,539,275 tonnes); the vertical development of wheat production (yield improvement) participated in about 74% of the total increase (1,134,445 tonnes), while the horizontal development (area expansion) participated in the rest.

There are several lessons learned from the Syrian case of achieving self-sufficiency in wheat. These lessons start with the strong willingness of the Government to achieve self-sufficiency. In order to achieve that, the Government allocates a significant share of the cultivable area to wheat in the Annual Agricultural Production Plans. To ensure the plan implementation, the Government uses output price policy as a key instrument, in addition to some other tools such as providing farmers with needed high quality inputs at due time as in-kind loan. Investment budget has also to be made available in future. This applies to the 11th and 12th Five Years Plans in the context of the National Programme for Food Security to improve the efficient use of natural resources especially water use and to boost agricultural production in order to maintain self-sufficiency in basic food staples especially wheat and wheat products bearing in mind the self-reliance principle.

**Keywords:** Food security policies, price policy, natural resources policy, self-sufficiency, Syria.

## Effects of sustainable water management and innovations for agricultural production and food security in Turkey

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<sup>(2)</sup> Ph.D, Deputy General , General Directorate of Agricultural Research and Policies, Ministry of Food Agriculture and Livestock Ankara Turkey Abstract

### Abstract

The decline balance which exists between the limited resources of water, soil and vegetation in the dry zones of the world makes it necessary to develop well considered strategies for the sustainable agriculture. Turkey is among the most affected countries under the influences of drought and desertification as a result of decline of water resources. The most significant problem in agricultural water management is the inefficient use of water. Over exploitation and illegal wells cause diminishment in quantity and quality of groundwater. Degradation of water quality ground and surface waters in irrigation threatens food safety.

Turkey takes initiatives on legal arrangements and institutions-organizations, technologies, financial, social and environmental for sustainable management of the soil and water resources. Its programme has been started to implement subsidies for water saving irrigation technologies. The programme was implemented to produce drought-tolerant crop varieties developed by various research institutes. On the other hand the effects of climate change will have serious impact on food security. The negative influence of climate change must be evaluated from the point of view of soil and natural resources as a result of food production with competition and increase in food prices.

Changing climatic conditions, decreasing of precipitation, dropping in the surface and ground water, increment at water demand and increasing danger of water pollution lead to reduce of water resources using for agricultural lands. Scientific evaluations clearly indicate that the risk of excess water demand in irrigated areas should be drawn by re-using marginal water, low quality irrigation water and other waste water with proper methods. Turkey believes that cooperation and trust is crucial for attaining water and food security in the region.

**Keywords:** Sustainable water management, dry zone agriculture, institutional arrangements, desertification, policies, Turkey.

# Groundwater management for water and food security and the importance of Cooperative Irrigation Management in Turkey

*Dr. Metin Türker*

## **Abstract**

Turkey is located in the arid and semi-arid regions. Annual rainfall changes between 2800 mm with 220 mm according to regions and seasons. In much of the country's agricultural land, plants do not get enough rain in their development stages for normal production, and for this reason water scarcity is a major factor to definitive yield and plant pattern. Groundwater is of utmost importance for irrigation in agricultural areas as well as it provides drinking, potable water, industrial water especially in areas where there is insufficient or not surface water resources.

In our country total usable groundwater of operational safety reserves are calculated as 13.6 billion m<sup>3</sup> / year. In addition, this reserve of about 7 billion m<sup>3</sup>/ year can be allocated to irrigation and irrigated 600,000 hectares of land are calculated. Conducted studies until now, current reserves 96% were allocated and 557,831 ha were brought under irrigation.

Besides the benefits of being the only alternative insufficient or not surface water areas, groundwater have important functions at increasing employment and income, affection of yield is more longer period than usual in drought period, investments are service in a short time as 2-3 years.

Groundwater is in the scope of public waters and covered by Government. Ownership a land does not means that that have the right to have the water below it. For this reason, in our country, groundwater is managed according to law numbered 167 "Law On groundwater".

By the State irrigation with groundwater 80% of the irrigated areas made by cooperatives. Groundwater irrigation facilities consists; wells, pumping, electrification and irrigation network and given that irrigation cooperatives 3 years grace period and a tital of 12 equal installments, 15 transferred on an annual basis.

Groundwater pumping irrigation facilities were built by the state, operation of cooperatives is a model for the management of groundwater resources. Also cooperative irrigations are important for rural development and food security.

**Keywords:** Groundwater management, cooperative Irrigation, Turkey.



### **Partners**

- International Development Research Centre (IDRC), Canada
- Agricultural Research Centre (ARC), Egypt
- International Center for Agricultural Research in the Dry Areas (ICARDA)
- International Fund for Agricultural Development (IFAD)
- Food and Agriculture Organization of the United Nations (FAO)
- International Food Policy Research Institute (IFPRI)
- International Water Management Institute (IWMI)
- Ministries of agriculture and water resources in partner countries

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