ICARDA
Science for Better Livelihoods in Dry Areas

Working Paper

Policies for Water and Food Security in Dry Areas

Synthesis of contributions and policy dialogue at the International Conference on Policies for Water and Food Security in Dry Areas

Toward a framework for countries and development partners for long-term investment in water management for food security in the Middle East and North Africa region.

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Enabling poor rural people to overcome poverty

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Acknowledgements

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Key words: Policies for Water and Food Security in Dry Areas, Water Policy, Water and Food, Water Security, Drylands agriculture.

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Key messages and recommendations for a strategic partnership to strengthen policies for water and food security

Recommendations (actionable options)

- Country food and water security strategies are needed.
- More investment should be directed at increasing rainwater productivity, yield gap reduction and managing risk.
- A regional/basin-level approach is needed for integrated watershed management for water and food security.
- Policy and institutional measures are needed for water valuation and costing.
- Policy and institutional options are strongly recommended to change cropping patterns in favor of less water consuming commodities and sustainable groundwater use.
- Countries' capacity for policy development, analysis, implementation and monitoring are needed.
- More effective approaches to enhance dissemination and adoption of improved production and water saving technologies should be developed.

The Way Forward

- Establish a strategic partnership for water and food security in dry areas.
- Develop a cooperative program that includes ICARDA, FAO, IFAD, IFPRI, IWMI, national agricultural research systems and other partners to enhance water and food security, and play an advocacy role for policy implementation.
- Set a follow-up meeting in 2017.

Abstracts & Case Studies

Presented at the

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

Cairo, Egypt, 2013

Abstracts

Country Case Studies

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

Contents

About this report

This synthesis report summarises the results of a dialogue on food security and water security. between policy makers, researchers, national leaders responsible for water and agriculture policy and members of the international development community at the International Conference on Policies for Water and Food Security in Dry Areas, held in Cairo in June 2013.

The meeting's focus primary focus was on challenges and proposed solutions and investments needed to improve water and food security in these agro-ecosystems – particularly the Middle East and North Africa. The dialogue provided insights into the approaches adopted by countries, and the essence of these policies and practices is presented in this report.

Together, conference participants drafted and agreed on a series of action points and next steps, in the Key Messages document presented in the Annex of this report.

Executive summary

Framework for countries and development partners for long-term investment and improvement of water management for food security in the Middle East and North Africa region.

There is a wealth of knowledge, research evidence, tools and methods available to developing countries on how they can improve the productivity of their water resources to ensure national and regional food security. Technical work and research-based tools are being applied today across the world's developing countries in areas such as water harvesting, the many facets of irrigation, or groundwater and river basin management. This has resulted in successes achieved by countries in the past three decades in producing more food with less water, facing changing climate patterns and achieving more 'crop per drop' from water used in agriculture.

Why another conference on water in agriculture? While substantial improvements have been made in increasing water productivity in agriculture in most countries during this period, many problems and inefficiencies persist. The relentless push toward agricultural intensification has caused severe degradation of water and land resources, and changing climate patters have made planning for water management less predictable – with increased water scarcity in some areas and more extreme events (drought and floods) in others.

There is general agreement among international water and agriculture experts that solutions to the major water and land management problems faced by countries today are known, and can be addressed with the existing knowledge and technologies. The main constraint to applying existing technical know-how to achieve improvements at field and community level is the lack of practical policies and enabling policy environments. Solid policies will ensure that know-how is effectively and equitably applied, that investments are sustained over sufficient time to bring long-term benefits to millions of smallholder farmers, and that food production systems remain resilient in the face of climate change.

Recognizing this, the International Center for Agricultural Research in the Dry Areas (ICARDA), the FAO Near East and North Africa Division, the Agricultural Research Center (ACR – Egypt), the International Fund for Agricultural Development (IFAD), the International Development Research Centre (IDRC – Canada), and Egypt's Ministry of Agriculture and Land Reclamation convened the first conference on Policies for Water and Food Security in Dry Areas.

The conference brought together a range of ministries of water and agriculture, international experts in water policy and practice from Afghanistan, Belgium, China, Egypt, Ethiopia, India, Iran, Iraq, Jordan, Lebanon, Morocco, Sudan, Syria, Tajikistan, Tunisia, Turkey, Uzbekistan, and Yemen, including leaders from the World Bank, USAID, CGIAR centers (ICARDA, IFPRI and IWMI), Islamic Development Bank, University of Florida, Institute for Water, Environment and Health.

The key outcomes of the meeting are new relationships between senior water and land research experts, a revamped interest in more efficient and equitable national water policies, and a shared vision for the region that is summarized in recommendations agreed by the group. This sets a framework for planning, investment and managing a regional strategy and policy approaches for water management – in both the agriculture and non-agricultural sectors. If taken forward, this framework sets a direction for countries and development partners for long-term investments and improvement of water management for food security in the Middle East and North Africa region – one of the driest places on the planet.

Conference Themes

- Incentives for sustainable and efficient water allocation and management
- Interactions between water management, food security and employment
- Coping with water scarcity: the water and food security nexus policy dialogue
- Policies for enhancing food security.

1. Introduction

Water policy has been a major topic of discussion in many forums, together with the directly related topic of food security. However, despite all the talk, effective implementation of policy in the field has been conspicuous by its absence. The "why" of this was central to this conference. We need to put policies into practice.

Bringing together scientists and policy-makers allowed authoritative debate of the nexus of water security, food security and policies, with a focus on the constraints and opportunities associated with the dry areas. The role of water within the wider socio-economic context received a lot of attention, reflecting both political and economic dimensions.

Water resources are limited, so in the face of multiple demands from competing sectors, there is an urgent need to improve efficiency of water use and to enable the multitude of small-scale and marginal farmers to produce the food needed. Competition for finite water resources comes from industry, an expanding urban population and alternative agronomic uses, including for biofuel plant production. At the same time, water resources are being curtailed due to pollution, and soils rendered less fertile due to abusive growing practices. How to reconcile these competing parameters is a policy nightmare, requiring very careful negotiation among all relevant sectors.

Integration is vital for all aspects associated with water supply and use, and ensuring equitable access for all sectors. Any incentives must also carry a strong element of responsibility – no free rides. Market distorting activities must be recognized as such and shunned, especially politically motivated short-term market distortion interventions.

Coordination is needed among domestic stakeholders, international agencies and donors. Although different entities have different aims, dialogue is needed to optimize ecologically sustainable use of limited resources and to provide equitable benefit for all stakeholders: from the small-scale farmer, through the value-chain actors, to the consumer. This should have the effect of enhancing quality of life for the poorest, stimulating economic activities with employment and increased GDP, while being sensitive to the environment. Without respecting the needs and aspirations of all stakeholders through an interactive process that allows for honourable negotiation to consensus, results will never be accepted by all parties.

Who can speak for the marginal and small-scale farmer? Their empowerment becomes a critical step in the overall paradigm, and here the availability of ICT could support empowerment.
Knowing the dimensions of the water security and food security parameters of the nexus provides the basis for policy formation, so systematic data collection, collation and analysis becomes a highly significant input in the overall discussion. This nexus can be strengthened by social norms that limit the extent to which water can be valued directly in monetary terms, so alternative allocation approaches can be needed.

There can be no food Security without water security

Sound policies for food security and agricultural water management are critical for national economies – and particularly for dryland areas, where water resources are already scarce and declining rapidly. The development of such policies requires an assessment of the current state of knowledge; the lessons learned from research and development programmes in different countries; and a better understanding of the inter-relationships between water policies, food security, historical background, employment and the environment.

Rainfed and dryland farming face challenges, including distress prone, vulnerable, under-investment, high poverty levels and threatened by climate change. *Dr Sikka, ICAR, India*

The conference presentations focussed on inter-related themes: incentives for sustainable and efficient water allocation and management; interactions between water management, food production and employment; coping with water scarcity within the water and food security nexus; and policies for enhancing food security. Countries presented lessons learned on these themes, with broader overviews from governments, international assistance agencies and intergovernmental organizations.

The effectiveness of current and alternative water and food policy options were discussed, and strategies identified to enhance land and water productivity, food security, employment generation and livelihoods, while preserving water resources. Identification of strategies involves assessing the opportunities and risks associated with current water policies and practices, and identifying trade-offs between different policy objectives (e.g. food security, employment, poverty reduction, and environmental conservation).

Integration of water policies with food security and employment in agriculture was prominent, together with means to align water policies with sustainable development aims. Policies need to enhance adoption of water-saving technologies, and to promote the use of integrated approaches to increase water productivity in agriculture.

Recent food price crises (2007-2008) have revamped 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 critical that more than 100 million under the age of five are underweight and that under-nutrition contributes to 2.6 million child deaths annually. 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 groundwater abstraction and diversion of ever more freshwater resources for farming uses. As a result, groundwater resources are used well beyond their natural recharge levels. Many regions are seeing their groundwater resources declining at alarming rates - in some places over a metre per year. Frequently, depletion has prompted farmers to abandon their lands.

Weather extremes, increased competition for production, urbanization, pockets of poverty, changing diets, political instability, high population growth, and an increasing demand for food pose difficult trade-offs that challenge policy makers dealing with water and food security.

Theme 1

Incentives: Good or bad for sustainable and efficient water allocation and management?

Incentives to promote or regulate agricultural production in the dry areas are most commonly transmitted through input subsidies, support prices, regulatory measures, infrastructure investment (e.g. in water-saving technology) and support measures such as extension or product market development. However, the development of specific policies enabling the implementation and the design of an incentive system at farm level for the adoption of water conservation technologies is not simple, especially if there is water scarcity and the need to develop an investment system that promotes efficient and equity in water management.

Scarcity remains the ultimate incentive!
Scarcity is the fundamental economic problem of having seemingly unlimited human wants and needs in a world of limited resources.

Questions of efficiency and equity run through the theme: how can policies improve water allocation, and what are the obstacles to implementation? How to reduce financial and environmental costs of water delivery and use, and what innovative incentives are available to promote efficient and equitable use of water? Such questions entail awareness of the impacts of cost-rationalization policies on productivity, food security, rural employment, livelihoods and sustainable growth.

There is no food security without water security, so without additional investments in water, food insecurity will increase, and increased investments in drinking water supply, irrigation and sanitation are vital. Water use efficiency can be increased through: (1) Irrigation techniques; (2) agronomic techniques; (3) cultivar selection; (4) incentives to use water carefully (metering, allocation); and (5) irrigation water supply technology, operation and maintenance.

Recommendations

- Small-scale farmers should be supported with information, knowledge and finance to invest in water-saving technologies.
- 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 degraded land and water resources, and reduce salinization of land and pollution of water systems.
- In marginal lands, an integrated systems approach needs to be adopted as diversification and risk management become more important.
- Enabling policy environments are crucial for enhancing technology adoption and diffusion. Effective water management requires that technologies, enabling environment, political support and capacity enhancement are in place, for which information dissemination and extension are vital.

More investment is needed in irrigation water-saving technologies, but investment alone is not sufficient. Enabling policies, institutions and incentives must be in place at different levels (household, community, national and global). Inclusive and stable land tenure is also needed for longer-term sustainable production. Less sustainable land and water management policies that prompt unsustainable and inefficient farming practices need to be identified and discontinued.

Effective policy-making needs reliable data, which means systematic information gathering, improved access to data, and careful analysis. Improving water management calls for a comprehensive approach to all dimensions of scarcity. Lack of accountability systems among the different stakeholders is a gap. Fundamental in setting up the way to solve these caveats are international assistance agencies and intergovernmental organizations that should continue providing support to governments in many fronts. One of them includes producing evidence-based policies that should be pragmatic, long-lasting, comprehensive, current, and tailored to local circumstances.

Theme 2

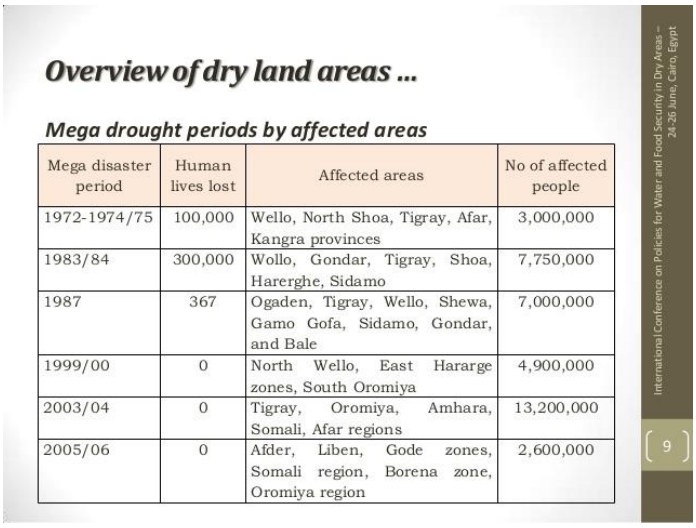
Interactions between water management, food security and employment

Most of 870 million food-insecure people live in dry areas, and 34 "dry" countries are below the water-poverty line. Irrigation is a crucial driver for improving food security in dry areas, but currently less than 20% of cropland is irrigated. A primary challenge is how to ensure efficient, equitable and reliable irrigation systems that increase productivity, quality, quantity and variety of food supplies. These supplies are vital to meet the needs of growing populations in different agro-ecologies in the face of continuous reduction in rainwater and depletion of groundwater. However, increasing supplies must happen in an environmentally friendly manner, and at reasonable and affordable prices for consumers, while making agricultural production an attractive business that enhances employment and food security.

There can be no food security without water security, so an integrated approach is needed, covering policy, technology, institutions, research and extension. Investment in agricultural research alone does not lead to the desired outcomes, but investment in agricultural research in combination with investments in irrigation infrastructure, drinking water and sanitation, rural road and health infrastructure, gender sensitive empowerment, etc., leads to the greatest returns. Information is power, and creating access to information is one facet of empowerment. Agricultural development has knock-on effects, creating demand for outputs of the manufacturing sector and triggering various types of services, with multiplier effects on GDP and employment.

Enabling policies, institutions and incentives at different levels are, in addition to investments, critical elements in any success paradigm. At plot level, improved on-farm management is needed for more efficient outcomes such as small dam and basin management operating at community level. Management of canal irrigation and reservoirs is a national-level task, with management of trans-boundary water sources requiring coordination at international level.

Nationally, defining property rights and coordination between institutions is very important, and capacity building is vital along the whole value chain. Traditional general information and knowledge is no longer sufficient. Site-specific and decentralized information is necessary.



Overview of dry land areas ...

Mega drought periods by affected areas

Mega disaster period	Human lives lost	Affected areas	No of affected people
1972-1974/75	100,000	Wello, North Shoa, Tigray, Afar, Kangra provinces	3,000,000
1983/84	300,000	Wollo, Gondar, Tigray, Shoa, Harerghe, Sidamo	7,750,000
1987	367	Ogaden, Tigray, Wello, Shewa, Gamo Gofa, Sidamo, Gondar, and Bale	7,000,000
1999/00	0	North Wello, East Hararge zones, South Oromiya	4,900,000
2003/04	0	Tigray, Oromiya, Amhara, Somali, Afar regions	13,200,000
2005/06	0	Afder, Liben, Gode zones, Somali region, Borena zone, Oromiya region	2,600,000

Information communication technology (ICT) in the form of mobile phones, the internet, social media, etc., has the potential to provide the missing links (or to strengthen weak links) and enhance efficiency in information flow among farmers, extension services and research. The involvement of the private sector is needed to provide services to small-scale producers and farmers (including satellite coverage and mobile telephone services; crop insurance; financial services; input supply and output market price data). This provides better risk management, early warning and advisory services for safety nets to mitigate or prevent disaster. The immediacy of ICT provides encouragement for youth to become interested in and involved in the agriculture value chain; and can provide inclusive benefits to all gender groups and education levels.

For effective socialization of water-related policy measures, there is a need for creating mechanisms to provide consistent collection of, easy access to, and useful and relevant analysis of data at various levels, including the site-specific data and information necessary to gain public support and to scale-up localized success stories.

Efficient irrigation has potential for creating agricultural employment through increased labour demand associated with higher-value crops, as well as increased productivity. Here, market and agroindustry participation is not an option, but a necessity. If water and food security are to be achieved, there is therefore a need for change in attitudes, away from a narrow focus on food self-sufficiency, towards value maximization and active participation in international trade.

In Ethiopia the large majority of lives that were lost during the mega droughts of the 1970s and 1980s were from the dry land areas of the country.

Given the trade-offs, adequately addressing the issues of water and food security requires integration (across sectors and across different levels and scales of water use) as well as south-to-south cooperation. Socially acceptable valuation of water, and increasing the efficiency of value chains, would create incentives for effective agricultural water management for increased water use efficiency and productivity increases. However, increasing water use efficiency can easily be adopted through demand-driven approaches with effective extension that enhances the adoption of improved technologies, coupled with a market information system that promotes commercialization. When considering the importance of sustainable water management and agricultural development, there is need to emphasize the services that agricultural development triggers, and the multiplier effect on GDP and employment.

Recommendations

Interactions between water management, food security and employment

- A value chain approach should be adopted for the complex issue of water and food security, with small-scale agriculture treated as a form of rural life but also as a business, which can attract investment and services. A value chain approach should promote diversification of livelihoods within and around the agricultural sector.
- Governments, assistance agencies and the private sector should promote the development of innovative, effective, dynamic and responsive institutions (including extension) to ensure delivery of high quality and appropriate enabling policies and services to all stakeholders. They should identify successful models and invest in scaling them up.
- As farmers appreciate and are willing to pay for good services, investment in improving service delivery, promoting public-private partnerships and demand-driven approaches can lead to successful policy interventions.
- A crucial need is to develop policies that promote effective and equitable approaches to valuation of water. One aspect would be to adopt community-based catchment management and participatory water resource development approaches, ensuring benefit sharing at all levels.
- Invest in research that helps bridge the knowledge gap, seeking innovations that increase efficacy of extension systems, stimulate employment and build capacity. Invest in rainfed agriculture to exploit its great potential, and increase investment not only in irrigation but also in drinking water supply, sanitation, energy, roads, health and education. Investment should come along with improved institutions and appropriate incentives. Adopt a systems approach, with a long-term strategy that provides a framework for integrated water resources development and management, with investment in the development of equitable legislation, and review institutional frameworks to promote decentralized decision-making and management, with increased stakeholder participation. In water and food security strategies, give special attention to the dry areas, where the majority of food-insecure populations live.

Competing demands could make it necessary for governments to reduce water allocation for irrigation. This calls for greater investment in research to identify mechanisms for increasing farm-level water-use efficiency. In parallel, production efficiency can be enhanced through farmer education, alternative technologies, introduction of water cost recovery based on marginal production, strategic shifts to higher-value crops and promoting changes in food habits. Effective water supply could be improved by increasing the efficiency of water distribution systems as well as utilizing treated wastewater.

Theme 3

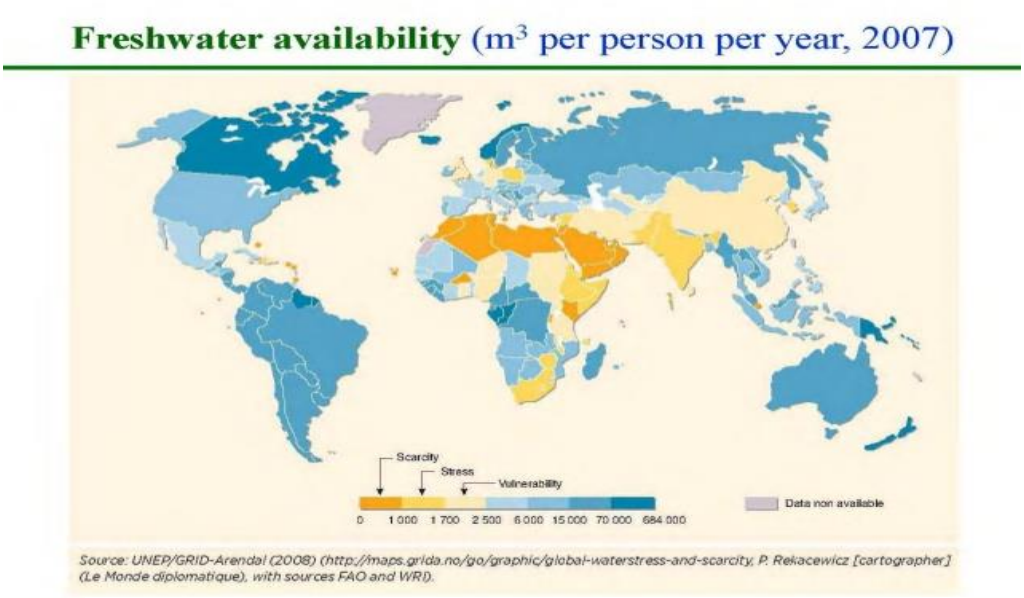
Policy dialogue: the water and food security nexus

There is great potential at the interface between water and food security, but there are three obvious gaps: there is a general weakness in scaling up from many successful cases; most of the (dis)incentives for water inefficiency lie outside the water domain and there is lack of multi-disciplinarity; and there is an absence of explicit water security policy.

There are many examples of successful cases, including system feasibility, design, technology, management and operations (irrigation modernization and rehabilitation, groundwater, drainage water re-use, wastewater re-use); water in crop production systems (on-farm water use and productivity, rainwater harvesting, conservation agriculture); water and environmental issues (forestry and catchment management, pollution from agriculture, water and food safety); fisheries and aquaculture; and water and livestock.

Despite positive experiences, scaling up of impact remains elusive. Numerous 'technical' lessons have been learned, but proliferation of pilot studies and proliferation of technology options collectively are not contributing impact at scale. Despite overall new technology opportunities, the core constraints on impact are not technological, as scaling-up, impact and delivery require factors beyond technologies.

Successful innovations are known, but are not being scaled up.
Dr Hammou Laamrani, IDRC



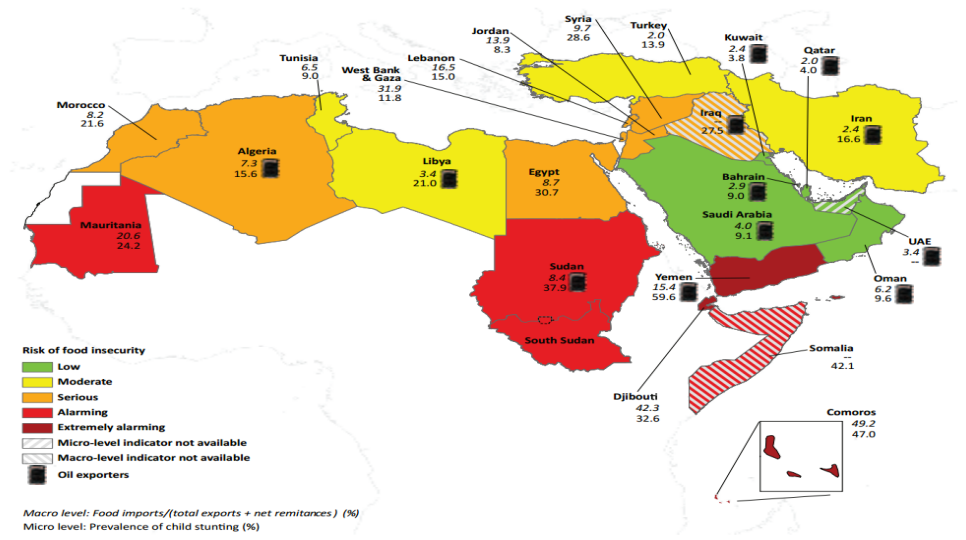
High demographic growth, urbanization, economic growth, climate change and unsustainable use of groundwater resources have all contributed to put water supplies in the Arab countries under severe stress.

Scaling up 'spaces', i.e. shifting from pilot to impact at scale, involves fiscal and financial elements; natural resource and environmental considerations; the policy context, institutional and organizational capacity; and other parameters, including political, cultural, partnership and learning. Different factors have relevance at different levels of uptake, as scaling-up from 100 ha to 1000 within a scheme involves one set of factors; scaling-up from 1000 ha to 10 000 across schemes invokes a different set.

A regional gap analysis identified three factors – lack of scaling up; problems external to the water sector; and lack at national level of clear food security policies.
Dr Chifa Tekaya, FAO

The second clear gap is that most of the (dis)incentives to water inefficiency are external to the sector, as there are bottlenecks, drivers, incentives and disincentives that predominantly lie outside of the 'engineering' and water management sub-sectors. Different (political economy) narratives mean different lessons, different gaps and different response options. Thus there are different water-associated demands and expectations; inter-related policies and structural rigidities on food security (e.g. import substitution, safety nets, self-sufficiency) mean large numbers of farmers are using water inefficiently. Subsidies (credit, energy, etc.) and price controls are distorting, transferring water to less competitive, high-water-consumption crops.
A small number of Water User Associations have been successful, but overall experience is less positive.

Figure 4—The risk of food insecurity in Arab-TI countries



Sources: Authors' calculations based on data from the FAO 2011b and World Bank 2011a.

The Persian Gulf states, including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and UAE, face a low risk of food insecurity. Iran, Libya, Tunisia, and Turkey exhibit moderate risk of food insecurity, whereas all other countries show serious, alarming, or extremely alarming levels of food insecurity risks. Among the countries at most risk are Yemen, Djibouti, and Somalia, followed by Mauritania and Sudan.

In demand management, shorter-term financial interests (e.g. deferring investment decisions) have overridden opportunities for efficiency and equity. For water allocations, current allocations to agriculture appear unsustainable in the light of resource depletion and environmental integrity. There is scope for public or public-private sector engagement, with real, practical opportunities (under different models) if oriented to farmer needs. Public management and decentralized governance can lead to distortion, reflecting different timelines between reform needs and short-term and political realities. A 'Whole-of-Government' ethos is needed, with a long-term, inclusive approach.

Theme 4

Policies for enhancing food security

The world is facing crises associated with water shortage, poor water quality, food insecurity, health challenges, economic and education issues. Stress is increasing over use (and abuse) of natural resources, higher prices for food, and overpopulation.

There is no question that irrigated lands are important: while they only represent 16% of the crop area worldwide, they provide 36% of food. Dry areas form 40% of the total area in the world, but are home to a disproportionally high percentage of the poor. Difficult challenges have to be faced. This Conference aims to help enhance water policies through lessons, sharing of experiences, and cooperation. The time for actions, commitment and solutions is here.

It has been highlighted that national policies need to be adapted to promote efficient water use and efficient agriculture. A strong message emerges that governments need to support technologies that can be easily adopted by farmers. Enormous challenges are ahead, and cooperation and joint efforts are a necessity, and not merely an option. Regional initiatives, such as those coming from ICARDA, FAO and others, need to be coordinated to promote better water management, sustainable agriculture and improved food security. Cooperation and regional action is no longer an option, but a necessity to achieve food security. Sharing benefits rather than sharing resources provides an opportunity for peace instead of conflict.

Decision support tools - mobile phones, internet, computers, smart cards, barcodes for scanning, GPS, remote sensing, traceability - provide farmers with valuable information on weather, prices, pests, diseases, policies, credit, insurance, transportation, etc. These tools are affordable and accessible by remote communities.

It is clear that water is not unlimited, so we have to put an economic value on it. Where are the entry points to valuing agricultural water, and how can one introduce equitable costing? Food cannot be seen as just from agriculture, and food security involves much beyond water. Food security as a policy concept involves not only ministries of agriculture, but also includes ministries of finance, planning, irrigation, water user associations and civil society in general. Problems arise where interests overlap, and all are trying to use 100% of the water available. As shown from ICARDA's groundwater research, farmers can be tempted to use more water than necessary as they seek to satisfy their needs before their neighbours deplete the resource. That is, individuals acting independently and rationally corresponding to self-maximizing interest behaviour can collectively act contrary to the group's long-term most beneficial interests by depleting the common resource.

ICARDA Director General, Dr Mahmoud Solh, highlighted the four dimensions of food security: food availability (production); food access (ability); food stability (national food stocks as part of food security strategies); and food utilization (e.g. improved sanitation facilities). Others participants added a fifth: nutritional security.

A strategy for food security at national level needs to address land and water resources, and other elements needed for food production, including any gap between food consumption and food production. Then there is a policy decision needed regarding self-reliance versus self-sufficiency, and comparative advantage will weigh heavily in the balancing act.

Policies are of no use if they cannot be implemented, so strategies are needed that take into account all elements of food security, and here international guidelines, such as those agreed in Codex Alimentarius, WTO, etc., set standards to be taken into account before setting policies.

However, one must avoid negative water policies. Thus subsidies for fuel for groundwater extraction can deplete resources faster than they can replenish; subsidies for pesticides can lead to their excessive use, with consequent deteriorated soil fertility or effects on food safety; subsidies for fertilizer can encourage over-use, leading to salinization and loss of productive capacity; excessive promotion of exports can leave the domestic market without supply and create frictions in the international community; and land policy that encourages a heritage system can lead to land fragmentation and leave holdings incapable of supporting a family, let alone also supplying the market.

A primary aspect of food security is that it is a poverty question rather than production or demand. National food security does not deal only with the issues of food insecurity at household level. There should be a balance. Even with comparative advantage, at least a certain part should be domestically produced. External assistance or investment should focus on sustainable development, and not simply resource exploitation. In the international aid arena, food security has re-emerged as a high priority, with increasing attention paid to integrated approaches and more regional involvement.
The mechanics of monitoring water use are complex, particularly for off-take from private tubewells, but some control must be exercised to prevent overuse and exploitation.

Food security or water security or poverty reduction? All three together!
Dr Steven Schonberger, World Bank

Actionable solutions

Introduction of national Water Policy Advisory Boards was proposed as a mechanism to push food policies, where a range of stakeholders and cross-sectoral players should build consensus as input to policy and the consequent practice. Water and food policy strategies should consider comparative advantages, country assets and natural resource endowments (and look at food self-sufficiency versus self-reliance), and policies must be predictive and able to adjust to changing scenarios. Nationally, policies must be aware of micro-level impacts and be protective of the most vulnerable sectors. Global treaties and agreements can guide policies and implementing strategies for all elements of food security. More agricultural research is needed to enhance effective water use. Investments should be promoted in agriculture (private and public, and along the value chain).

Resources that you don't measure, you cannot manage.
Dr Mahmoud El Solh, Director General, ICARDA

Inefficient basin and furrow irrigation systems (left hand side) can be corrected through research and technology producing cost-effective and water-saving irrigation systems (right), such as drip irrigation and sprinklers. Water valuation should consider the equity dimension, preferring a water-value approach rather than a simple water-price approach. Inability of the poor to pay water prices does not mean they should not have access to water. Water is a human right and the equity principle that should drive water policies implies that the poor should also have access to water for basic needs.
Valuation is contentious. Is water a public or an economic good? If people are profiting from use of water, should they pay because it is an input to their business? Ethically, can one share the benefits without sharing in the cost?

Promoting diet change for water saving and sustainability requires strategic educational programmes. Nutrition and food security should be considered at different levels: not only national macro-level, but more importantly at the micro-level of the household.

At a practical level, push forward use of marginal sources and treated wastewater, while at the policy level ensure an integrated approach to problems of food security and effects of climate change, with strategies that should include safety nets, stability in food prices, and buffer stocks.

Key messages and recommendations

As agreed by the delegates to the
International Conference on Policies for Water and Food Security in Dry Areas
Cairo, Egypt, 24-26 June 2013

Context

Recognizing that:

- The temperate and semi-tropical dry areas occupy about 40 percent of the earth's total land area and are home to more than 2 billion people or 30 percent of world population, the majority located in the developing world.
- Characterized by natural resources limitation and degradation, particularly water scarcity, the dry areas have less than eight percent of the world's renewable water resources and are challenged by frequent droughts, extremes of temperature, land degradation and desertification. Poverty is disproportionally concentrated in dry areas; population growth rates are high; women and children are highly vulnerable; a large proportion of children are malnourished; and distress-migration is common.
- Climate change has serious implications for further degradation of natural resources, including attrition of unique biodiversity, and to increase already existing food insecurity and poverty.
- The current food production systems and food patterns are characterized by huge inefficiencies in input use, and food losses and food waste. At the same time, the use of scarce water resources is characterized by very low on-farm water use efficiency and excessive use of irrigation water.
- The challenge in enhancing water and food security is to remove inefficiencies in food production and water-use systems. A parallel important thrust is to increase current production levels to higher production frontiers through innovative R-4-D, coupled with increased investment in agriculture and water infrastructure and management.
- Achieving water and food security requires more than technologies. Enabling policies and institutions are critical factors to enhance the uptake and adoption of improved technologies and water saving practices, and thus removing inefficiencies in resources use.
- The challenge remains of how to ensure reliable food supplies (in adequate quantity and variety) to meet the demand of growing populations in different agro-ecologies. This must be achieved within a scenario of climate change and depleting groundwater, in an environmentally friendly manner at reasonable and affordable prices for consumers, while making agriculture production an attractive business for farmers.

It is within this context and thrust that the International Conference on Policies for Water and Food Security in Dry Areas was co-organized by the Egyptian Ministry of Agriculture and Land reclamation and its Agricultural Research Center, ICARDA, FAO, IFAD and IRDC. The conference was held in Cairo on 24-26 June, 2013 and was attended by some 200 policy-makers, donors, experts, scientists, and representatives of developmental organizations and research-for-development organizations, from 28 countries across the globe, with representatives of 8 international organizations and 7 international support agencies.

Key Messages (Issues and Lessons Learned)

- Incentives are needed for sustainable, efficient and equitable water allocation and use, although incentives alone are not enough in isolation. Together with conductive policy and institutional options, and involvement of local communities and other actors, incentives should optimize the use of scarce water resources and increase on-farm water use efficiency and water productivity in rainfed areas, and reduce excessive irrigation water use and waste in dry areas.
- In developing countries, agriculture is the backbone for national economic growth. Beside its direct contribution to gross domestic production (GDP), it triggers many services, including agro-industries and transport, for example. Agriculture will continue to be the major employment market and source of job creation in the economies of developing countries in dry areas. Close linkages and interactions exist between water management, food security and employment. This is particularly true within food value chains and added-value functions of agricultural commodities, inputs and services. Policy-makers need to value the social and environmental benefits of agriculture beside its economic value.
- Regardless of advances in science and technology, and successful pilot activities in many countries, these successes and improved technologies have not been widely disseminated and adopted due to weaknesses in scaling up approaches and extension, and lack of enabling policies and institutions. For example, weak extension institutions are a common constraint in many developing countries.
- There is need to better understand the main reasons for the small scale of practical impacts, despite successful pilot experiences.
- Effective responses to water and food security challenges require explicit water and food security strategies, which are absent in many developing countries in dry areas, despite the existing vision of the importance of water and food security
- There is need for a more comprehensive approach to water scarcity to improve water management, and scarcity of accountability at various scales (farm, district, irrigation scheme, national, river basin and global levels) is emerging as a principal constraint to better water sector performance.
- The urgent need for increased investments in agriculture, water and in research for development (R-4-D) must be emphasized. However, investments alone are not sufficient. Enabling policies and institutions are equally important to better target investments to achieve water and food security. This includes re-structuring subsidies to avoid situations where they distort production decisions and encourage misuse of scarce water resources. The three dimensions of water costing and valuation; policy; and water and land property rights, need to be incorporated in an integrated manner.
- More attention should be paid to the importance of and the need for social protection measures, such as safety nets and incentive packages to protect small-scale farmers from price volatility in local and international markets, and from production risks. This requires adequate access and updated information so that policy decisions can be based on evidence.
- There is a need to put in place effective, dynamic and responsive institutional and information sharing systems that ensure delivery of high quality services to all stakeholders, particularly farmers, who are willing to pay for good services. Hence, there is a need for more investments to improve service delivery and promote demand-driven approaches for technology dissemination.
- Information and Communication Technologies (ICT) can play a key role in enhancing information flows, involve private sector and improve risk management strategies. There is need for better “knowledge transformation” of research and policy options to make them more useful to small-scale farmers.
- Although more agricultural research is needed, technologies are already available to enhance both water use efficiency and food production in a sustainable manner, but these technologies are not finding their way to the end users or the farmers.
- There is need to emphasize nutritional security as an integral element of food security and water security.
- The importance of food distribution issues needs more attention. Even if food is available globally, the challenge is to ensure access to that food by the poor. This calls for a focus on household food security and the nutrition options available to the poor. In the absence of effective food distribution systems, increasing overall food availability at the national level may not necessarily lead to enhanced household food security.
- In some developing countries, brackish water in general and treated wastewater are important sources for enhancing water and food security.

Recommendations (actionable options)

- Develop country food and water security strategies through the necessary investment, incentives and policy options to guide water investments, following an integrated system and eco-efficient approach.
- Given that rainfed farming is the major source for food security in dry areas of developing countries, it is imperative that more investment is directed towards increasing rainwater productivity, reducing yield gaps, and managing risk. This requires targeted policy options and more public investments, with incentive packages for dry areas to increase the productivity and resilience of rainfed farming systems.
- Adopt a regional (or basin-level approach) approach to water and food security, with integrated catchment management approaches, given that most surface water resources are shared among neighbouring countries, and that the natural resource base for individual countries is not sufficient to achieve self-sufficiency in food security. Regional integration and trade can contribute substantially to achieve self-reliance in water and food security.
- The excessive use of irrigation water from surface and groundwater sources requires policy and institutional measures for water valuation and costing to rationalize water use. This needs to be carefully developed and implemented to ensure the necessary efficiency targets in economic, environmental and social dimensions, respecting the interests of small-scale farmers, who produce 80% of the food in certain developing countries. One policy option would be to assign a specific quantity of water free-of-charge—depending on agro-ecology, cropping patterns and farm size—after which appropriate water usage charges might be imposed on water users.
- The depletion of groundwater in dry areas has reached alarming levels, leading to groundwater mining and desertification. Policy and institutional options are strongly recommended to change cropping patterns in favour of less water-consuming commodities and to optimize the use of groundwater on a sustainable basis. This may suggest the use of alternative energy sources for pumping and lifting water to fields to optimize use of expensive energy sources.
- Enhance the capacities of countries for agricultural policy development, analysis, implementation, and monitoring and evaluation. This involves the analysis of trade-offs associated with alternative policy and technological options, *ex ante* assessment of the potential impacts of different policies, and *ex post* evaluation of the consequences of policies implemented. An important dimension here is the assessment of the effectiveness of existing agricultural policies, and drawing on lessons learned to guide and better inform science- and evidence-based policies and institutions.
- Develop more effective methodologies and approaches to enhance the dissemination and adoption of improved production and water-saving technologies. Extension strengthening and support are critical to improve small-scale farmers' access to improved knowledge. In this regard, it is strongly recommended to enhance capacity development of extension institutions and help them to synthesize production packages and share successful case studies and other experiences, facilitating scaling up to achieve sizeable impact on water and food security.

The Way Forward

- Establish a "Strategic Partnership Framework for Enhancing Water and Food Security in Dry Areas" to better coordinate and complement the efforts of national, regional and international organizations to promote existing knowledge and technologies, enabling institutional and policy options to achieve sustainable productivity growth, increase on-farm water use efficiency, and improve access of small-scale farmers to water and improved knowledge. This partnership framework would be established by ICARDA, FAO, IFAD and IDRC, who would jointly sign a foundation agreement. It would be open to countries and other organizations. It is suggested that ICARDA coordinate this partnership framework and activate it, particularly through its lead of the CGIAR Research Program on Dryland Systems, which targets enhancing food security and improving livelihoods in five selected regions globally.
- Develop a cooperative program among NARS and other partners, including ICARDA, FAO, IFAD, IFPRI and IWMI, to develop, analyse and promote agricultural policies and institutional options to enhance water and food security, play the policy advocacy role for policy implementation, and help countries to develop and implement water and food security strategies.
- Set up a follow-up meeting in 2017. The organizers and other partners should call for a similar conference in 2017 to present the progress achieved towards the implementation of the conference recommendations and to better respond to emerging challenges and constraints.

Appendix 1 – Programme of the Conference

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

Intercontinental Citystars Hotel - Cairo, Egypt

24-26 June 2013

Programme

Monday, June 24, 2013

8:00-9:00 Registration

9:00-10:00 Opening Session

· Welcome Statement of President of ARC, Dr. Abd El Moneam El Banna

· Welcome Statement of Director General of ICARDA, Dr. Mahmoud El Solh

· Statement of Assistant Director General/Regional Representative for the Near East and North Africa, FAO, Dr. Abdessalam Ould Ahmed

· Statement of IFAD Representative

· Statement of IDRC Representative, Dr. Hammou Lamraani

· Statement of H.E. The Minister of Agriculture of the Republic of Lebanon, Dr. Hussein Hajj Hassan

· Statement of H.E. The Minister of Melioration and Water Resources of Tajikistan, Mr. Rakhmat Bobokalonov

· Statement of H.E. The Minister of Agriculture & Irrigation - Republic of Yemen, Eng. Farid Ahmed Mogawar

· Statement of H.E. The Minister of Agriculture and Land Reclamation, Egypt, H.E. Dr. Ahmed Mahmoud Ali Algizawi

· Statement of H.E The Minister of Water Resources and Irrigation of Egypt, H.E. Dr. Mohamed Bahaa El Din

· Statement of H.E. The Prime Minister of Egypt, H.E. Dr. Hisham Mohamed Qandeel

10:00-10:30 Group photo

Coffee break

Plenary Session 1

10:30-10:45 Objectives and structure of the conference: Dr. Kamel Shideed, Assistant Director General, International Cooperation, ICARDA

Theme 1: Incentives for Sustainable & Efficient Water Allocation and Management

Chair: Dr. Mohamed Abdel Motaleb, Director General, National Water Research Center - Egypt

10:45-11:00 Statement of H.E. Mr. Ghani Ghuriani - Deputy Minister of Agriculture, Technical Affairs, Ministry of Agriculture, Irrigation and Livestock, Afghanistan

· Statement of H.E. Dr. Jahangir Porhemmat, Deputy Minister and Head of Agricultural Research, Iran

· Statement of Dr. Mahdi Al-Kaisey Iraq - Deputy Minister of Agriculture, Iraq

· Statement of H.E. Mr. Kudbettin Avci - Deputy Minister of Food, Agriculture, and Livestock, Turkey

11:00-11:30 Keynote speaker 1(a): Mr. Steven Schonberger, Sector Manager, Water and Agriculture, MENA Region, The World Bank

11:30-11:45 Discussion

11:45-12:15 Key note speaker 1(b): Dr. Mahmoud El Solh, Director General, ICARDA - Challenges Facing Water and Food security in Dry areas: the Role of Science and Technology

12:15-12:30 Discussion

Plenary Session 2 - National case studies and experiences

Chair: Dr. William Patterson, Economic growth Director, USAID

12:30-13:00 National case study 1. Egypt: Dr. Hani Ramadan, Director for Soil, Water and Environment Research Institute, Egypt

13:00-13:30 National case study 2. Tunisia: Mr. Mohamed Lazhar El ECHI, Deputy Director of Studies and Agricultural Development, Minister of Agriculture, Tunisia

13:30-14:30 Lunch break

14:30-15:00 National case study 3. Turkey: Dr. Metin Turker, Deputy Director General, General Directorate of Agrarian Reform, Ministry of Agriculture & Rural Affairs - Groundwater management for water and food security and importance of cooperative irrigation managements in Turkey.

Plenary Session 3 - Panel discussion session

Moderator: Dr. Ramesh Chand, Director, National Centre for Agricultural Economics and Policy Research, India

15:00-16:30 Panel discussion theme 1:

- Policy maker: Dr. Mohamed Ait Kadi, Director, Conseil Général du Développement Agricole, Ministry of Agriculture and maritime fisheries – Morocco

- Professional expertise: Mr. Steven Schonberger, Sector Manager, Water and Agriculture, MENA Region, The World Bank

- Donor organization: Dr. John Pasch, Director, Office of Water, USAID

- Research for Development: Dr. Jeremy Bird, Director General of IWMI, Sri Lanka

16:30-16:45 Coffee break

16:45-18:45 *Concurrent sessions of contributing papers for the themes*

Four Parallel contributing papers sessions 1, 2, 3 and 4 (4 papers each session, each paper 15 minutes plus 15 minutes discussion after the presentations)

Tuesday, June 25, 2013

Plenary Session 4 - Theme 2: Interactions between water management, food security and employment

Chair: Dr. Abdessalam Ould Ahmed, Assistant Director General and Regional Representative for the Near East and North Africa, FAO

09:00-09:30 Keynote speaker 2(a): Dr. Paul Siegel, consultant, The World Bank - ICT and Agricultural Risk Management: A "No-Regrets" Approach to Improved Water Management, Food Security, and Employment in Dry Areas

09:30 09:45 Discussion

09:45-10:15 Key note Speaker 2(b): Dr. Clemens Breisinger, Research fellow, IFPRI – Investments, institutions and incentives for achieving food and water security

10:15-10:30 Discussion

10:30-11:00 Coffee break

Plenary Session 5 - National case studies and experiences

Chair: Dr. Salah Abdel Momen – Former Minister of Agriculture and Land Reclamation and former President of ARC

11:00-11:30 National case study 4: China: Dr. Jing Liu, Institute of Agricultural Economics Development, Chinese Academy of Agricultural Sciences - Grain Production Adaptability to Climate Change in China

11:30-12:00 National case study 5: Ethiopia: Dr. Dawit Alemu, Senior Economist, Ethiopian Institute of Agricultural Research, Ethiopia - Ensuring Food security in dry land areas of Ethiopia: polices, actors, and achievements

12:00-12:30 National case study 6: Jordan: Dr. Mohamed Hiary, Head of Technical Monitoring Division, Secretary General's Office, Ministry of Agriculture, Jordan

12:30-13:00 National case study 7: Morocco: Dr. Mohamed Ait Kadi, Director, Conseil Général du Développement Agricole, Ministry of Agriculture and Maritime Fisheries, Morocco

13:00-14:00 Lunch break

Plenary Session 6 - Panel discussion session

Moderator: Dr. Guido Gryseels, Director General, Royal Museum for Central Africa, Belgium

14:00-15:30 Panel discussion on Theme 2:

- Policy-maker: H.E. The Minister of Melioration and Water Resources of Tajikistan, Mr. Rakhmat Bobokalonov

- Professional expertise: Dr. Paul Siegel, consultant, The World Bank

- Donors: Mr. Elwan Yasser Hamdy, Senior Irrigation Engineer, African Development Bank

- Research for Development: Dr. Zafar Adeel, Director United Nations University, Institute for Water, Environment and Health

15:30-16:00 Coffee break

Plenary Session 7 - Theme 3: Coping with water scarcity: water and food security nexus policy dialogue

Chair: Prof Dr. Adel El-Beltagy, President of the Governing Board of CIHEAM and Chair of International Desert Development Commission

16:00-16:15 Introductory address: Dr. Abdessallam Ould Ahmed, Assistant director General, Regional Representative, Egypt

16:15-16:45 Keynote speaker 3: Dr. Andy Bullock, FAO. Findings on water and food security nexus, regional gap analysis

16:45-17:00 Discussant: Dr. Mahmood Ahmad, Agriculture and Water Policy consultant

17:00-17:45 Facilitator: Professor Fekri Hassan, Director, Cultural Heritage Programme, French University of Egypt

Policy dialogue: Iran, Iraq, Lebanon, Oman, Yemen, AfDB, FAO, NRC, AWC

Wednesday, 26 June 2013

Plenary Session 8 - Theme 4: Policies for Enhancing Food Security

Chair: Dr. Hussein El-Atfy, Executive Council Member and Acting Secretary General, Arab Water Council & former Minister of Water resources and irrigation

9:00-10:00 Keynote speaker 4: Dr. Abdessalam Ould Ahmed, Assistant Director General and Regional Representative for the Near East and North Africa

10:00-10:30 Coffee break

Plenary Session 9 - National case studies and experiences

Chair: Dr. Moujahed Achouri, FAO Deputy Regional Representative for the Near East and North Africa and FAO Representative in Egypt

10:30-11:00 National case study 8: India: Dr. Alok Kumar Sikka, Deputy Director General, Natural Resource Management, Indian Council of Agricultural Research, India - Technology and policy support for ensuring water and food security in dry areas : India’s Experiences

11:00-11:30 National case study 9: Iran: Dr. Abdol Ali Ghaffari, Director General, Dryland Agricultural Research Institute - The Islamic Republic of Iran - Country report by Islamic Republic of Iran on water, soil and drought management toward maintaining food security

11:30-12:00 National case study 10: Syria: Dr. Awadis Arslan, Director General, General Commission for Scientific Agricultural Research, Syria - Successful story of Syrian self-sufficiency in wheat

12:00-12:30 National case study 11: Uzbekistan: Dr. Shukrat Mukhamedjanov, Chief of program Productivity of lands, Scientific Information Center ICWC, Uzbekistan

12:30-13:30 Lunch break

Plenary Session 10 - Panel discussion session

Moderator: Dr. Hammou Laamrani, Senior Program Officer, Agriculture and Food Security, IDRC, Egypt

13:30-15:00 Panel discussion on Theme 4:

- Policymaker: H.E. Eng. Farid Ahmed Mogawar, Minister of Agriculture and Irrigation, Republic of Yemen

- Professional expertise: Dr Moujahed Achouri, FAO Deputy Regional Representative for the Near East and North Africa and FAO Representative in Egypt

- Donors: Dr. Demba Ba, Director, Agricultural and Rural Development Department, Islamic Development Bank

- Research for Development: Dr. Mahmoud El Solh, Director General, ICARDA

15:00-15:30 Coffee break

Concluding Session

Outcomes of the Conference: Main messages, findings and recommendations

Chair: Dr. Mahmoud El Solh, Director General, ICARDA

15:30-15:45 Moderator 1 presentation: Dr Ramesh Chand, Director, National Centre for Agricultural Economics and Policy Research, India

15:45-16:00 Moderator 2 presentation: Dr. Guido Gryseels, Director General, Royal Museum for Central Africa, Belgium

16:00-16:15 Moderator 3 presentation: Professor Fekri Hassan, Director, Cultural Heritage Program, French University of Egypt

16:15-16:30 Moderator 4 presentation: Dr. Hammou Laamrani, Senior Program Officer, Agriculture and Food Security, IDRC, Egypt

Remarks: H.E. Dr. Mahmoud Abu-Zeid, President, Arab Water Council

Discussions

Key messages and recommendations

16:30-17:00 Closing Statements

ARC Statement: Dr Abd El Moneam El Banna, President

FAO Statement: Dr. Abdessallam Ould Ahmed, Assistant Director General, and Regional Representative, Egypt

IDRC Statement: Dr. Hammou Laamrani, IDRC Representative

ICARDA Statement: Dr. Mahmoud El Solh, Director General, ICARDA

Minister of Agriculture and Land Reclamation of Egypt: H.E. Dr. Ahmed Mahmoud Ali Algizawi

Appendix 2 - Contributed papers

Contributed papers

Session 1.

Organizer: Dr. Boubaker Dhehibi, Agricultural Resource Economist, ICARDA

Chair: Dr. Mekki Omer, Water Harvesting Research Institute, Sudan

1. Dr. Teresia Rafael Olemako: Challenges of institutional decentralization in wetland management of the Pangani river basin, Tanzania
2. Dr. Mohamed. S. Abdelmoaty: Water shortage at the ends of irrigation canals in North Delta Region
3. Dr. Ismail A. Muharram: The Yemeni experience of the assessment of the present situation of WUAs and their role in community water management in Yemen
4. Dr. Chandrasekhar Praharaj: Managing precious water through need-based micro-irrigation in long duration pigeonpea under Indian Plains conditions

Session 2.

Organizer: Dr. Yigezu Yigezu, Agricultural Economist, ICARDA

Chair: Dr. Theib Oweis, ICARDA, Syria

5. Dr. Sayed Ahemed Abd El-Hafez: A conceptual framework for water use accounting based on water balance approach, crop rotation and its economics
6. Dr. Youssef Hamada: Model exploring linkages between water, food security and employment
7. Dr. Rashid Musaad: Investments in improved water management, effects on employment, livelihoods and food security
8. Dr. Aymen Frija: Critical assessment of groundwater management instruments in Tunisia: current situation and perspectives

Session 3.

Organizer: Dr. Roberto Telleria, Agricultural Policy Specialist, ICARDA

Chair: Dr. Mahmood Ahmad, Agriculture and Water Policy consultant

9. Dr. Roberto Telleria & Dr. Aden Aw-Hassan: The impact of food and agricultural policies on groundwater use in Syria
10. Dr. Ali Chebil: Impact of improved technology package on irrigated durum wheat Productivity: The case of central semi-arid Tunisia
11. Dr. Azza Bendary: Assessment of the efficiency of water irrigation management: a comparative analysis of the potentials and challenges in two rural areas in Egypt
12. Dr. Ayman F. Batisha: Enhancing water security resilience in the face of climate changes in the Arabic world

Session 4

Organizer: Dr. Aden Aw-Hassan, Director, Social, Economic and Policy Research Program, ICARDA

Chair: Dr. Sandra L. Russo, Director, Program Development, University of Florida

13. Dr. Atef Hamdy: Addressing water scarcity through recycling and making the best use of waste water
14. Dr. Atef Hamdy: Integrating gender into climate change response
15. Dr. Mohamed Ali Ahmed: Agricultural development strategies in West Africa: impact of biophysical and socio-economic processes
16. Dr. Zafar Adeel: Building resilient food systems by ensuring water security

Abstracts & Case Studies

Presented at the

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

Cairo, Egypt, 24–26 June 2013

Contents

Abstracts

Country Case Studies

Enhancing water security resilience in the face of climate changes in the Arabic world

Ayman F. Batisha
Researcher, Environment and Climate Research Institute, National Water Research Center, Cairo, Egypt

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 increase in 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 sustainable 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 – The El Bahr El Sagheir Canal

Mohamed S. Abdelmoaty, Emam, O.E. and Ahmed M. Elfarouk
Channel Maintenance Research Institute, National Water Research Center, Delta Barrage, P.O. Box 13621, Egypt

Abstract
The irrigation network extends 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. The water shortage problem is one of the severe problems that face farmers in the North Delta Region. However, the high salinity of cultivated soil there increases the complexity of the problem. In this region farmers use all available types of 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 167 000 feddan [ca 70 000 ha]. 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 irrigation water to downstream reaches, and to evaluate these solutions economically. An intensive field measurement programme was applied to the study area. The results of these measurements were analysed, the different water resources in the study area were located and identified. 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

Ismail A. Muharram[(1)] and Mohamad N. Salam

1. Chairperson of Environment Protectors Organization and Sustainable Development, Yemen

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 and functioning of the WUAs in community water management, especially at spate irrigation schemes in selected pilot areas in Yemen. The study was implemented over a period of four weeks. This included collection, review and assessment of related documents and reports, with 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 analysed 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 WUAs formed, and the role of WUAs in community water management.

The study finds success stories for 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.

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

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

C.S. Praharaj

Principal Scientist, Indian Institute of Pulses Research, Kanpur, Uttar Pradesh, India–208024

E-mail: cspraharaj@gmail.com

Abstract

Application of location-specific agronomic measures for rainfed areas has considerably augmented pulses production in the Indian subtropics. Managing agro-inputs with the help of modern techniques has facilitated 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 conditions. Thus, a need was felt to use precious water more judiciously, sensibly and by need-based application through modern technology, due to the ever-increasing share demanded by urban households for domestic water supply, and by 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 spells after rainy months, could possibly alleviate moisture stress in growing crops, such as long duration pigeonpea with 8-9-month maturity. Therefore, a field experiment was conducted for two years (2010-2012) at Kanpur, India, under Eastern Indo-Gangetic Plains conditions (with low fertile sandy loam soil) to assess the critical stage-based supplemental drip-fertigation in comparison with the standard practice (rainfed).

Three planting patterns were compared in the main plots, with five drip-fertigation schedules in sub-plots were compared in a split plot, with 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 realised under drip-fertigation at branching only.

Although different planting patterns did not influence crop performance, a single irrigation (2 cm as 5 splits) as 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 the second year (9.4%) and in pooled data (6.3%). Yield attributes such as pods per plant, 100 seed weight and harvest index, showed similar trends as for 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 addressing water scarcity
Atef Hamdy
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Abstract
As growing populations and their increasing economic activities demand more water, water reclamation and re-use 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 no major limitations in terms of amounts treated, is 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 necessary 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 wastewater should be counteracted by improving the efficiency of public administration. This improvement could 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

Rosanna Quagliiariello[(1)] and Atef Hamdy[(2)]
1. Head of Gender Unit, CIHEAM-Mediterranean Agronomic Institute, Bari, Italy
2. Emeritus Professor, CIHEAM-Mediterranean Agronomic Institute, Bari, Italy

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, both at international and domestic levels. Integrating gender and climate change at national level remains a challenge, as national governments often face difficulties in integrating a 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 rarely present. 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 programmes 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 centre of adaptation programmes because they are a group particularly vulnerable 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 labour productivity. Furthermore, in the face of extreme events such as drought, floods and other climate-related disasters, women play a key role in adaptation 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; and 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 systems.

The gross and net depletion fractions (DF) are 6.1% and 6.2% less in 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 mm vs. 1212 mm). The RSCW rotation has the highest net returns, about US$2286 per ha, compared with US$2003 ha 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.

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

Agricultural policies and 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_2 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 national programmes 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. The 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 increased 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, analyse 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 geographical locations in West Africa.

It seems that there is no 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 is no 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 metres 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 metres thick, but in the centre it may be up to 20 m thick. The Nile Delta has an agricultural area of about 4 million Feddan [1.68×10^6 ha], 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 have been 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 levelling 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 analyse and discuss different instruments currently used in Tunisia for managing the groundwater resource. In this case, a SWOT analysis is used 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 depend highly on the WUAs performances.

Moreover, at the national level, many decisions and policies targeting groundwater sector have been established since the 1990s; however their implementation and enforcement is still very weak, mainly due to non-favourable 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 run-off 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 ha of rainfed area have been treated with terrace for sorghum cultivation, benefiting 6427 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 kg/ha under an average of 150 mm of rainfall and from 650 to 2250 kg/ha under an average of 250 mm of rainfall. Simple preliminary cost benefit analysis is conducted for terrace cultivation for a 2.1 hectare area. The economic impact of that intervention is that average gross margin has increased by 191% from $200/ha with traditional practice to $582/ha with the improved terraces.

Food self-sufficiency for a poor household of six members is estimated at 0.5 kg/person/day, with a total of 1100 kg/year to cover household consumption and another 1100 kg/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 the 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 programme 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 government 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 decentralization of wetland resources and their associated livelihoods are managed by civil society organizations (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 decentralization 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 subject 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^3 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 re-use 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 re-use 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 discusses the opportunities that provide for integrating policy development, and the necessity to consider the possible trade-offs. A 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_2 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 an optimal cultivation level based on suitable food security in comparison with the existing situation.
Keywords: Sustainable development, climate change policy; adaptation, emissions scenarios.

Country Case Study: China

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, the Cobb-Douglas production function was applied, and a quintile regression method adopted. The article empirically estimates the contribution of improvement irrigation ratio and stable-harvesting ratio to the grain yield.

The research findings show that other input things being equal, the contribution coefficients of increased irrigation ratio and stable-harvesting ratio to grain yield are statistical positive at above 5%, which proves 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.
Acknowledgement: Thanks to Dr Xin Xiangfei, CAAS, who inspired me to establish the regression model, and Ms Li Meijuan, CAAS, for help with GIS. My appreciation also extends to Oxfam Hong Kong for funding this research.

Country Case Study: Ethiopia

Ensuring food security in dryland areas of Ethiopia: policies, actors and achievements

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Abstract

The paper presents the importance of dryland 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 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, namely utilization of human labour, proper use of agricultural land, the combining of endogenous and exogenous knowledge; focus on innovations adapted to AEZs (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 dryland areas, the water and food security policies and interventions explicitly address dryland agriculture by differentiating them into sedentary dryland 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) dryland 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 (roads, telecommunication, education, etc.), and (vi) implementation of food security-specific programmes.

As a 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, diseases and pests, etc.), (ii) the challenges in establishing effective technology multiplication and delivery mechanism in dryland areas due to the associated high risks, (iii) the limited agricultural technology uptake in dryland areas, (iv) the nature of the long period required 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

Country Case Study: India

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-scale 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-scale and marginal farmers particularly who largely practice subsistence agriculture. The recent technological advances and investments in 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 with 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 programmes 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. ICAR has come up with location-

specific technologies for 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 run-off 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 Case Study: Iran

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

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Abstract

Owing to its diverse ecological characteristics, Iran benefits from favourable conditions for producing a 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 tonne of agricultural products and 118 million tonne of produce are forecast to be harvested this year.

Currently 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 droughts, Iran has increased its grains production by 3.6 million tonne, reaching 19.5 t/ha 2010. Wheat was the main grain produced in 2010 in Iran with a 3.2 million tonne surge and reaching 13 million tonne in 2010.

The Islamic Republic of Iran is located in the 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 is arable land, 84 million ha rangelands, 13 million ha forests and the rest wastelands and 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 the major crop in the Islamic Republic of Iran, where it is grown on 6.4 million ha. 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 attained self-sufficiency in wheat production for the first time for 40 years during 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. The agriculture sector plays a pivotal role in attaining food security, social equity and poverty alleviation in Iran in terms of timely access of all the 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 a 2600 Kcal recommended daily intake.

The Islamic Republic of Iran has long developed a comprehensive network of agricultural faculties and national research institutes, and 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.

Country Case Study: Jordan

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 plays a limiting factor role to restrict economic progress, and as food deficit create social troubles and could lead to conflict.

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

As a result of higher demand and allocations that exceed resources, the Ministry of Water and Irrigation introduced its 15-year strategy in 2007, to find solutions for water scarcity, by reconsidering priorities, re-allocating water shares, treating wastewater, and desalinating brackish and sea waters.

Unfortunately as the resulting policies were disadvantaged the agricultural sector, so the government has stopped the southern agricultural companies from planting the desert, instead conveying Desi water to Amman. During the 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 re-allocation 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 behaviour related to crop selection, cropping patterns, irrigation practices, and the competition between water policies and food security concerns to achieve water security.

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

Country Case Study: Syria

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 backward and forward to 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 national GDP ranged between 16% and 22% at constant prices of 2000, providing employment to about 20% of the total labour force, and represents about 14% of total trade.

In 2011, the total area of Syria amounted to 18.5 million ha, 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 ha, divided into 24% irrigated land, 56% rainfed land and 20% fallow land. The total area in turn is separated into five Agricultural Settlement Zones according to annual rainfall.

In line with the development of the sector, Syria has been adopting policies to achieve food security in general, and self-sufficiency for 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 policies are to convert rainfed 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 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 SP 7700 million in 2005 to SP 11 700 million in 2011.

As a consequence, in 2011, 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. 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 mentioning that wheat production increased by 74% over the last two decades (1 539 275 tonne); the vertical development of wheat production (yield improvement) provided about 74% of the total increase (1 134 445 tonne), while horizontal development (area expansion) provided the rest.

There are several lessons to be 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-Year 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.

Country Case Study: Turkey

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

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Abstract

The delicate balance that 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 sustainable agriculture. Turkey is among the most affected countries under the influences of drought and desertification as a result of declining water resources. The most significant problem in agricultural water management is the inefficient use of water. Overexploitation and illegal wells lead to diminished quantity and quality of groundwater. Degradation of water quality in ground and surface waters in irrigation threatens food safety.

Turkey takes initiatives on legal arrangements, institutions and organizations, technologies, financial, social and environmental for sustainable management of 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. At the same time, the effects of climate change will have serious impacts 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 precipitation, falling surface- and ground-water levels, increased water demand and increasing danger of water pollution lead to reduced water resources for use in agriculture. Scientific evaluations clearly indicate that the risk of excess water demand in irrigated areas should be mitigated by re-using marginal water, low quality irrigation water and other wastewater with proper processing 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 ranges between 2800 mm and 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 limiting factor to definitive yield and plant growth patterns. Groundwater is of utmost importance for irrigation in agricultural areas as well as providing drinking, potable water, and industrial water, especially in areas where there is insufficient or no surface water resources.

In our country, total usable groundwater in terms of operational safety reserves are estimated to be 13.6×10^9 m^3/year. In addition, this reserve can supply about 7×10^9 m^3/year allocated to irrigation, and irrigate an estimated 600 000 ha of land. On the basis of studies until now, 96% of current reserves were allocated and 557 831 ha were brought under irrigation.

Besides the benefits of being the only alternative, insufficient or no surface water means that groundwater has important functions in increasing employment and income, the growth period can extend and consequent yield is more than usual in drought period. The necessary investments mean schemes are in service in a short time, 2–3 years.

Groundwater is in the scope of public waters and covered by Government. Ownership of a land does not means that you have the right to the water below it. For this reason, in our country, groundwater is managed according to Law No 167, "Law On groundwater".

While the State owns the irrigation rights with groundwater, 80% of the irrigated areas are operated by cooperatives. Groundwater irrigation facilities consist of wells, pumping stations, electrification and the irrigation network. Irrigation cooperatives have an initial 3-year grace period and a total of 12 equal annual instalments, so schemes operate on a 15-year life.

Groundwater pumping irrigation facilities were built by the state, but operation by 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.