

Abstracts/Briefers Agriculture/Environment Water Background Papers

A literature Review conducted by the Water Team Nov 2011 to Jan 2012

1. US Forest Service Proposal to the US Agency for International Development Establishment of a Youth Conservation Corps

Amman, Jordan

October 27, 2011

The US Forest Service (USFS) proposes a large-scale partnership with the US Agency for International Development (USAID) in Jordan to establish a youth conservation corps. The initiative would capitalize on the great assets in Jordan, its well-educated and highly motivated youth, to help address one of its greatest national challenges, water security. The initiative is inspired in part by the United States Civilian Conservation Corps (CCC), a depression era public relief program that sought to address both unemployment and the need for conservation work across the country. Though short-lived, this program was one of the most successful government works programs in the history of the country and its legacy of trails, trees, visitor infrastructure, bridges and dams are still widely in place and well appreciated by the American public today. The CCC worked on flood control, reforestation, range management, forest management and protection, recreation development, wildlife conservation and emergency response. CCC paved the way for several similar programs, like the Student Conservation Association, Youth Conservation Corps, Americorps, Peace Corps and Teach for America. Save the Children, an international NGO working in Jordan since 1985, reports that 60% of Jordan's population is under the age of 25, while 70% of Jordan's youth who are one year out of school are still unemployed. The people of Jordan are one of its greatest assets. They are well educated and highly motivated. Despite this, young graduates have tremendous difficulty obtaining work in their field of study.

Goal: to establish a youth conservation corps and utilize this corps to increase resiliency and productivity of critical watersheds in Jordan.

- A. Objective One: Establish a youth conservation corps in Jordan.
- B. The Forest Service will work with partners to establish the youth conservation corps (YCC) in Jordan beginning by heavy consultation with appropriate ministries and civil society organizations, such as Youth and Social Development, Environment and Agriculture, and NGOs such as the Royal Society for the Conservation of Nature, Al-Shejara Society, the Hashemite Fund and others. The YCC project will work with partners listed above in a collaborative way to identify target geographic areas for intervention based on environmental criteria and partner institutions. Objective 2: Utilize the YCC to restore important watersheds and increase watershed resiliency. YCC staff will work with stakeholders to establish work categories, potentially to include: forest culture, range and grazing management extension, monitoring, reforestation and re-vegetation, elementary education and outreach on underlying thematic areas, litter control, tourism/protected area site development.

2. Rural Economic Development (RED) Project

Formerly *Jordan Small Ruminants Project* ACDI VOCA 2008

ACDI/VOCA formally submitted the findings from their assessment of the small ruminants sector in the Badia. As a result of the constraints identified during that assessment, they are also outlining in this program summary many of the opportunities for growth and development that we feel can be addressed through a program such as our Rural Economic Development (RED) project.

"Realizing food security is a top priority. Thus, they seek to care for farmers and animal breeders and to direct subsidies of animal feed to those who qualify. In parallel, the government will promptly implement the natural grazing fields' project...within the comprehensive program to develop the Jordanian badia..."

- His Majesty King Abdullah II, Opening of the 15th Parliament's Second Ordinary Session

Agriculture, and its critical role in addressing food security issues, is one of the top areas of the economy targeted by the Government of the Hashemite Kingdom of Jordan for investment and expansion. This is supported by increased consumer demand, growing private-sector expansion and improved government policies and programs for rural regions that primarily depend on herding sheep and goats. In July 2008, ACDI/VOCA conducted a rapid field assessment of the small ruminants sector in throughout the Badia region to determine the feasibility of implementing a project in Jordan.

The key objectives of the proposed RED project are to:

1. Increase productivity, product quality and profitability of small ruminant producers
2. Increase productivity, product quality and profitability of dairy sector enterprises
3. Increase access to critical sector support and input supply services, including finance, veterinary services and quality forage
4. Strengthen capacity associations/cooperatives in the small ruminants sector
5. Increase awareness of nutritional value of hygienic milk leading to increased demand

Despite major economic strides in the past decades, Jordan continues to face significant challenges to its economic development. Deep pockets of poverty remain, with 14 percent of Jordanians living below the poverty line, rising to 19 percent in rural areas.² The Badia, which makes up approximately 80 percent of Jordan's territory, includes four branch areas with poverty rates of over 34 percent. The economy remains narrowly-based, centered on a few industries and clusters around Amman. The economic activity centers of Amman and Zarqa together account for more than two-thirds of the country's population and approximately 80 percent of its GDP.³ The arid and semi-arid broad swath of territory that constitutes the Badia—like similar areas in the Middle East and North Africa with less than 300 mm average annual rainfall—depends on the small ruminant (sheep and goat) dairy and meat sectors as an important source of income. Small ruminants require low initial capital and maintenance costs and use marginal lands and crop residues to produce milk and meat, even in steep mountain terrain and desert regions. The animals are resistant to harsh conditions and disease, and are critically important to food security and nutrition (protein, calcium, vitamins and energy) in addition to income. For many people, and especially infants, goat and sheep milk and dairy products are an essential alternative to cow's milk. In addition to addressing domestic food security needs, there is significant local and export market demand for higher value products such as yogurt, artisanal cheeses, *kefir* milk powder and evaporated milk made from goat and sheep milk, as well as for specialty foods including traditional and gourmet products. The sector faces significant constraints to growth. At the producer level, there is *poor access to quality feed* for animals. While Jordan produces 5 percent of the feed required to support livestock, it imports the remaining 95 percent. In 2004, Jordan imported 765,000 MT of barley and 427,327 MT of maize to help meet the needs of farmers. Natural grazing supplies only 25 to 30 percent of feed requirements, causing producers to often sell their lambs at low weight due to lack of feed and import additional animals to meet demand for meat. To meet domestic needs, Jordan imported almost 12,000 MT of mutton and lamb in 2004 alone. Since 70 percent of small ruminant flock income is derived from meat, increasing the weight of lambs would significantly increase household income.

3. Water Valuation in Jordan Report Final Report Prepared for French Agency of Development (AFD) August 2011 (91 pages)

Because water is provided by the government with heavy subsidy, strategic biases or simply the belief among farmers that water is a free gift from God (Abu-Zeid, 2001), could probably lead to erroneous estimations of water values when using direct methods such as contingent valuation

This study focuses on the use of water as an intermediate good, used as an input in the production of other goods and services. It also attempts to analyze the benefits of intersectoral water use in a country where water markets are ill-defined and prices are distorted, because of government intervention or because of the absence of completely defined user rights. When used as an intermediate good, the value of water must be assessed from the producers' point of view. One of the common ways to estimate the value to users of water is the willingness to pay for water, which represents a lower bound on water value, as there is additional value to the water. In this approach, the economic value is a measure of the maximum amount an individual is willing to forego in other goods and services in order to obtain some commodity, service, or state of the world. The trade-offs people make when they choose less of one and more of some other commodity reveal something about the values people place on these goods.

The agriculture sector is a major consumer of water, and the returns to water from crop Production tend to be low in comparison to other sectors.

The importance of the agricultural sector stems from the fact that it is the major source of food items especially fruits and vegetables and also one of the sources of hard currencies originated from exports. In addition, the agro-industrial sector is characterized by a large number of small enterprises. Despite its low contribution of 2.5% in the GDP, agricultural exports represent about 9% of Jordan's total exports of which fruit, vegetables and nuts represented 67%. In the last two years vegetable and fruit exports have jumped and that together they represent almost 70 percent of total agricultural exports. This indicates that there is a high potential for increasing horticultural exports. Following is the data collected during the study:

- 1. Gross water requirement for all crops grown in MJV & SJV, taken from MWI**
- 2. Water supply quantities, from JVA (2000 -2009)**
- 3. Cultivated crop areas in both MJV & SJV from DOS 2000 -2009.**
- 4. Farm gate prices of crops grown in both MJV & SJV from DOS 2000-2009.**
- 5. Actual cropping patterns DOS 2000-2009.**

Tomatoes and Cucumbers provide the greatest profit per cu. M. of water but the number of factors is complex. Crop production is then a dynamic process in which decisions about inputs are made sequentially as crops are planted, grown and harvested. Linking water supply and agricultural production is a complex research issue, as it integrates different dimensions of water supply and several decisions taken by farmers at different periods of time (planning of farming activities, water scheduling, water use, etc.) This paper reviews those complex interactions and provides insights into decision making in Agriculture. The observed values of water were in the range of those found in other studies for irrigated vegetables (Haddadin et al., 2006). He reports that the value of water is 0.48 JD/m³ for vegetables under plastic houses and 0.35 JD/m³ for citrus crops and 0.37 JD/m³ for fruit trees.

4. Assessment of Agricultural Production and Marketing Issues in Jordan

Report prepared for the USAID/Jordan to be presented at: Roundtable Discussion Organized by Mercy Corps on "Rural Community Approaches to Integrated Water Resource Management" in Jordan, August 21st & 22nd 2007
Amer S. Jabarin Consultant August 2007

The main objectives of the report are:

- To provide the Government of Jordan with descriptions of policy modifications and regulatory reforms that will encourage farmers to shift production to crops that yield a higher value per unit of water and position Jordanian agriculture to more effectively compete in both local and international agricultural markets.
- Recommend revisions in current policies that will strengthen demand-based agricultural production, and recommend a new policy to improve the quality of agricultural labor to support Jordan's efforts to become more competitive in export agricultural markets.

The ultimate objective of these policy recommendations is to create a regulatory environment conducive to improving the economic returns to water use in agriculture in Jordan.

The terms of reference for the present report states the main objective is to identify the exact Government of Jordan (GOJ) laws and regulations identified for revision in the two reports prepared by KAFA'A. The other objective of the report is to review all laws, policies, implementation orders, letter of instructions, and temporary laws and highlight the precise sections within those laws that need revisions. These objectives will be attained through conducting the following tasks:

- Review the two reports by KAFA'A.
- Review all (GoJ) laws and regulations that pertain to the subject matters.
- Prepare a folder that includes all marked supporting documents. To include all applicable laws, regulations, implementation orders, letter of instructions and policies.

Current import tariff policy encourages resource allocation to crops that represent inefficient uses of water, in terms of income generated per cubic meter of irrigation water: bananas, apples, grapes. Total border protection for these crops is in the neighborhood of 50%.

Summary of Proposed Policies in this report

Improve the Incentives Regime for Agricultural Marketing through:

- Abolish the requirement that all sales of fresh produce go through municipal markets, allowing exceptions for exports and for direct sales to retailers and the public.
- Eliminate the market tax of 4%, leaving in place the 4% sales tax and the commission fee.
- Reduce the tax and commission rates for cut flowers to the level of rates for fresh produce.
- Implement a cost-sharing arrangement for to cover half the cost of trial export shipments, of new products and for new markets in the case of existing products (II).
- Support the reestablishment of farmers markets in Amman and major towns (II).

Proposed policy changes are also summarized within the following sectors in Agriculture:

- *Export Quality Standards*
- *Agricultural Labor Policy*
- *Water Management Policy for Agriculture*
- *Other Agricultural Policies*

5. Aquifer Study-----Specific suggestions to the results of USGS groundwater trends study Dan Goode (April 2012) (7 pages)

Recommendations to update the water level trends

Further analysis of the levels could be done in important areas by segregating the water levels by aquifer. In some locations, nearby wells are open to different aquifers. These data could be segregated to evaluate the trends by aquifer, where this is important (e.g. Zarqa and highlands areas).

Recommendations to update the salinity trends

Further analysis of the salinity could be done in important areas by segregating the water levels by aquifer. In some locations, nearby wells are open to different aquifers. These data could be segregated to evaluate the trends by aquifer, where this is important (e.g. low elevations in Zarqa, Azraq).

Recommendations to update the Spring and stream-flow trends

Spring data should be relatively straightforward, but more analysis may be needed for streamflow analysis (although there is less stream-flow data). For springs, an additional analysis should evaluate the past drying up of springs, using historic data.

6. **Aqaba Sahara Forest Project 2012**, Promoted by Embassy Norway. *“We are very excited to join forces with Qafco and Yara to realize this truly unique system of green technologies. The Pilot Plant will prove the benefits of a holistic approach to challenges in the food, water and energy-sector,”* says CEO of The Sahara Forest Project, Joakim Hauge. *“Increased food demand must be met with innovative thinking and an efficient agricultural sector. This project demonstrates that Yara’s continuous research and development efforts go well together with environmental activities aiming at solving one of our times’ most important challenges,”* says CEO Jørgen Ole Haslestad of Yara International *“While contributing with our industrial experience and nutrient knowledge in this environmental project, we are at the same time developing potential new and exciting markets in desert areas,”* A cornerstone of the pilot is greenhouses utilizing seawater to provide cool and humid growing conditions for vegetables. The greenhouses will also produce freshwater themselves. The greenhouses will be coupled with a state of the art parabolic trough solar collector with a thermal desalination unit supported by PV-technology. The pilot will also allow for cultivation of algae in a system of photobioreactors and open pond cultivation systems. An important part of the pilot is to demonstrate the potential for cultivating desert land and making it green. Outdoor vertical evaporators will create sheltered and humid environments for cultivation of plants. Additionally, the pilot will contain outdoor hydroponic raceways for cultivation of halophytes – plants tolerant of irrigation with salty water. The facilities in the pilot plant will be supported by on-site laboratories, scientists and professional growers.

In addition to the planned Pilot Plant in Qatar, The Sahara Forest Project is also carrying out projects in Jordan. The Qatar pilot will provide valuable experience and technology optimization that will help accelerate the projects also in Jordan.

In 2011, a Memorandum of Understanding was signed between the Aqaba Special Economic Zone Authority and The Sahara Forest Project AS in Amman, Jordan. The Jordanian Minister for Foreign Affairs, H.E. Nasser Judeh, and the Norwegian minister for Foreign Affairs, H.E. Jonas Gahr Støre, were both present at the signing ceremony to show joint Jordanian and Norwegian support for the agreement.

1. Concentrated Solar Power

2. Saltwater greenhouses

3. Outside vegetation and evaporative hedges

4. Photovoltaic Solar Power

5. Salt production

6. Halophytes

7. Algae production

In 2011, a Memorandum of Understanding was signed between the Aqaba Special Economic Zone Authority and The Sahara Forest Project AS in Amman, Jordan. The Jordanian Minister for Foreign Affairs, H.E. Nasser Judeh, and the Norwegian minister for Foreign Affairs, H.E. Jonas Gahr Støre, were both present at the signing ceremony to show joint Jordanian and Norwegian support for the agreement.

7. Water for Food –Water for Life --A Comprehensive Assessment of Water

Management in Agriculture Edited by David Molden 2007 The Comprehensive Assessment of Water Management in Agriculture is a critical evaluation of the benefits, costs, and impacts of the past 50 years of water development, the water management challenges communities face today, and the solutions people have developed around the world. It is a multi-institute process aimed at assessing the current state of knowledge and stimulating ideas on how to manage water resources to meet the growing needs for agricultural products, to help reduce poverty and food insecurity, and to contribute to environmental sustainability. The findings will enable better investment and management decisions in water and agriculture in the near future by considering their impact over the next 50 years. The assessment was originally framed by 10 questions, later expanded as interest grew (see box), and includes the overarching question: how can water in agriculture be developed and managed to help end poverty and hunger, ensure environmentally sustainable practices, and find the right balance between food and environmental security?

These 10 questions were defined in 2001 by the Steering Committee of the Comprehensive Assessment:

1. What are the options and their consequences for improving water productivity in agriculture?
2. What have been the benefits, costs, and impacts of irrigated agricultural development, and what conditions those impacts?
3. What are the consequences of land and water degradation on water productivity and on the multiple users of water in catchments?
4. What are the extent and significance of use of low-quality water in agriculture (saline and wastewater), and what are the options for its use?
5. What are the options for better management of rainwater to support rural livelihoods, food production, and land rehabilitation in water-scarce areas?
6. What are the options and consequences for using groundwater?
7. How can water be managed to sustain and enhance capture fisheries and aquaculture systems?
8. What are the options for integrated water resources management in basins and catchments?
9. What policy and institutional frameworks are appropriate under various conditions for managing water to meet the goals of food and environmental security?
10. How much water will be needed for agriculture, given the need to meet food security and environmental sustainability goals?

Question: Is there enough land, water, and human capacity to produce food for a growing population over the next 50 years—or will we “run out” of water? *The Comprehensive Assessment’s answer:* It is possible to produce the food—but it is probable that today’s food production and environmental trends, if continued, will lead to crises in many parts of the world. Only if we act to improve water use in agriculture will we meet the acute freshwater challenges facing humankind over the coming 50 years. Further appropriation of water for human use is not possible because limits have been reached and in many cases breached. Basins are effectively “closed,” with no possibility of using more water. The lack of water is thus a constraint to producing food for hundreds of millions of people.

Only if we act to improve water use in agriculture will we meet the acute freshwater challenges facing humankind over the coming 50 years.

Enough food grown at the aggregate global level does not mean enough food for everyone. Some good news: 75% of the additional food we need over the next decades could be met by bringing the production levels of the world’s low-yield farmers up to 80% of what high-yield farmers get from comparable land. Better water management plays a key role in bridging that gap.

Policy action 1. *Change the way we think about water and agriculture.* Thinking differently about water is essential for achieving our triple goal of ensuring food security, reducing poverty, and conserving ecosystems.

Policy action 2. *Fight poverty by improving access to agricultural water and its use.* Target livelihood gains of smallholder farmers by securing water access through water rights and investments in water storage and delivery infrastructure where needed, improving value obtained by water use through pro-poor technologies, and investing in roads and markets.

Policy action 3. *Manage agriculture to enhance ecosystem services.* Good agricultural practice can enhance other ecosystem services. In agro-ecosystems there is scope to promote services beyond the production of food, fiber, and animal protein.

Policy action 4. *Increase the productivity of water.* Gaining more yield and value from less water can reduce future demand for water, limiting environmental degradation and easing competition for water.

Policy action 5. *Upgrade rainfed systems—a little water can go a long way.* Rainfed agriculture is upgraded by improving soil moisture conservation and, where feasible, providing supplemental irrigation.

Policy action 6. *Adapt yesterday’s irrigation to tomorrow’s needs.* The era of rapid expansion of irrigated agriculture is over.

Policy action 7. *Reform the reform process—targeting state institutions.* Following a realistic process to suit local needs, a major policy shift is required for water management investments important to irrigated and rainfed agriculture.

Policy action 8. *Deal with tradeoffs and make difficult choices.* Because people do not adapt quickly to changing environments, bold steps are needed to engage with stakeholders.

8. Biodiversity in Jordan (8 pages)

Jordan has a rich and highly diverse vascular flora, 2,500 species included within 152 families and 700 genera. Jordan has 1 percent of the total world flora represented within its boundaries. No serious study to identify endemic, rare, and endangered species has been carried out in Jordan. Species known to be rare or endangered include orchids, ornamental bulbous plants, and some rare edible and medicinal plants. Since agriculture and cereals evolved in this part of the world, Jordan is rich in crop genetic resources.

Plant diversity in Jordan is facing a dramatic decline and some species have become extinct in the wild since the early part of this century. Key factors driving this decline include the loss and degradation of habitats, over-exploitation of plant and animal species, extensive agricultural and uncontrolled development, overgrazing, introduction of invasive species, illegal collection of plants, and depletion of major water sources. The Royal Society for the Conservation of Nature (RSCN) lists 100 endemic species of plants, 200 to 250 rare species, 100 to 150 threatened species, and 10 to 20 species that have gone extinct over the past 90 years.

Rangelands receiving less than 200 mm average rainfall per year cover 91 percent of the country and include Badia, steppes, and parts of the Jordan Valley. Rangelands provide animal feed at little or no cost. Grazing is a way of life and source of income for a large number of the inhabitants of these areas. Traditional grazing cycles were based on a transhumant system that allowed for the natural regeneration of forage. This situation no longer exists and traditional grazing rights are mostly ignored. Overgrazing, uprooting of range plants, off-road driving, improper cultivation patterns, and urbanization are degrading rangelands.

The government has recognized for many years the importance of rangelands and the need for their sustainable management. The first range reserves were established in the 1940s to protect, improve, and manage rangelands through research and development activities. Currently, there are 27 rangeland reserves covering a total area of about 0.8 million hectares and nine cooperative range reserves covering 0.1 million hectares.

. In terms of what is needed to conserve terrestrial, aquatic, and marine biodiversity in Jordan, the following recommendations will be addressed in part by USAID activities under this Mission strategy:

1. Establish an effective legal and regulatory framework for environmental management and clarify overlapping institutional mandates, authorities, and arrangements.
2. Establish an effective network of protected areas to safeguard a representative sample of major and key ecosystems.
3. Build environmental management capacity and foster integrated land-use planning
4. Promote public awareness and expand environmental education.
5. Promote investment in ecotourism development as a growing engine of economic development with focus in and around conservation hot spots while linking it to sustainable local livelihoods development.
6. Promote improved governance types of natural resource management with particular focus on local communities' empowerment and participation with equitable benefit sharing.
7. Support the completion and maintenance of the national Protected Area network within the principles of ecosystem management.
8. Prevent overgrazing by livestock and improve range management.
9. Strengthen law enforcement to reduce illegal hunting, trade in endangered species, and other wildlife crime.
10. Stop illegal woodcutting and encroachment of urban settlement into woodlands through technical and hardware assistance support of the law enforcement body represented by the MoEnv staff and the Royal [Environmental] Rangers.

Assist in capacity building of the new MoEnv and other associated national civil society organizations

9. CONCEPT PAPER: SUSTAINABLE AQUIFER MANAGEMENT IN JORDAN'S HIGHLANDS

NOVEMBER 14, 2010

I. BACKGROUND

The threats to Jordan's water supply from over-pumping of its aquifers are detailed in scientific and development planning documents dating back over two decades. In summary, Jordan is over-pumping 80% more water every year than the safe yield, and the imbalance is worsening because of population increases (estimated to double over the next 25 years) and precipitation decreases caused by climate change (estimated to at 50% in this century). The negative economic, social, and environmental consequences of continued depletion of Jordan's aquifers are difficult to project, but are clearly serious.

Across the country, about 6% of water is used in industry, about 30% for household use, and about 64% for irrigation. Clearly stated policies from King Abdullah and the Ministry of Water and Irrigation make household water the highest priority, yet in the populous northern and middle areas, the recharge to ground water is only equal to current water extraction for municipal and industrial use. The Disi Aquifer project to bring 6,000 year-old water to Amman from the south east of the country should be able to deliver 100 MCM, which is approximately the same volume of water currently over-pumped from ground water in the Amman-Zarqa and Azraq Basins, the supply from the Disi Aquifer is projected to last for about 5 decades.

The government has raised expectations that water supplies will increase, and at current rates of supply larger populations will have difficulty meeting basic health needs and business growth would be unlikely, and the high pumping costs will double or triple the cost of water. Very deep aquifers may also provide water in the future, but also at very high costs.

Desalinated Red Sea water will probably contribute to Jordan's water supply in the future, but unlimited supplies of fresh water sometimes promised would only be possible with unlimited funds for energy and infrastructure. The proposed Red-Dead conveyance system to produce desalinated faces serious technical, financial, environmental and political obstacles, which may be insurmountable, and certainly will be overcome only after years or decades of intensive work. No existing technology can produce desalinated water cheaply enough to use for irrigation (although increased volumes of municipal wastewater can be treated and used for agriculture or groundwater recharge).

The greatest danger of depletion of Jordan's aquifers is that crucial water sources will not be suitable for human consumption due to high salinity of the groundwater and become unusable for decades to come where the restoration of these aquifers will need decades to be suitable for human consumption again. This has already happened with some wells where the salinity exceeds 11,000 mg/l. The loss of usable groundwater in rural areas would eliminate most highland agriculture, displace communities, and force migration to the cities. Amman and other cities, already failing to support the cost of inexpensive

10 Curtailment of Groundwater Use for Irrigated Agriculture in the Amman-Zarqa Basin Uplands: An Economic Analysis James B. Fitch **Water Resources Economist** Fitch & Marshall, Inc. Yakima, WA, USA (40 pages)

Groundwater from the Amman Zarqa Basin (AZB) is an important and valuable natural resource. Water from the Basin is being seriously over-abstracted. Consequently, the water table is dropping and water quality is declining. This threatens the durability of one of the principal sources of M&I supply for the Amman area, and is thus of strategic importance to Jordan. Irrigation, which is generally thought to be a relatively low-value use, accounts for about half of current abstraction.

This socio-economic study evaluates various options for improving the management of groundwater in the AZB uplands. Specific objectives of the study are:

- ❑ Study agricultural production and water use in the uplands.
- ❑ Estimate the value of groundwater used in irrigation.
- ❑ Show what will happen if over-abstraction continues.
- ❑ Study options for curtailing irrigation use, and determine the social and economic impacts of curtailment. Options studied include:
 - Raise water use efficiency with an Irrigation Advisory Service.
 - Government buy out of wells and/or farms.
 - Reduce cropped area by imposition of license limits.
 - Exchange recycled water for groundwater.
- ❑ Help define future role of agriculture in the AZB.

The value of water used in production was found to vary from crop to crop (see the attached chart: "Returns to water for principal AZB crops"). Watermelon and sweet melons were found to have water values similar to the opportunity cost, but for most crops it is less. For tomatoes, the second most important crop (15 percent of area in the B2/A7), the value of water is quite low. For olives, the crop that accounts for the highest proportion of land area in the Basin (40%), the profit per m³ is negative. It is important to note that many of the olives and other fruit trees in the Basin have been planted quite recently and have still not reached the age of full production. Since the primary budget analysis used average yields for all olive plantings, the value of production and of water is lower than it would be for mature trees.

The effects of continued high abstraction

If nothing is done to curtail abstraction in the basin, this will have serious impacts on all water users. The water table will decline, and salinity levels will increase. This will have various negative impacts on agricultural users. Costs of pumping will increase, and yields of many crops will decline due to the salinity. The aquifer is expected to go dry in some areas, and it is estimated that 74 wells will have to be abandoned by 2015 as a result. Other wells will need to be deepened or reconstructed.

It is recommended that the government move to strengthen its licensing system by setting limits on all wells that currently do not have them and by ensuring that all wells have meters that work.

Most farms do not earn high enough incomes to afford water charges of JD 0.250 per m³, which is the rate currently paid by industrial well operators. The study shows that many farms could afford a block rate based on 0.015 JD/m³ for water within limit,¹ and 0.100 JD/m³ for water above limit. Farms that are highly productive could afford to buy water.

It is recommended that the buy-outs and water charges be implemented jointly so that the two approaches complement each other.

11 McKinsey/Coca cola/ Nestle Min of Water and Irrigation Consolidating the fact base, prioritizing solutions and refining the implementation plan (16 pages) [*This paper provides an excellent overview of the history of Agric and water in Jordan.*](#)

The Ministry of Water and Irrigation (MWI) within the Government of Jordan has recognized water as a scarce resource critical to the future growth of the Hashemite Kingdom of Jordan - a view that is shared by other parts of the government. MWI has requested the 2030 Water Resources Group (WRG), an innovative public-private partnership between the International Finance Corporate, McKinsey & Company, Nestle, Veolia and experts from Harvard University, to prepare a proposal which will bring global expertise in water resource management and solutions to support the water sector in Jordan. The end objective of the exercise will be to prioritise the entire set of solutions available to Jordan and review the current action and investment plans to create a roadmap for implementation of solutions in Jordan.

- Need for a better understanding of future water demand particularly in agriculture, industry and tourism uses. There is a need to build projections for future water demand based on the economic development plans of the Ministries of Agriculture, Industry and Tourism to account for the planned move to higher value crops and development of special economic zones for industry.
- Inefficient water use in agriculture, particularly in the highlands. Water tariffs for agriculture are low and despite policies in place to limit ground water over-extraction, agriculture in the highlands make inefficient and unsustainable use of scarce groundwater resources. Therefore, there is substantial scope for implementing efficiency measures for agriculture particularly in the highlands.
- Over-reliance of current planning on a few supply-side "silver bullet" projects. While the Disi aquifer and the Red-Dead conveyor projects are critical projects that will provide supply in future, there is a need to integrate the current initiatives under the MWI and implementing agencies - Water Authority of Jordan (WAJ) and Jordan Valley Authority (JVA) as well as programmes by development agencies such as USAID, GTZ, JICA and others to get a complete economic picture of all solution options (both demand and supply-side) at the governorate and national level.
- Need to review the current action plan and investment plan based on the "Water for Life" strategy and other related initiatives to create comprehensive implementation and investment plans at both the central government and governorate levels that address the prioritized supply and demand solutions at the basin level and identify clear accountabilities and time horizons for implementation.
Key to the solution is the need for focus on agricultural water efficiency
Water withdrawals in 2009 were 548 mcm for agriculture and 309 mcm for domestic uses

- 12 **Accelerating water sector transformation in Jordan** **McKinsey** FINAL REPORT 20 October 2011 (210 pages) Overall water demand is expected to almost **double from 866 MCM supplied today to ~1,550 MCM by 2030**, mainly driven by strong growth in municipal water demand, new energy industries and extension of water-intensive mining industries

This report is the culmination of a 4 month project by the 2030 Water Resources Group for the Ministry of Water and Irrigation, Government of Jordan. This report is a synthesis of the findings of the project and should be read in conjunction with the detailed appendices (included at the end of the report) and the presentation shared with the Steering Committee and taken in the context of the several Steering Committee meetings, workshops and discussions held during the project.

This report has the goals of:

- 1) Elevating water as a national policy priority to an economy-wide problem
- 2) Rebalance focus on all elements of water enabled growth (supply and demand side; scarcity and access) with fact-based prioritization of solutions
- 3) Developing a new holistic approach to the solution with engagement of all stakeholders, including the private sector

Under current plans, Jordan will target doubling its GDP between 2009 and 2017 and reduce unemployment from 12.5% in 2004 to 6.8% by 2017. By 2030, this increase in economic activity and wealth will require a doubling of water demand to 1,550 MCM - 650 MCM more than current and funded supply. _ Total water needs will grow from 866 MCM today to ~ 1,550 MCM by 2030 driven by industrial demand growing from 36 MCM to 150 MCM (mainly from mining), today's negligible demand for energy generation growing to about 150 MCM, population pressure and higher consumption more than doubling allocation need from 320 MCM to 736 MCM and agricultural allocation remaining at current levels (about 510 MCM excluding unreported ground-water abstraction). _ Jordan's total sustainable water supply in 2009 was 708 MCM, with an additional 158 MCM from groundwater over-abstraction resulting in a total current supply of 866 MCM. If implemented as planned, the 325 km pipeline Disi-Amman conveyor would add 100 MCM of supply, As-Samra) the largest waste water treatment plant extension) would add 45 MCM, other new waste water treatment plants to deal with increased wastewater from newly connected customers would add 31 MCM and the Kufranja dam will add 5 MCM of supply, bringing Jordan's total accessible water supply to 889 MCM. _ Assuming that groundwater over-abstraction will have been stopped by 2020, as per MWI's current plans, by 2030, Jordan will require approximately 650 MCM more water than the currently financed sustainable supply. The Jordan Red Sea Project (JRSP), which will provide 930 MCM of desalinated water to Jordan by 2055 (370 MCM by 2025) to meet future water needs and refill the Dead Sea is critical to meeting this future need for water. At an estimated investment of JD 8-10 billion, JRSP is the most expensive water project globally in the last five years, and could be difficult to finance and substantially increase the future cost of water. Jordan's current water use efficiency and productivity, especially in agriculture and municipal use, provides opportunities for flexibility against the high future cost of supply. _ At 0.35 JD/m³, water in Jordan is already expensive by global standards. Future water supply is expected to be even more expensive, at an average of 0.9 JD/m³ across current and new sources in 2025 after the completion of the Phases I and II of the JRSP. Successful realization of planned non-water revenues (currently planned at ~40% of total revenues) and international grants could reduce the future cost of water but the marginal cost could remain > 1 JD/m³. In addition, the high investment need of JRSP (JD 8-10 billion) represents a significant financing challenge and risk to Jordan's debt and deficit targets in the National Agenda objectives. Opportunities for more efficient and productive water use could provide flexibility in reducing the magnitude and timing of JRSP's financial impact. _ Non-revenue water (NRW) in municipal areas is as high 43% on average increasing to 60% in some cases. At today's NRW levels, Jordan could lose 320 MCM of expensive municipal water by 2030 – an amount equal to today's total municipal water supply. Hence, NRW reduction has substantive potential to addressing the future allocation need and avoiding the high marginal cost of water. _ Agriculture uses 60% of today's water supply, but has low productivity. The Jordan Valley, where 167 MCM are used, has a large share of high productivity crops, including bananas, citrus fruits and dates, and has average productivity of 0.8 JD/M³. But in the Highlands, where 344 MCM are used, average productivity is 0.3 JD/M³, and irrigated olives, which represent roughly half of Highlands water demand, are on average a value destroying crop after removing subsidies.

Roadmap to success suggestions by McKinsey

- Increase the efficiency and productivity of water use as a priority
- Gain flexibility through economic choices in agriculture.
- Ensure water security through supply side efficient mega-projects

Agricultural growth projections

Only limited growth at 2% per annum is expected, based on the Ministry of Agriculture's current review of its agricultural strategy (Exhibit 3). This strategy plans for a 15-25% increase in crop production without increasing irrigation water allocated to agriculture. Growth would come from two main drivers: expansion of rain-fed areas, which is intended to account for the large majority 13 EXHIBIT 4 of the increased production; and increasing crop productivity on a per-hectare basis for both rain-fed and irrigated areas.

13 History of the Highlands Agric

James B. Fitch ARD paper 40 pages (Also see abstract 10)

While dryland agriculture – primarily the cultivation of barley and wheat – was important to the traditional way of life, it was only one of many activities upon which Bedouin survival depended. Livestock production was long a mainstay, but this had been undermined by decades of over-grazing, which reduced the productivity of the range for both grazing and occasional production of grains. The situation was made more difficult by a drought in the decade of 1969-1979 led to the loss of much of their herds and the abandonment of large parts of the traditional areas of pasture and the establishment of settlements. Many of the villages in the northeast

The government's initial attempts to introduce the Bedouins to irrigation farming entailed the development of government wells that supplied water to groups of small farms, through lined canals. An example of this was the Dulayl Project. According to Abu Jaber², these projects were not very successful. He described the farmers as being "very poor at farming" due to "lack of basic agricultural skills or dislike for the occupation." After five years, he reported, "there was ample evidence that farm units were neglected." Furthermore, while "...several hundred households were settled down... the cost involved in those developments was too high and it was doubtful that this investment represented the best available opportunity for those people. Settlers did not put available resources to optimum use and if current practices continue, it would not be at all surprising to find those farms returning to the desert."

So far, however, irrigation farming has not been abandoned to the desert. Due partly to the examples and experience that the government irrigation projects had provided, many private individuals subsequently applied for licenses to construct their own irrigation wells. Through the 1970s and 1980s, the government encouraged such well development. Initially, the Natural Resources Authority (NRA) was the licensing agency. Except for a few wells licensed near the end of their tenure, the NRA's licenses did not state any quantitative limitation on water abstraction. In 1984 WAJ assumed responsibility for all licensing of privately owned wells, including industrial wells. Licenses issued since then have included limits on abstraction, but these limits have not been enforced.

To obtain a well license, it is necessary to own land. Originally, the Bedouins were the recognized landowners of the area. Eventually, however, investors from other areas bought some of the land from the original owners. In some cases, the new landowner secured a license and developed a well, while in other instances the land was purchased together with a well that had already been developed. In contrast to the small 25 dunum farms that had been established in the government projects, the farms based on private wells often run several hundred dunums or more in size.

While the government eventually quit establishing new irrigation projects of the Dulayl type, it did continue with the development of roads, schools, domestic water supplies, and other infrastructure for the towns of the AZB, as it was doing in other parts of the Badia and rural Jordan. Due to such infrastructure improvements as well as to the development of farming and the availability of other job opportunities in the area, the Bedouin groups have gradually discontinued much of their traditional way of life. Most have now taken up residence in permanent houses rather than the tents that had been the basis for their former nomadic existence.

Due to well development, irrigated agriculture has become a base industry in the economy of the AZB. In 1999, for example, Mafraq and Zarqa governorates, which cover the area in the Amman-Zarqa Uplands,³ together accounted for 16% of Jordan's total tree crop area and 24% of its vegetables.⁴ Furthermore, as will be discussed in Chapter 4, it appears that Upland production areas account for a

² *Op. cit.*, pp. 100-114. Abu Jaber further reports that "traditionally, the Bedouin despised manual labor and vocations, though he might offer his services out in the wage labor market under severe economic pressures." p. 100

³

⁴

disproportionately high amount of Jordans' fruit and vegetable exports. Thus they are an important source of the country's foreign exchange earnings. Furthermore, as the analysis in Chapter 5 will demonstrate, agricultural production in the Basin is responsible for about 2,200 permanent jobs and 5,500 temporary jobs for agricultural workers.

By the early 1990s, based on studies of the natural recharge of the various AZB aquifers, the MWI and WAJ began to realize that there was not sufficient water to support the high levels of abstraction that had evolved in the Basin. It is now recognized that, as a result of high abstraction, the water table is declining and salinity is increasing. This poses threats to the long-term durability of the water supply. Very few new agricultural well licenses have been issued since 1992, but as explained above, total abstraction from those already licensed constitutes a serious concern.

What is to be done about the over-abstraction? Given the key role which agriculture plays in the national and AZB economies, abandoning agriculture entirely might not be wise. If some curtailment of agricultural use is in order, how much should this be? What would be the benefits and costs associated with reducing agriculture in the Basin? How might the reduction best be accomplished.

Present Cropping patterns

Olives are the major crop being grown in the area, accounting for 39% of the total irrigated crop area. Tomatoes (17% of the crop area) are the second most important crop.

Size and Types of Farm.

One of the most interesting factors disclosed by the survey is the relatively large size of the farms in the AZB uplands. As Figure 3.3 demonstrates, they average about 340 dunums of irrigated area, compared to only 25 dunums which is the size usually reported for irrigated farms in the Jordan Valley.

Ownership

The largest single category of owners were classified as "investors" (60 % of the farms), meaning those who did not originally come from the area but who have purchased land and wells – or who have constructed wells on lands they purchased – from area natives.

The fact that in 22% of the cases tenants, sharecroppers, or even hired laborers are in charge of the farm suggests that some farms may not be very effectively managed. In most instances where the owner is not the farm manager (50% of the cases, according to the survey), the owner does not live on the farm.

Crop Values

Using gross margins, the value varies from a high of 0.492 JD/m³ for sweet melon to a low of 0.047 JD/m³ for olives.

Water use fees. Water user fees represent an option to strict license enforcement. Such fees are a means of inducing farmers and others to use water more efficiently. Such fees would cause water users to recognize the fact that water is a scarce resource and to take this into account in their decision making. User fees constitute one type of *incentive system*.

Buy-out of wells In buying out the licenses, the government would be, in effect, compensating the owners for their investments. Viewed in another way, the buy-out could be seen as compensation for future income lost. In fact, analysis of the RA survey showed that almost 60% of the farms in the AZB upland have crop revenues which are less than their estimated variable costs, and the sales revenues of 73% are less than their total costs. In other words, *many farms are losing money*.

Recycled Water for Crops in Dulayl and Hashimiya

The cost of supplying pressurized recycled water to farmers in the Dulayl and Hashimiya area is estimated to be JF 0.380 per m³. This is less than the JD 0.424 per m³ value of water. This means that the value of the groundwater saved is greater than the cost of supplying the water.

14 Dissemination of agronomic guidelines in the Jordan Valley -Farmers' Training campaign--Progress Report - April,2009 Sameer Abdel-Jabbar Ahmad Sobh Commissioned by GTZ (49 pages)

The main recommendation of the guidelines is that farmers can save an enormous amount of money by adjusting amount and type fertilizer to the real needs of the plants. At the moment almost all farmers use two to four times more fertilizer than needed, as they do not consider the nutrient contents in the irrigation water and the soil. In addition, they usually apply more than the plant would need – to be on the safe side.

A second set of recommendations refer to the safe use and handling of reclaimed water while using and dealing with water (occupational health).Recommendations in the guidelines consider all this.

The campaign aims at training 1000 farmers in the project areas which extend from DA 28 in the south to DA 22 in the north to ensure at least 500 farmers implement the guidelines recommendations on their field by the end of the program phase. The total number of farm units in the project area is 3064. The total area of these farm units is 11565.6 hectare.

In future, agriculture will increasingly depend on marginal water sources such as reclaimed water as drinking water will be diverted for

Lack of any existing extension organization All the previous analysis of the existing extension organization revealed that despite MoA is mandated by all extension work in the Jordan Valley and rest of the country, their role in this regard still weak and ineffective and all efforts exerted to revive it fruited little as viewed by farmers and other donor organizations.

Illiteracy among farmers

High percentages of farmers are illiterate and got used to decades-old practices which are in favour of over-fertilization.

Irrigation water Results showed high contents of nutrients in water, enough to meet around 15% -40% of plant nutrition requirements.

Alternative strategies

Due to obstacles and weak JVA contributions in middle directorate, the project team started to look for other strategies.

Social and sport clubs and societies in the villages were addressed to take part in farmers's invitations and organizing training events. The response of these associations to the idea was good and showed high interest not only in inviting farmers but also to train some of their members on the use of fertigation excel sheets to be able to provide this service to other farmers when needed. It is worth to mention that some of these associations are equipped with computers and printers. In addition to this, they have good relations with farmers and some farmers are already members of these associations.

Key farmers were also invested in farmers' invitations and some training events were organized and hosted by them.

No trainings held during June, July and August because temperatures are extremely high and these months are not suitable for trainings. From October, 2007 till February, 2008 not more than 25% of training took places in theses months, the reasons for low number of trainings over this period are

- Weak JVA cooperation during this period was weak in terms of farmers invitations
- Exceptional frost spell

15 News Article in the Thursday Oct 13, 2011 Jordan Times

2012 state budget to support farmers union – Bakhit: Dailies cited the Prime Minister Marouf Bakhit on Wednesday October 13, 2011, as saying that the government will allocate financial support for the Jordanian Farmers Union (JFU) in the 2012 state budget. During a meeting with members of the JFU's board, attended by Minister of State and Minister of Agriculture Samir Habashneh, Bakhit said the government will study the possibility of reducing electricity prices for the agriculture sector and also work to lower the sales tax imposed on greenhouses. The premier stressed the need to revive the role of cooperative societies and the possibility of providing them with plots of land to invest in agriculture, particularly barley cultivation.

Tourism minister lauds the U.S. government support to Jordan's tourism sector through (USAID): Ad-Dustour daily reported on a meeting held between the Minister of Tourism and Antiquities Haifa Abu Ghazaleh and the U.S. Ambassador to Jordan Stuart Jones during which they discussed closer cooperation. The minister lauded the U.S. government support to Jordan's tourism sector through the U.S. Agency for International Development (USAID), and called on U.S. media to shed light on Jordan tourism sector, through highlighting the security and stability of the Kingdom.

Jordan shares ecotourism expertise with neighbors: Jordan Times daily reported that Jordan's successes in ecotourism and environmental sustainability has been replicated in Lebanon and Syria through a recently concluded project implemented by the Royal Society for the Conservation of Nature (RSCN). The Swiss Agency for Development and Cooperation, which funded the project, selected the RSCN to implement and oversee the project because of its experience in ecotourism and successful management of 8 nature reserves in Jordan.

16 Plantation Project of 30 Groasis at the Jordan University of Science & Technology (JUST) March 2011 Irbid Jordan



The Groasis waterboxx is an 'intelligent water battery' that produces and captures water FROM THE AIR through condensation and rain. The condensation is caused by artificial stimulation and the water is captured through physical capacities, without using energy.

The Groasis waterboxx makes it possible to plant trees, bushes or vegetables on rocks, on mountains, in gardens, in ashes of recently burned woods, eroded areas or deserts or any other place, without the help of irrigation with good planting result.

Proven technology

The Groasis waterboxx has been tested 4 years in the Sahara desert by the Mohammed I University of Oujda in Morocco, with convincing results. Trees that were planted during the Summer with the Groasis waterboxx survived well. The trees planted were measured and showed an average growth of more than 90% in length within one year. In 2010 over 15,000 boxes were planted in experiments in Ecuador, USA, France, Spain, Morocco, Mongolia, India and Kenya.

Science Awards

In November 2008 the Groasis waterboxx was rewarded the Dutch Bèta Dragons Science Award 2008. This competition is organized by the Platform Bèta Techniek in cooperation with the Dutch Ministry of Economic Affairs. In 2010 Popular Science, USA's biggest science magazine with over 3 million readers, rewarded from 117 break through inventions in 11 categories developed by mostly 'Fortune 500 companies', the Groasis waterboxx with the Green Tech Award in the Categorie 'Sustainable' and with the 'Best of What's New' award over all 11 categories.

Groasis Technology compared to drip-irrigation

The Groasis Technology is extremely (cost)-effective compared to irrigation. With the Groasis Technology there is a one-year investment cost. With drip-irrigation costs continue eternally. Here are the effects:

17 Groundwater governance in MENA: Taking stock and addressing the challenges (15 pages) The National Center for Agricultural Research and Extension, Jordan

Groundwater has been tapped by individual farmers, public companies, or investors/companies which have developed irrigated agriculture in formerly dry or desert areas. In many cases it is often the *sine qua non* of family farms, which rely on agriculture as their main or sole source of income (De Gooijer et al., 2009) and are threatened by overabstraction as well as sectoral competition.

To improve the groundwater management in the MENA region, innovations in governance are needed in the fields of social and institutional aspects, and public strategies. In Tunisia groundwater management strategies focused on different policies for water resources supply and demand (Al Atiri, 2007). In Jordan, Palestine and Egypt there has been an attempt to develop different local level water resources management scenarios to enable a more decentralized level through a regional partnership, empowers, with stakeholder involvement (Batchelor, 2008). In Yemen, projects have been conducted to improve groundwater management through a community based system, enabling a water user association to develop and better long term local groundwater management (Taher, 2008; Noaman, 2008). In Jordan decision-makers and researchers have worked extensively on identifying policy-options and assessing their relevance (Chebaane et al., 2005; Macoun and El Nasser, 1999).

The overarching goal of is therefore to contribute to finding solutions and mitigation measures to the groundwater crisis focussing on the crucial area of governance, and to pave the way for a larger and ambitious regional initiative across the MENA region that will build capacity through fostering informed dialogues between science and policy, and across countries. This proposed work will build upon the important insights produced by earlier USAID and IDRC projects in the MENA region, notably on water demand management and specifically targets policy-makers.

- 1) To establish a state-of-the-art knowledge base on groundwater management and governance problems and possible responses at the world level.
- 2) Characterization of past and current groundwater governance systems in Jordan, Tunisia, Oman and United Arab Emirates, and assessment of the policies options that have been envisaged, implemented, tested, and of their effectiveness.
- 3) An assessment of the strengths and weaknesses and differences between and within each governance system.
- 4) Investigate 4 problem-aquifers in different political economies and document the history of policies and interventions, as well as the opinions, perceptions, and strategies of the various stakeholders.
- 5) Development of suggestions for groundwater governance development and of a portfolio of context-specific possible options and traps to be avoided.
- 6) Capacity building of relevant decision-makers in the 4 countries and preparation for a wider regional initiative.

17 Background materials from the “Groundwater governance in MENA”:

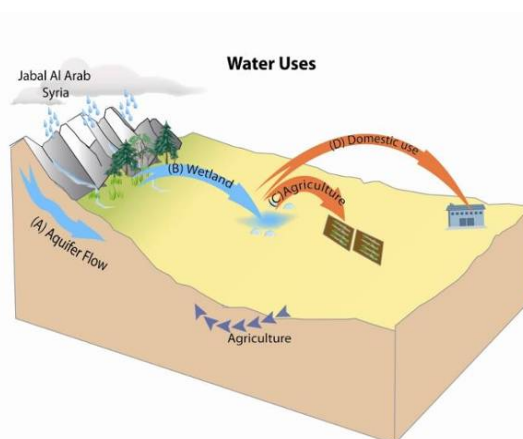
Jordan is among the countries with highest levels of water scarcity (140 m³/capita/year) (MWI, 2008). Twelve Jordanian groundwater basins have been identified as having a total renewable annual supply (“safe yield”) of about 280 MCM (MWI, 2001). Groundwater development was rapid in the 1980s and early 1990s, as successive Governments freely awarded licenses for tube-wells (MWI, 1998). Over-abstraction is evident in six of twelve Jordanian basins where the safe yields have been exceeded by more than 200 percent in some cases (Margane, 2004). Over-exploitation is paralleled with deterioration of water quality and soil salinization, that may lead to soil sterility and desertification owing to abandonment of farms (El-Naqa and Al-Shayeb, 2009; Venot and Molle, 2008).

The Azraq Basin is one of the most important groundwater basins in Jordan. It is located in the Northeastern part of the country, 120 km from Amman and contains in its middle a unique wetland ecosystem endowed with a wealth of biodiversity and habitats.

The intensive pumping carried out through the last 20 years in the Azraq basin has caused a lowering of the basin's water table, and the drying up in 1993 of the four natural springs in the middle of the Azraq oasis that discharged fresh good quality water for thousands of years, spurring wildfires across the increasingly dry environment. The lowering water table of the basin, in turn, has encouraged deeper excavation of wells that once provided large outputs of water for irrigation, which contributed to lowering and degrading the water table and its quality even further.

The Azraq basin is now the second most overexploited aquifer in the country, with abstraction exceeding the safe yield by 260%. Severe impacts on the environment and on farming itself have been observed. The overexploitation of the aquifer for both urban needs and irrigation resulted in an environmental catastrophe for the wetland ecosystem, abandon of unproductive lands, trebling of the salt content of the aquifer, declining land productivity and rangelands, and reduced tourism potential.

Several projects and initiatives (involving Jordanian institutions and USAID, GTZ, IUCN, etc) have addressed the Azraq tragedy and produced successive pieces of knowledge. Recently, a Highland Water Forum has been established to tests deliberative approaches in the resolution or alleviation of the problem. This case study will be a fertile ground for stock-taking and subsequent case-studies and policy dialogue.



18) Farming in the Desert Analysis of the Agriculture situation in the Azraq Basin (GIZ 2010) (80 pages) This article (Booklet) has many excellent suggestions/techniques/plants etc. for water efficiency listed on pgs. 55 to 63. (These pages area a read me first in next steps)

The absence of a specific policy that mitigates agricultural expansion and land exploitation has led to a dangerous spread of agricultural investments and a sharp increase in groundwater exploitation over the past three decades.

The total abstraction from the basin almost tripled in 20 years: have increased from 21.6 MCM/yr. in 1983 to 58.5 MCM/yr. in 2004. This over-exploitation led to a drop in the water table by 0.3 to 0.8 meter per year, (some wells are reported to have dropped by 20 meters), increasing water quality problems due to dramatic salination of the aquifer or pollution, and to the drying up of the wetlands. MWI estimates that the recharge in the Azraq basin is 24MCM per year. 18 MCM of this is underground recharge from rainfall on Syria. In the 1960s and 1970s well drilling techniques improved, energy to pump water was cheap and the land was basically disease free, causing a boom in agriculture production. Most of that investment was from private sources as the government made most of its investments in the Jordan Valley. In the 1970s most of the growth was from olive orchards, irrigated with traditional wells. In the 1980s large farms were developed with drilled wells. Much of this expansion was in response to King Hussein's request to make the desert green. In the 1990s the growth was based on cheap land and free water. As a consequence the Oasis completely dried out in 1993. Typically 2/3 of the farm was planted in trees (Olive, grapes, pomegranate, and stone fruit) and the remainder in vegetables. With subsidies for energy and field crops, profit margins were guaranteed. Today, the problem of groundwater overdraft remains with over abstraction reaching 215% of the safe limit. Illegal abstraction from the Azraq basin, which is the abstraction from wells that are registered as - illegal wells -, amounts to 13 MCM/y. The situation in North Badia is completely different as 90% of the farms have their wells registered.

Based on the interviews with farmers, it can be said that most farmers are not aware of groundwater depletion, or at least not relating the problems they are facing to the excessive use of water in agriculture. 35% of farmers consider there is absolutely no problem. Despite the groundwater Control By Law No. 85 (2002) and its amendments about taxation of water used for agriculture, the legal instrument seems to be ineffective. Indeed, as long as no clearly defined procedures and means are deployed on the field to enforce the rules, the law does not offer sufficient control over water abstraction. Water fees seem to play no role in the cost calculations of the farmers. Generally, as groundwater is still easily accessible in Azraq area (around 35 m deep), most farmers consider the water resource abundant ("it is like a sea down there" as some farmers mentioned, meaning the groundwater) and attribute the drying up of the Azraq wetland to the over abstraction of drinking water to Amman. They consider that the "special case for Azraq" (the clause in bylaw 85 that specifies a price for private agricultural wells within Azraq) in the water bylaw is unfair, and most refuse to pay their water bill: 12 out of the 36 surveyed farms have not paid their bills, most of which are large, recent farms. 5 farms did not provide information about their water bills, as the persons met during the interviews were the managers of the farms. The share of energy costs out of the total production costs is always higher than that of water: 9 to 22% of total production costs are to be charged to energy for farms connected to electricity, and from 40 up to 82% for farms using diesel. For most of the farms, water costs are less than 10% of the total production cost, whereas energy represents on average 20 to 50% of the total production costs. Mixed family farms of vegetables and trees are large water consumers, consuming 68% of the total abstracted water while covering 58% of the irrigated agricultural area. In comparison, large olive tree farms achieve more water savings; using 12% of the abstracted water while covering 25% of the area. Overall the irrigation efficiency is very low at about 63% of the potential.

19 List of Planned ICARDA tasks to improve the Watershed in the BADIA (1 page)

<p>1.1 Develop and implement a strategic plan for each watershed.</p> <p>1.2 Develop working partnerships for improved Institutional collaboration between NARES, CGIAR Centers and Agricultural Universities within region and US Universities.</p> <p>1.3 Strengthen NARES and create links between national and provincial agricultural research and extension organizations, extension workers and farmers and farm women to disseminate HV water efficient technologies and land use management practices and provide technical support.</p> <p>1.4 Facilitate reorientation of existing national extension systems to decentralized, participatory, market driven extension approach.</p> <p>1.5 Validated policy recommendations extended to national and provincial governments regarding integration with recommended technologies and management practices being disseminated at farm, community and watershed level.</p> <p>1.6 Policy analysis and support provided to key institutions in the seven participating countries by IFPRI, IWMI and U.S. universities.</p>
<p>2.1 Data collecting, processing and analysis</p> <p>2.2 Baseline development</p> <p>2.3 Benchmark development considering various policy and technology options</p> <p>2.4 Uncertainty and risk analysis</p> <p>2.5 Scenario testing capability and decision-support made available at the watershed level</p> <p>2.6 Interface development and stakeholder participation</p> <p>2.7 Decision-support system implementation</p>
<p>3.1 Identify short-term training and post-graduate education needs for each benchmark watershed.</p> <p>3.2 Tender out the development of distance learning/e-learning modules in core compulsory and agro-ecological based modules to regional and U.S. University partners.</p> <p>3.3 Develop the infrastructure and capacity of regional universities and ICARDA to accommodate the e-learning.</p> <p>3.4 Train the Benchmark Technical Training Teams:</p> <p>3.5 Carry out targeted short-term training for national research and extension staff and farm and community leaders.</p> <p>3.6 Enroll and commence relevant post-graduate degree programs for national research and extension staff engineers, managers and relevant universities.</p> <p>3.7 Develop a knowledge management plan.</p> <p>3.8 Hold regional, national and local conferences, workshops and knowledge exchange forums between all trained participants at all levels to build strategy and ensure efficient utilization of trained staff knowledge and skills.</p>
<p>5.2 Introduce identified and tested water-use management technologies for immediate dissemination and use by farmers.</p> <p>5.3 Develop a scaling-up strategy for each integrated benchmark site.</p> <p>5.4 Ensure dissemination of methods alongside enhanced livelihood possibilities of crop/livestock technologies to encourage adoption.</p> <p>5.5 Increase the capacity of local communities to manage water resource allocation and use through the formulation of WUAs.</p> <p>5.6 Empirically document that water and land use management in the target watersheds has been improved.</p>
<p>5.1 Develop a Strategic Research and Extension Plan for target areas in each benchmark watershed.</p> <p>5.2 Identify constraints to implementing identified crop/livestock technologies and market development.</p> <p>5.3 Organize farmers and farm women interested in producing and marketing water efficient crops/products into Farmer Interest Groups or Producer Groups to collectively increase farm household income and improve ecosystem sustainability.</p> <p>5.4 Test, refine, adapt and disseminate water efficient crop or livestock strategies to farm households through on-farm trials and demonstrations.</p> <p>5.5 Conduct exposure visits for FIGs and FAs.</p> <p>5.6 Facilitate contracts and agreements between FIGs and buyers.</p> <p>5.7 Conduct targeted training for producer groups.</p> <p>5.8 Facilitate inputs in the inception phase.</p> <p>5.9 Produce crop or product to specification.</p> <p>5.10 Harvest, handle and deliver crop/product.</p> <p>5.11 Empirically document that rural livelihoods in the target watersheds have been improved.</p>

20) AgriBusiness Study by Amy D'Angelo, Independent Consultant for the USAID EAT Project David Quinn, Policy Specialist, USAID EAT Project (January 2012) There are two Agbee papers which look at constraints to expanding agriculture in Jordan.

This memorandum contains a summary of the major constraints within the business enabling environment for agriculture in Jordan through the lens of three overarching themes that impede agricultural sector growth. The data contained herein was gathered during through a literature review and targeted stakeholder interviews across a wide range of private agribusinesses, NGOs, government officials and donor representatives from November 14 – December 7, 2011.

The two main farming areas, the Jordan Valley and the Highlands, have very different characteristics and dynamics. The Jordan Valley, along the western border of the country, sits at 100 to 400 meters below sea level and serves as a natural greenhouse, making it ideally situated for meeting the market needs of Europe in winter. Originally a predominantly tribal area with a few large landowners, the valley was developed in the 1960s through government appropriation and redistribution of the land into small farms of 3-5 hectares in size.⁵ Most farms are connected to an irrigation system controlled by the Jordan Valley Authority. By contrast, farms in the Highlands rely on rainfall and private wells. Farms are generally much larger (10s or even 100s of hectares), and the population is a combination of former Bedouins, rich absentee landowners and “hobby farmers.”⁶ Some of the Bedouin families have retained some portion of their herds and engage in a mix of farming and livestock. Rich investors from Amman have established large plantations that grow high-value crops such as a bananas and citrus. The Jordan Valley consists of 300,000 du and makes up 40-50% of the production (by volume); the Highlands are larger and make up 50-60% (by volume).⁷

In general, the agricultural sector benefits from favorable government policies and faces few legal and regulatory constraints to economic growth. Registration and licensing are reported to be straightforward and efficient, labor is readily available, inputs are easily accessible, and agriculture receives very favorable tax treatment, with many producers paying little to no taxes. Nonetheless, agriculture in Jordan suffers from three main issues that prevent the sector from achieving its full potential. First, water scarcity constrains production in the Jordan Valley and threatens the sustainability of agriculture in the Highlands. Second, smallholders lack the opportunities and incentives to move beyond a basic marketing chain, which limits export opportunities and suppresses prices in local markets. Third, the government’s approach to the agricultural sector prioritizes rural poverty and food security concerns over economic growth. The JVA allocates a certain amount of water to each farm (or group of farms), based on the amount of land and type of crop grown. However, the amount the JVA provides only meets 50-70% of the scientifically-recognized crop requirements. This shortfall forces many farmers to leave 30% or more of their land uncultivated. According to stakeholders, instituting more sophisticated irrigation methods would allow farmers to plant more of their land using the same water allocation. However, many farmers do not have the money to invest in better irrigation technology, nor the inclination to do so for a small farm of only 3 hectares

The majority of farmers in Jordan have poor post-harvest practices, poor market linkages and limited marketing facilities, which limits their opportunities and incentives to move beyond a basic marketing chain. In general, fruits and vegetables are harvested and packed without sorting, grading or weighting into various types of containers. In short, there are opportunities for agricultural-led economic growth in Jordan but trade-offs do exist. For example, absent effective government enforcement of water policies, encouraging agricultural development in the Highlands would likely be directly in conflict with water conservation goals. By contrast, facilitating the implementation of quality standards in local markets could decrease poverty among smallholders and increase employment in satellite industries such as packaging, grading and transportation. Further research should be conducted to quantify these trade-offs and determine which efforts are most likely both to promote the development of agribusiness in Jordan and to support the social and environmental goals of USAID/Jordan.

21 Badia Ecosystem and Livelihoods Project (BELP) October 2011 (18 pages)

The Jordan Badia Ecosystem and Livelihoods Project is one of four projects under the regional MENA Desert Ecosystems and Livelihoods Program (MENA-DELP), currently under development as a GEF and World Bank partnership. The goal of the program is to capture and harness the value of desert ecosystems in order to optimize the flow of goods and services for environmentally and socially sound development of deserts. GEF financing leveraged through the MENA-DELP will enable countries in the region who have already expressed their interest to operationalize their existing or planned investments in desert ecosystems. The focus of these projects will be on different production sectors, from eco-tourism to agriculture to livestock management, and on improving the sustainability of these investments through an integrated ecosystem management approach. Emphasis will also be placed on participatory approaches, capacity building and on harnessing valuable local knowledge. This initial group of countries will also serve as an example in terms of promoting the MENA-DELP framework as incentive for other countries in the region with no existing or planned investments in the desert biome to develop these as a national priority in subsequent phases.

The proposed Project Development Objective (PDO) is to *sustain livelihoods by enhancing ecosystem services in three poverty pockets of the Jordan Badia* during the years 2012-2016 . The PDO will be measured against the following proposed PDO-Level Indicators:

- Number of new sustainable eco-tourism related jobs along the Al Azraq/Shaumari-Burqu' corridor
- Acreage of rangelands managed by communities in a sustainable manner in Al Jafr and Al Husseinieh
- Number of men and women benefitting from project capacity building in Ar Ruwaished, Al Jafr and Al Husseinieh poverty pockets

Under component 1 (Ar Ruwaished poverty pocket), the project will expand eco-tourism into the northeast Badia by using the (Royal Society for the Conservation of Nature) RSCN-managed Al Azraq and Shaumari reserves and attached facilities as a starting point, from which a 250 km eco-tourism corridor will be developed. The corridor will be developed around a concept of “*low volume, high value*” community-centered eco-tourism.

Under component 2 (Al Husseinieh and Al Jafr poverty pockets), the project will support the development of a more sustainable natural resource base for local communities through the establishment of water harvesting mechanisms, establishment and management of two rangeland reserves managed by the communities, and capacity building for livelihood support and maintenance.

Under component 3, an effective Project Management Unit (PMU), capable of directing and supporting project implementation will be established in the National Center for Agriculture Research and Extension (NCARE – the project Implementing Agency).

22) A REVIEW OF WATER POLICIES IN JORDAN AND RECOMMENDATIONS FOR STRATEGIC PRIORITIES (DAI STUDY SUBMITTED APRIL 2012) 118 PAGES

During the past 20 years Jordan's public and private sector has engaged in extensive well-drilling and over-pumping of groundwater that is far beyond natural recharge capacity. This over pumping has reduced the natural base flows into the side-wadis and natural springs along the rift causing significant economic and environmental harm. Programs in rain-water harvesting in rural and urban settings have been limited in geographic scope and have had negligible total impact on surface water capture for domestic use or groundwater aquifer recharge.

Groundwater over-abstraction in the Highlands is unsustainable and will terminate at different rates in the 11 over-exploited groundwater basins as supply is exhausted, saline water is encountered, or pumping costs exceed financially supportable levels on private farms. While USGS modeling shows that over-extraction at current rates can continue for up to 30 years in some well fields, extraction costs and water quality issues may lead to earlier closure in others. A groundwater extraction by-law in 2002 began imposing abstraction tariffs and requiring well registration and monitoring, but has not slowed extraction rates. External factors such as market competition and increasing energy costs appear to be pushing Highlands agricultural users towards adoption of higher efficiency irrigation methods, but this trend seems to be offset by the use of groundwater to increase the value of land for speculative real estate investment, notably in the planting of low-value olive trees.

Tariff increases, shifting to higher value crops and more efficient production technologies, and administrative closures will be needed to reduce over-abstraction of groundwater and shift its allocation towards domestic and industrial use.

By the year 2015 treated wastewater is expected to increase by an additional 76 MCM/year bringing the total wastewater available for reuse to about 180 MCM/year, most of which would be used to irrigate food crops, fruits and vegetables, and tree crops, with a small allocation to support forage and fodder production for livestock.

Recommendations

USAID should work with public and private sector stakeholders to design and pilot a Highlands Strategic Groundwater Reserve Program to lay out a government and donor coordination roadmap of communication, technical, administrative, and financial steps to reduce extraction rates.

Highlands renewable aquifer conservation requires steady strategic investment to shift users from current unsustainable over-abstraction rates. USAID should support the design and piloting of a Highlands Strategic Groundwater Reserve Program that could incorporate the following elements. The design of a communications program and lobbying effort with registered and unregistered well users should be done to raise their awareness of over-extraction issues and strategies to reduce over-extraction. This design should be accompanied by a realistic, time-phased effort to reduce extraction rates, improve energy efficiency to maintain profitability, and increase revenues from adjustment of extraction tariffs. It is important to sort properties by their financial and economic performance in water use. Expertise could be obtained from the WAJ WDM –Water Demand Management- Unit, the Highlands Water Forum, USAID's IDARA project, and Utah State University studies. Zero- or negative-return properties wells would become candidates for closure against compensation for land value or water rights. USAID might design and seed a fund to support alternate use financing (e.g. solar farms) for land or a straight single payment or Trust Fund annual payments for water rights, if a water rights market can be established. On wells where returns were profitable USAID could examine the supply of seed capital for loans or loan guarantees to structure crop conversion and production intensification (e.g., high density tree production, plastic greenhouses, and semi-hydroponic controlled atmosphere greenhouses at the high end). Finally, using the existing groundwater abstraction bylaw, USAID should continue to push for progressively increasing groundwater extraction surcharges and suppressing illegal and abusive extraction as a Condition Precedent for the Cash Transfer program. .

23 Water For Life (Jordan Water Strategy 2008- 2022)

"Our Water situation forms a strategic challenge that cannot be ignored. We have to balance between drinking water needs and industrial and irrigation water requirements. Drinking water remains the most essential and the highest priority issue ". **H.M. King Abdullah II November 7, 1999 70 pages**
Jordan's vision for a water strategy is one whereby 2022, we have:

Goals for Water Demand by 2022

1. Irrigated agriculture in the highlands will need to be capped and regulated and the by-laws will need to be reinforced.
2. Appropriate water tariffs and incentives will be introduced in order to promote water efficiency in irrigation and higher economic returns for irrigated agricultural products
3. Jordanians are well aware of water scarcity and the importance of conserving and protecting our limited water resources.
4. Viable options to reduce water demand within each sector are readily available.
5. Water tariffs within and outside the water sector should support water demand management.
6. Non-revenue water to be 25% by 2022.

We will create awareness among the Jordanian public and decision makers as it is the first step towards behavior change and lays the foundation for policy change.

For example, if a high percentage of the population knew that 64% of all water goes to agriculture, but contributes little to the country's economic growth, an increase in irrigation tariffs would receive more public support. The true value of water is not properly understood in Jordan, nor is the cost of water delivery, or the costs and benefits of alternative approaches to water management. Once a robust foundation of knowledge is created among all concerned parties, the challenges will be easier to manage and will be more likely to encourage prompt action.

We will target audiences to include public and private sectors and the general public. The private sector includes farmers, industry leaders, small and medium sized businesses, associations, chambers and non-government organizations

We will work with the Ministry of Education to introduce Water Awareness programs in the form of events and curricula at all school grades. (Goal #2)

Jordan must improve its policy to equitably allocate transferable surface and groundwater rights to farmers to permit intra- and inter-sectoral transfers of water. Jordan Valley farmers would know in advance their allocation for the crop season and plan accordingly, subject to contingency provisions for unanticipated drought. Farmers could sell part or all of their surplus annual water right to other farmers. **We could buy highland groundwater rights at market prices to reduce withdrawals from aquifers under stress.**

Jordan must develop policy to provide incentives for farmers to grade agricultural produce by quality, sort by size and conformity, and practice proper post-harvest handling and transport, thereby increasing product quality and lengthening shelf life. This allow farmers to focus on high-quality crops and **will bring increases in profit thus enabling farmers to upgrade technology and better afford increased water tariffs that more truly represent the value of water consumed.**

Jordan must remove tariffs on imported crops to promote transition to crops with

Page II Water for Life (Jordan Water Strategy 2008- 2022)

higher economic returns per unit of water used. For instance, growing bananas is a commonly cited but not unique example of an egregious waste of water to produce a crop that can be imported significantly cheaper than it can be produced in Jordan. Jordan can no longer afford such uneconomical use of scarce water supplies. (Goal #4)

Jordan must encourage groundwater basin water users associations. **We will invite these associations to participate with the government in setting and implementing protection zones of surface and groundwater.** Practice has shown that local communities are in the best position to decide on the appropriate use of public goods. Jordan must stop unsustainable extraction of groundwater in order to prevent permanent economic and environmental harm. Jordan's groundwater by-law 85 was created to protect and monitor the country's precious groundwater resources. Under this by-law, we have certain responsibility to collect fees for legal wells. Yet fees from the majority of wells used for agriculture purposes are not collected. Without fees coming back into the sector from users, we will be subsidizing water in perpetuity. In addition, hundreds of illegal wells pump water daily in Jordan, which stresses the country's aquifers. The by-law also requires the government to establish appropriate pumping reduction plans for aquifers under stress; currently 10 out of Jordan's 12 groundwater basins are showing a deficit, the other two are close to their limit, and the situation will only get worse. **We will establish and implement Groundwater Management Plans in order to begin to slow this dramatic decline in groundwater.**

Jordan will implement regulations (incentive structures) to encourage rainwater harvesting. (Goal #3)

We will modify policy and regulation to facilitate water allocation among users in Jordan by considering return per cubic meter used while ensuring satisfaction of basic domestic water need. This action will provide higher returns per cubic meter of water used, will increase ability to pay tariffs, reduce stress on the GOJ budget caused by high water subsidies. **(Goal #1)**

Jordan will continue expanding the use of treated wastewater, which shows great potential for agriculture, industry, and urban landscapes. Treated wastewater should go to the use that demonstrates the highest social and economic return and can reduce the demand for fresh water and reduce ultimate disposal costs. Where economically practical, treated wastewater can be used to replenish aquifers. Public education of using treated wastewater for possible aquifer recharge must begin now.

We will revise Groundwater by-law 85/2002 to introduce stringent controls on the use of groundwater including the abolition of the free abstraction and limiting the abstraction quantity based on the aquifer safe yield. Enforcement measures against illegal use, abuse and deteriorating groundwater conditions shall be introduced. **(Goal #1)**

Irrigation Water Conservation

- 1. We will enhance on-farm irrigation efficiency in order to maximize the agriculture output of a unit of land area per unit flow of irrigation water.**
- 2. Irrigated agriculture in the highlands will need to be capped and regulated and the by-laws will need to be reinforced. . (Goal #1)**
- 3. Appropriate water tariffs and incentives will be introduced in order to**

promote water efficiency in irrigation and higher economic returns for irrigated agricultural products

Irrigation Water Resources

- 4. We will promote the use of rainfall harvesting methods for use in irrigation. (Goal #6)**
- 5. We will use all treated wastewater for irrigation whenever safely possible while ensuring that health standards for farm workers as well as consumers are reinforced. (Goal #3)**
- 6. We will limit the use of brackish water in irrigation in order to minimize soil salinity and conserve brackish water for other uses. (Goal #2)**
- 7. We will reduce evaporation losses and pollution by conveying water through closed pipes networks and minimize energy costs through gravity flow systems. Supplementary pumping shall be used where needed. (Goal #2)**

Irrigation Water Management

- 8. Under the new structural reform, we will have one organization responsible for bulk water supply in the Jordan Valley.** Farmers associations will be formed and empowered to handle retail water. For this purpose appropriate legislation will be introduced.
- 9. For private farmers in the highlands, who abstract water from the groundwater through licensed permits, we will establish a strict monitoring system and reinforce it rigorously in order to prevent illegal and/or over-exploitation of water wells. (Goal #4)**
- 10. We will review, amend and reinforce rigorously by-law 85/2002. (Goal #4)**
- 11. We will more clearly define, impart, and monitor training needs in order to improve the efficiency of bulk irrigation operations, forecasts and scheduling of irrigation services. (Goal #4)**
- 12. Over time, we will redefine the role of the new institution responsible for irrigation in the Jordan Valley to focus on regulation and supervision of services. Involvement of stakeholders and the private sector in irrigation management shall be introduced and gradually promoted.** Care will be taken to monitor and supervise the use and distribution of water resources in that regard. (Goal #4)
- 13. We will meter irrigation water at strategic locations. Digital meters shall be installed for volumetric measurement of in-flowing water. (Goal #2)**
- 14. We will gradually phase-out of the business of irrigation water distribution.** The retail function shall be privatized through water users associations. Adequate tariffs and incentive systems will be developed and introduced (Goal #5)
- 15. We will monitor abstraction from all groundwater wells periodically to assure conformity with the provisions of the abstraction permits. (Goal #4)**
- 16. We shall strictly follow and implement Bylaw 85/2002 to close down any water wells which extract water from a deteriorating and depleted aquifer. (Goal #1)**
- 17. We shall implement the bylaw to close down all illegal water (Goal #1)**

On Regulation and Controls

- 18. We will discourage planting crops with high water requirements through the use of market pressures by imposing higher water tariffs on irrigated agriculture. (Goal #5)**
- 19. We will control planting of perennial crops through permits. This should be linked to water balance and stress. (Goal #5)**

On Irrigation Efficiency

20. We shall encourage the private sector to increase irrigation efficiency in the highlands by introducing appropriate water tariffs and incentive systems (Goal #5)

21. **We shall encourage automation of irrigation networks.** Electronic surveillance and monitoring of irrigation networks shall be employed to reduce losses through leakage and breaks.

22. **We will implement periodic preventive maintenance of pumps, motors and valves. Human resources for proper maintenance management shall be in place and properly trained. (Goal #4)**

We will encourage farmers to use modern and efficient irrigation technologies. Protection of on-farm workers and of crops against pollution from treated wastewater shall be ensured. (Goal #6)

Specific Goals for Jordan by 2022

Treated wastewater will be used for the activity that provides the highest social and economic return and standards for use in agriculture will be introduced and reinforced.

2. Desalination projects at the Red Sea are operational

3. Rainwater harvesting is encouraged and promoted.

4. Infrastructure for desalination of sea and brackish water is sufficient.

5. An alternative energy source to keep the cost of desalination as low as possible is available

Agenda to meet the above Goals by 2022

1, Irrigated agriculture in the highlands will need to be capped and regulated and the by-laws will need to be reinforced.

2. Appropriate water tariffs and incentives will be introduced in order to promote water efficiency in irrigation and higher economic returns for irrigated agricultural products

3. Jordanians are well aware of water scarcity and the importance of conserving and protecting our limited water resources.

4. Viable options to reduce water demand within each sector are readily available.

5. Water tariffs within and outside the water sector should support water demand management.

6. Non-revenue water to be 25% by 2022.

Other Suggestions for Agric.

Gov. could buy highland groundwater rights at market prices to reduce withdrawals from aquifers under stress.

Will bring increases in profit thus enabling farmers to upgrade technology and better afford increased water tariffs that more truly represent the value of water consumed.



Middle East Water and Livelihoods Initiative (WLI)

Improving Rural Livelihoods through Sustainable Water and Land-use Management in the Middle East: Egypt, Iraq, Jordan, Lebanon, Palestine, Syria & Yemen



24

WLI/ICARDA has technology test sites in Jordan and is actively support agriculture through its Water Livelihoods program. The program is ongoing.

Priority research issues for WLI:

1. Immediate income generating options
2. Integrated water harvesting and soil productivity
3. Alternative grazing and feeding systems for livestock/crop production

Work plan for 2011:

Activity 1: Assess potential income generating activities for target communities in the Badia.

Activity 1.1: Conduct community meetings to identify potential income generating activities

Activity 1. 2: Introduce income generating options in the communities

Bio-physical component:

Activity 1: Model water flow, level, run-off & sediments

Activity 2: Select a new demonstration site for implementing water harvesting technique, and disseminate findings

Expected Program Outcomes

- Potential income generating activities identified
- Income generating options introduced in the communities
- Implications of water harvesting, interventions on bio-physical processes and socioeconomic conditions evaluated

Following is a consultant's comments and observations with closing opinion comments

'Olive trees in the Azraq region are a very inefficient use of water'. You can find this information in our document related to Agriculture in the Highlands. The yield of olive trees is lower in the Azraq region than in the North of the Highlands. The inefficiency of this crop in this area is even mentioned in the McKinsey report, i think.

The fact that olive trees are planted to establish property rights isn't in any report but we know it through our interviews with stakeholders groups from the region. The problem in Azraq is in essence a matter of land tenure and the number of illegal wells. To understand the agricultural situation in Azraq, it is important to know the land tenure issue:

The Law Nr. 20 of 1973 recognizes the State as the owner of rangelands and it gave the authority of managing this land to the Ministry of Agriculture. The vast area of the Badia land belonged to the State and was treated as rangelands, whereas Bedouins consider land as a private property, based on tribal claims and proprietorship under a legal title of land that has been given to them by the State since 1940 (Source: Dr. Salem Al-Oun, Land Tenure and Tribal Identity in the Badia of Jordan: Reality and Projections", 2005, Al Al-Bayt University).

Land ownership can be categorized as the following:

1. Private land called Miri and Mulk, owned by individuals.
2. Tribal land (Wajehat El Ashayeria) claimed by the tribes and historically distributed by the Sheikhs.
3. State land (free access to all resources) owned by the State and at the same time claimed by tribes, although it is not divided among the tribe members.

There is a misunderstanding by both parties (government and people) as to which land is state land and which land is tribal land. Bedouins distinguish between two kinds of lands: the tenure which is tribal land belonging to one tribe and respected by other tribes (nobody other than the 'owning' tribe has the right to use, cultivate or own it) and private land which is registered and documented for individuals.

Since 1970, many rangelands in Jordan have been moved from State ownership to Bedouin ownership based on the argument of Bedouin settlements. Government policy has been motivated by the conception that giving away land might encourage Bedouins to settle. Other forces have contributed to this phenomenon such as that most Government cabinets were driven by political and social forces and tried to avoid conflicts with Bedouins. Most of the time, giving away land was considered a reward for some tribal key figures. Settlement became a tool to gain the right to own land by law and then it was sold to non Bedouins or non-settlers. Originally, urban settlers found an opportunity to own private farms at affordable prices, irrigated with quality water that cannot be found to this extent anywhere else. In Azraq, the

cost of digging wells and of extracting water is in fact much cheaper than in other areas of Jordan where in 2007, the average energy cost per extracted cubic meter was 0.060 JD compared to 0.150 JD in Mafraq (Ansgar, 2007). Investors' financial capabilities were well above those of the poor Bedouins, whose economic hardship forced the majority of them to sell land for cheap prices. Agriculture, particularly the hardy olive trees, was the cheapest proof of investment in the land, therefore the number of farms, hence the number of wells, mushroomed.

Currently, the Department of Land and Survey is in charge of the registration of land in someone's name:

- In most Arab countries, there is a law called "Wa'd el Jad" that states that Bedouins have the right to informally/inofficially sell tribe-owned land. It so happens that individuals and tribes claim certain lands as theirs simply by delineating them. Tribes claimed hundreds (if not thousands) of Dunums in Azraq, and the Sheikhs of these tribes in their turn, sell this "tribe-acquired" land according to wa'd el jad by means of an informal piece of paper. Of course, land acquisition by 'Wa'd el Jad' is not recognized. It is considered as an illegal acquisition of land.
- Concerning land acquisition of Treasury Land (state-owned land):
 1. If the farmer has already established his farm, he has to go to the Government (DLS- Department of Land and Survey, which depends on the Ministry of Finance) to contract with him:
 - Farmer informs DLS about the fact that the land is now under agricultural use,
 - DLS surveys the quality and intensity of his farming activities with the help of the MoA department present in that area. The role of DLS is to check if there is any legal claim to this land.
 - In case this farm is profitable and older than 15 years, a Committee established by the MoA gives its permission and sends the report to DLS.
 - In case of an agreement on the legalization of this land, the only constraint is that the same land can't be sold for the next 10 years in order to avoid the trade of treasury land.
 2. If the farmer wants to establish a farm, he has also to go to the DLS to contract with him:
 - Farmer informs DLS about the fact that he wants to make an investment on governmental land,
 - DLS forms a committee to check if there are any claims to that land,
 - In case the committee grants the applicant the approval to invest on the land, a contract of one year can be signed, renewable and negotiable each year. Generally the legalization of that land comes after 5 years. I think the criteria are based on economical and social reasons but this has to be checked.
 3. For the renting processes, the renting contracts are organized by the Land Registration Directorates.

I don't know if this helps you. Basically, the idea is even in case of an illegal acquisition, if the illegal owner can prove a form of investment, the official acquisition of this land can be obtained. In the Badia, the cheapest proof of investment remains agriculture. Actually, this same idea is picked up in the Groundwater By-Law. There it says that extraction from non-licensed operating wells must stop, except: "in case there are economic or social reasons justifying the continuity of extracting water from the said wells [..], allow the extractions of water from the said wells...". So actually it doesn't matter if it is State Land or Tribal Land, as long as somebody can prove profitable investment.

We shouldn't forget that 'everybody is a farmer' in this country and the main objective governing many sectors is to keep this country stable and to avoid any trouble. We are confronted with the resistance of a traditional society versus that of a modern one. To tackle this issue in Azraq and in the Badia, it is to 'attack' the Jordanian tribal system. I think the most important point from which to tackle this issue is water. Farmers need to freeze the growth of planted areas (this process needs to be monitored and controlled). Clear criteria need to be established for the investment on land (based for example on profitability, initial investment, social reasons, etc). The legalization of land needs to be more transparent and fair.

26 MIDDLE EAST AND NORTH AFRICA WATER CENTER NETWORK (MENA WCN) ASSESSMENT AND DESIGN: ANNEXES

SEPTEMBER 2010

(123 pages)

This paper is an excellent treatise on the strengths and weaknesses of agriculture and water related organizations in Jordan. Pages 111 through 120 provide an insight into the Development partners, NGOs, Universities and other resources in Jordan.

Each organization is reviewed and a history and description of programs is provided.

Below the University of Jordan is copied to provide an sample of the information provided.

University of Jordan

Khalid Al Karak, President

Dia-Eddin Arafah, Vice President for Scientific Faculties and Institutes Amer Salman, Chairman, Department of Agricultural Economics and Agribusiness Manar Fayyad, Professor, Chemistry Department The university was established in 1962 and now has 19 faculties and 37,000 students and 1,500 faculty. Currently, 250 students are enrolled in United States and European universities in masters and Ph.D. programs. It has roughly 150,000 graduates Ten percent of the budget in 2010 is set aside for medical research, but three priorities for applied research are in water, energy and environment. They spoke of the Open Mind Academy which focuses on global issues of high priority to Jordan. On 30 May the UJ launched the Center of Excellence on Water, Environment, and Energy with a conference. The conclusions: there is a need for a Center, capacity building and applied and basic research. It could be expanded to be a regional Center in the future. The Cabinet in April approved a motion by the Minister of Higher Education to move forward. The President said that this effort is of great interest to UJ: "Come and let's talk" about was to bring together government, universities, the private sector and donors. He said UJ will provide financial support to the WCN and is preparing to break ground for a building where the WCN could be housed. The university budget has a line item for research that can be used to make a Jordanian contribution. The university is pushing ahead with joint ventures. He said the new network should be independent and free of university by-laws and regulations. He needs approval from different councils but it can be done easily. Note: While the university president said that changing the by-laws was easy to do, it is a more complicated process than he suggested. It can be done, but it takes time. The following groups must approve any bylaw change in this order: Dean's Council _ University Council (president, vice presidents, students, faculty) _ Board of Trustees _ Ministry of Higher Education's Higher Education Council _ Regulatory Office in the office of the Prime Minister _ Cabinet _ Royal Court. It can be done, but it takes time. The Center will need a business plan and an action plan. UJ has formed an internal steering committee which includes Dr. Manar. It will bring together different existing entities including the Center for Strategic Studies.

Page 183 provides a table with all Donor and Lending Agencies and the gaps they are addressing and the programs which are being implemented.

Policy Recommendation Paper
May, 4th 2011 (10 Pages)

The Highland and Water forum is a group of farmers from the Badia who are cooperating with the Ministry of Water and Irrigation to work out Water issues and policy. The representative from the Ministry is Secretary Maysoun Zubi.

This is a Policy Recommendation Paper was written by the Highland Water Forum Core Group members during the two last forum meetings dedicated to the theme 'Law and Regulations' pertinent to groundwater abstraction. A Mini Core Group (15 persons), whose members were chosen within the last forum meeting (22nd of December, 2010) and extended by some additional Core Group members to ensure, that all stakeholder groups are fairly represented, revised this Policy Recommendation Paper (14th of February, 2011).

This policy recommendation paper is addressed to the Steering Committee⁸ of the Highland Water Forum by the members of the Highland Water Forum Stakeholder Dialogue, otherwise referred to as the Core Group. The paper aims at supporting decision-making and contributing to the development of a just and effective groundwater bylaw that takes into account the interests of all parties involved, resolving the outstanding problems regarding water, wells and land - in line with a vision of sustainable groundwater management of Al-Azraq Basin.

The topic of 'Legislation and Regulations' concerning groundwater management addressed the following themes:

1. New farming activities in the Highlands
2. Groundwater abstraction legislation
3. Violations in groundwater use
4. Role alignment and cross-sector coordination among governmental entities
5. Sovereignty of the law, effective law enforcement and good governance
6. Awareness campaigns
7. Management of groundwater resources

I. Recommendations

1. New farming activities in the Highlands

To prevent the expansion of new agricultural areas in the Highlands, taking into consideration the socio-economic feasibility of farming activities.

Hundreds of farms are coming to existence every year, and in the past few years the agricultural area expanded in the Zarqa and Mafrq Governorates leading to further over-abstraction of groundwater used for agriculture.

The Core Group encourages the Government of Jordan to contain the existing agricultural area by fixing a maximum area that is allowed to be cultivated in the abstraction license and/or the land ownership deed based on a survey that will show the exact areas of cultivated lands in these governorates. The Core Group also recommends that the Government of Jordan takes measures to prevent new agricultural activities from emerging and to support and re-enforce the regulation⁹ targeted at the freezing of drilling new private agricultural wells.

⁸ The Steering Committee of the Highland Water Forum was chosen and mandated on March 2010 by the Prime Minister and is chaired by HE the Minister of Water and Irrigation. It is made up of the following members: The Secretary Generals of the Ministry of Water and Irrigation, Water Authority of Jordan, Jordan Valley Authority, Ministry of Planning and International Cooperation, Ministry of Agriculture, Ministry of Environment, Ministry of Interior Affairs, Ministry of Public Reform/Mega Projects, Representative of the Royal Court, Representative of the Royal Water Committee, President of Badia Research and Development Centre, Director of the Centre of Water and Environmental Studies of University of Jordan, Representative of Donor Lender Consultative Group, and representatives of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), French Agency for Development (AFD) and the European Union Delegation in Amman.

⁹ Decision of Prime Minister in 1992.

28 The National Strategy for Agricultural Development 2002-2010 (172 Pages)

This Paper is very comprehensive with a clear roadmap describing how to address each of the agriculture development challenges, and identifying the agencies responsible to engage. Find below 4 pages including comments from the 172 pages.

This is a work plan based on developing strategies for the agricultural subsectors that would form the basis for the preparation of the National Strategy for Agricultural Development. The AC established five specialized sub-sector committees for the preparation of the sub-sector strategies according to a unified methodology. An information committee was also established to provide the subcommittees with needed data and statistics.

The five sub-sectors committees are:

- 1- The committee for rain-fed agriculture.
- 2- The committee for irrigated agriculture in the Jordan Valley.
- 3- The committee for irrigated agriculture in the Highlands.
- 4- The committee for animal production and rangeland.
- 5- The committee for marketing of agricultural products.

Suggestions for Agric. development include the following and program engagement outlines are included:

1. Environmental Monitoring (Aquifer Monitoring part of program)
2. Increase production /profitability on small farms
3. Better utilization of scarce Resources in the highlands
4. Water Harvesting techniques improved and disseminated
5. Beekeeping expanded and improved
6. Sheep and Goat husbandry improved
7. Small ruminant program enhanced
8. Forage production with recycled water expanded
9. Rangeland management improved.
10. Plant and Animal Sectors combined for synergies
11. Livestock breeding programs expanded to increase production
12. Use of cactus for forage expanded
13. Better use of industry byproducts for feed expanded
14. Development of new livestock feed programs
15. Establish a program to reduce desertification

Agriculture is not expected to remain the most important sector in the national economy, as it has been since the 1950s. The nature of subsequent socio-economic development, which led to the rapid development of other sectors of the economy, especially services and industry, has resulted in a continued decline in the contribution of agriculture to the GDP. The contribution of Agriculture to the GDP, at current prices, has declined steadily from 14.4 percent in 1971, to 8.3 percent in 1975, to 7.1 percent in 1980, to 6 percent in 1995 and finally to 3.8 percent in 2000.

The decline has not been limited to its relative share in the GDP, but also in absolute value, which decreased, during the period 1991-2000, from about JD 223 million in 1991 to JD 178 million in 1995, and to JD 114.6 million in 2000. While the decline in absolute values of the agricultural output during this period can be partially attributed to the occurrence of dry seasons, as the ratio of low rainfall to good rainfall years was 5:1, it also coincided with the implementation of a structural adjustment program, which included liberalization of trade in agricultural commodities, abolishing agricultural subsidies, reducing customs duties on agricultural imports, and eliminating non-customs trade barriers.

The decline in the contribution of agriculture to the national economy could be attributed to the following main reasons:

- Failure of government policies to provide a suitable enabling environment to encourage the private sector to invest in agriculture.
- Failure of the private sector to establish agribusiness projects, with appropriate economic size and structures and to build strong organizations that would enhance farmers' and stakeholders' role in agricultural development and in participation in shaping and implementing agricultural development policies.

- Failure of public and private institutions to support agricultural development. Cooperatives and farmer associations failed to solve farmers' economic and social problems. Moreover, universities and public institutions involved in research and technology transfer did not succeed in carrying out the duties assigned to them.

These factors resulted in a poor level of investment in agriculture and the absence of a comprehensive and integrated plan for agricultural development. Agricultural industry also did not receive adequate attention, in spite of its importance in maximizing the value added of agricultural products. Human resources in the rural areas as well, did not receive its share of rehabilitation, training, education, and health and social care.

The decline of the contribution of the agricultural sector to the GDP has caused some people to view the sector as a burden on the national economy. This negative attitude towards its development resulted in an approach that minimized investment in agriculture in favor of other sectors rather than one that focused on identifying problems and constraints for overcoming them, and enhancing the agricultural sector integration with the other sectors of the economy.

Insufficient and inaccurate data and statistics may have contributed to the development of this negative attitude towards agriculture, such as calculating the value of agricultural output at prices lower than market prices, which reduced the contribution of agricultural output to the GDP. For example, the average price of vegetables exported to the Arab Countries in 2000 was estimated at 170 fils/Kg and that of fruit at 190 fils/Kg, and that of vegetables and fruit exported to non-Arab countries at 330 fils/Kg. Live-sheep exported to the Gulf Countries in 2000 was estimated at JD 57 per animal.

Strategies no longer focus on the economic dimension of development alone, but emphasize the social and environmental dimensions as well. Jordan should not be an exception in its stand on the significance of agriculture and its role in development. To the contrary, due to its scarce resources, Jordan must give more attention to the development of agriculture in its economic, social and environmental aspects, and to deal with the agricultural sector on this multifaceted structure, which does not only consider economic returns, but the social and environmental benefits important for national security, environmental safety and public health.

However, the two most important domestic changes were the implementation of a structural adjustment program, which started in 1989, and of an agricultural sector adjustment program, which started in 1994. These programs resulted in the liberalization of trade in agricultural commodities, opened the local market for imported agricultural commodities and eliminated most of agricultural subsidies.

Among such measures included accession to the WTO, signing of the Arab Free Trade Agreement and of the European-Jordanian Partnership Agreement. Although these agreements provide new opportunities to Jordan, they create challenges to local production that will require intensive efforts and substantial changes in the current policies, to overcome them.

The total amount of water available for irrigation in 1975 was 354 MCM, out of which, 178 MCM was surface water, 74 MCM was from springs, and 102 MCM was underground water. This amount increased to 557 MCM in 1998, which includes 225.6 MCM of surface water, 260.4 MCM of underground water, and 71 MCM of treated wastewater.

There was a noticeable increase in the irrigated area, the rain-fed agriculture has suffered from the loss of large areas of the best land, especially in areas bordering the municipal and village councils.

In the early 1960s, the agricultural sector provided work for about 33 percent of the total Jordanian labor force. Given the problems that the sector had suffered from, and the rapid development of other sectors of the economy, this percentage has dropped to about 18 percent of the total labor force during the seventies, to 10 percent during the eighties and only to 6 percent in the nineties.

The area of rainfed land left uncultivated increased due to many factors, including the small size of holdings, land fragmentation and low revenue expected from field crops cultivation, and increase the areas of fallow-land. The average area of rainfed land left uncultivated including, fallow-land, is estimated at one million du annually.

- The irrigated area continued to increase, and advanced irrigation methods in both vegetables and fruit tree production was introduced.

An Agricultural Marketing Organization (AMO) was established in 1987 and abolished in 2002. Its staff was transferred to the MoA.

The Government approved by-laws allowing the division of lands owned by several parties, in areas outside the municipal and village boundaries and to the west of the railway, into units of 4 du (previously the minimum was ten du). This has led to the fragmentation of agricultural land into small size holdings, too small to be efficiently used for the production of traditional field crops.

- Low productivity of rain-fed agriculture due to poor agricultural research, technology transfer and agricultural extension services addressing rain-fed problems. Also crops are sometimes planted in unsuitable agro-ecological environments, such as growing cereals in marginal areas, wheat in low-rainfall areas suitable only for barley and growing olive trees in heavy soils. This is aggravated by the low efficiency of production inputs, which is related to the weakness or lack of well trained human resources on modern production technologies.
- Continued low productivity in the livestock sector. It is estimated that the average mortality rate of calves in dairy cow farms is more than 20 percent, compared to 2-5 percent in developed countries and around 15 percent in broiler chicken farms, compared to 5-10 percent in developed countries.

Unavailability or shortage in some of the production inputs (of high standards, dependable and accredited sources) in some production areas, such as the shortage in improved cereal seeds and in high quality fruit tree seedlings.

- Low competitiveness of products due to the small size of production enterprises, which prevents the benefits of economies of scale, and the limited use of modern technology for increasing the efficiency of production inputs and reducing production cost.
- Absence of plans for directing production to meet local market demand, and export and processing needs in terms of type of produce, varieties and timing of production, and the absence of contractual farming for export and processing purposes. This is due to the failure of the production system to interact with the marketing system and to achieve a link, in a frame of a mutual dependency relationship.
- Poor integration between plant and animal sectors, resulting in the decline of added value of their products.
- Poor rate of adoption of modern production technologies by farmers, due to poor agricultural extension and technology transfer services.
- Absence of producers organizations, such as councils and farmers commodity associations across the different production sectors, necessary to organize the producers, provide guidance for production, and facilitate organizational representation of producers through participation with the public sector, in planning development and policy formulation.

The Future of the Agricultural Sector

5-1 The Agricultural Sector in 2010 Assuming that the Current Trends of Agricultural Development will continue.

- The area of agricultural land will decrease (due to the irrational expansion of city and village boundaries to agricultural land and the absence of a law that defines land uses. This will have a direct negative impact on agricultural production and transform a growing number of agricultural producers to job seekers in urban centers, thereby creating social and environmental problems in urban areas.
- Maintaining the current rates of groundwater extraction, which exceed double the safe yield, will result in an accelerated drop in water table levels of groundwater basins, increased cost of pumping, and increasing water salinity (to the point that it may not be suitable for domestic use or unrestricted agricultural use). Continuing extraction at this level will ultimately cause groundwater depletion, loss of investments made in the irrigated agriculture in the highlands, and of other, related agribusinesses.
- Increasing the quantities of fresh water pumped from the King Abdullah Canal for municipal and industrial use outside the JV area and replacing it with treated wastewater of high salinity, will lead to increased soil salinity, deterioration of soil productivity and quality of produce, and a decreasing consumer confidence in Jordanian products.
- The increased ratio of treated wastewater in irrigation water will lead to limiting its use to restricted agriculture. This will result in losing an important agricultural area in the JV, important for its productive capacity and comparative advantage in the regional and international markets and of investments already made or planned these areas especially for enhancing agricultural exports.
- The economic reform policies and the Agricultural Structural Adjustment Program, which advocated abolishing subsidies on production inputs, trade liberalization, and opening the Jordanian market to agricultural imports

(without taking advantage of measures provided by international agreements to encourage agricultural production in developing countries), will force increasing numbers of small farmers and livestock breeders to leave the sector and migrate to urban areas in search of work opportunities, increasing the problems of unemployment and poverty at the national level.

- The continued dependency of the present inadequate marketing system and the poor interaction and organizational relations between producers and consumers, will lead to the continued complaints of producers about the big difference between the prices they receive and consumer prices, laying the blame on the Government for not organizing and developing the marketing system. Agricultural producers will continue to complain about market congestion and material losses, and will pressure the government to provide them with support and subsidies through interventions which are either not allowed by international and regional agreements or that the government cannot provide permanently.

Suggestions to Strengthen Agriculture and Water

Despite the important role of forests in bio-diversity conservation, preventing soil erosion, recharging aquifers, and maintaining an environmental balance, this resource has not been treated as an important natural resource. Thus its contribution has been confined to providing firewood and contribution to local tourism.

- There has been increased interest in establishing reserves to protect forests and the forest ecosystem, resulting from global interest in biodiversity conservation. These reserves serve as a natural plant gene-bank, especially wild plants with potential medicinal uses and endangered species of plants, animals and birds. The number of established reserves forest reached six.

- Some forest areas serve as touristic and entertainment sites that can be expanded and developed for future environmental tourism.

- .1 Protect agricultural resources and improve their present use for sustained productivity.
2. Increase rain-fed cropped area by exploiting neglected areas and reclaiming new land.
3. Protect the environment and the agro-biodiversity and improve the quality of agricultural produce.
4. Increase the efficiency of rain-fed agriculture, maximize its economic returns, and increase its contribution to overall agricultural development.
5. Encourage crop diversification by introducing high-value cash crops and maximizing integration of plant and livestock production.
6. Promote production for agricultural processing and export to achieve integration and contribute to increase the added value of products.
7. Create job opportunities for rural populations, specifically women, to reduce unemployment and limit rural migration.
8. Reduce the risk facing rain-fed agriculture and its resources.

Implementation Strategies:

- Complete the soil survey and classification project on a more detailed scale for areas with annual rainfall of more than 200 mm, giving priority to high rainfall areas (Program 1- Project 1).
- Implement a soil analysis program to determine the level of soil nutrients in order to formulate plans for maintaining soil fertility (Program 1–Project 2).
- Develop watershed areas based on integrated management systems, without affecting the quantities of water flowing into dams constructed for irrigation purposes; introduce water harvesting techniques (Program 1- Project 3).
- Introduce high value crops suited for small-holdings, such as medicinal and herbal plants and some kinds of fruit trees, to facilitate the re-introduction of small holdings in the agricultural production system (Program 11- Projects 1,2,3,4,5).
- Develop a unified national information database for agricultural resources, and develop a Geographic Information System to be used in planning the optimal use of land, and to monitor changes affecting agricultural resources (Program 14- Projects 1,2).
- Provide marketing services for products of rain- fed area by expanding demand for such products and guide farmers to grow crops with high demand in market (Program 16- Project 1).
- Adopt a regional planning approach to ensure balanced allocation of land for the different uses.
- Provide suitable incentives to encourage farmers to use land according to its productive capacity and protect it from degradation.
- Adopt a specific land-use policy that gives priority to protecting agricultural land.
- Control urban encroachment on agricultural land.
- Provide the required funds to implement land and resources programs that are not attractive to the PS.
- Train technical staff in land-use planning (Program 4- Project 4).

- Establish a system to ensure resource protection and development after project completion, and to make certain that beneficiaries of government-supported projects are committed to maintaining soil conservation measures.

29 PRELIMINARY ASSESSMENT OF ECOLOGICAL RESTORATION STRATEGIES TO IMPROVE WATER RESOURCES IN THE HASHEMITE KINGDOM OF JORDAN US

Embassy/Amman

*April, 2012 Barry Hill, Regional Hydrologist Pacific Southwest Region US Forest Service
Program Contact: Natasha Marwah (11Pages)*

Barry Hill (US Forest Service) has provided his input towards low hanging fruit in increasing aquifer replenishment in three main regions of Jordan. The North Badia, The south Badia and the Valley. Following are some highlights of his suggestions.

Water supply in Jordan is also affected by widespread landscape degradation resulting from deforestation, overgrazing, and cultivation. These activities have reduced soil infiltration rates and caused incision of alluvial valleys that formerly retained groundwater that supported agriculture. Consequently, in many areas of the kingdom, runoff and evaporation account for much of the sparse annual rainfall, leaving only a small fraction available for food production and human consumption.

1. **Increase hill-slope infiltration rates.**
2. **Harvest runoff from hill-slopes with naturally low infiltration rates**
3. **Increase groundwater storage in eroded alluvial aquifers**

Based on existing scientific information, ecological restoration programs can reasonably be expected to reduce flood flows that are currently lost to evaporation in saline lakes and closed depressions. Such a reduction in flood flows will lead to increased infiltration and groundwater recharge, and eventually to increased available water in form of increased stream base-flows, spring discharges, and shallow groundwater. At this time, the proportion of the water "saved" from evaporation through ecological restoration programs that can later be recovered as available water cannot be reliably estimated. Water-supply benefits of ecological restoration programs, while potentially substantial, may require years to decades to be realized.

In the most arid desert areas of the Kingdom, runoff harvesting on hill-slopes with naturally low infiltration rates can be used to provide water to grow browse shrubs for livestock. Along the more permeable desert wadis, planting of shrubs can be used in conjunction with check dams to increase hydraulic roughness, slow flood flows, and increase groundwater recharge.

In the less arid uplands in western Jordan, reforestation has been shown in modeling studies to have significant potential to reduce flood flows and increase infiltration, groundwater recharge, and perennial spring flows. Ecological restoration of eroded alluvial valleys also has a significant potential to benefit water resources, based on prehistoric and historic patterns of water use and similarities to alluvial valleys currently

30 Economic Impacts of Groundwater Drawdown in Jordan Draft Report

December 28, 2011 Dr. David E. Rosenberg Utah State University (25 pages)

Presented are research methods developed and results that can identify the economic impacts of groundwater level drawdown and forecast the future point in time when it will be un-economical for Jordanian agricultural pumpers to use groundwater.

Dr. Rosenberg also forecasted the number of years it will take for the production well to go dry by dividing the difference between the well depth and groundwater level by the groundwater level trend provided in Step 2.

When the well was forecast to first go dry, Dr. Rosenberg also determined whether it would be financially advisable to drill a new, deeper well to a lower depth where the crop activity would become unprofitable.

Economic impacts include:

- a) Increased pumping costs from groundwater level drawdown.
- b) Pump and well retrofit costs from groundwater level drawdown.
- c) Increased pumping costs from estimated individual pumping well drawdown (cones of depression) for target pumping wells, based on currently estimated water levels.
- d) Increased pumping costs from estimated individual pumping well drawdown for target pumping wells based upon future water levels predicted via simulation model, and
Costs to treat or cope with saline water based upon projected concentrations

Two project tasks:

- 1) Estimate economic impacts a) and b) and assess their relative contribution to the overall impact using readily available data, and
- 2) Assess the availability of geologic, water, and water quality data and recommend suitable approaches to estimate impacts c), d), and e).

Recommendations

Based on the results and analysis, USU recommends:

- Take immediate action to help Azraq farmers growing low-value crops like olives to either transition to higher-value crops or leave agriculture all-together.
- Raise awareness among farmers growing low value crops in the Dead Sea and Yarmouk basins that they will likely face problems in about 10 years time. Encourage these farmers to transition to higher value crops and/or deepen their wells as the wells go dry.
- Identify additional impacts associated with dynamic drawdown (cones of depression). Task 1 identified economic impacts associated with changes in the static groundwater level. Dynamic drawdown is the distance the static water level declines at a well that is pumping. Dynamic drawdown is greater (sometimes much greater) than static drawdown. We recommend considering the economic impacts of dynamic drawdown by:

31 Youth: Work - Middle East Water and Livelihood Initiative (WLI's Youth Work)
Submitted to USAID by the International Youth Foundation (IYF) April 21, 2011
(12 Pages)

Under the Middle East Water and Livelihoods Initiative (WLI), USAID is working to increase standards of living in rural communities Egypt, Iraq, Jordan, Lebanon, Palestine, Syria, and Yemen by addressing inefficient water usage and building the capacity of local entities to engage in sustainable land and water management practices (Annex 1). Another important goal of the program is to enhance the knowledge, skills, and training of community members in order to help them develop new livelihoods and increased income. Under the Middle East Water and Livelihood Initiative's Youth Work (WLI's Youth Work), IYF proposes to help design and support high quality youth employment, entrepreneurship, and engagement projects to teach young people skills relevant to managing local water, maintaining sustainable agriculture, securing food sources, and building and operating related supply chains. In short, this proposal proposes to create a cross-cutting youth employability program, to be called WLI's Youth Work, across all seven WLI countries. WLI's Youth Work will begin with a Rapid Community Assessment (RCA) at each benchmark site to determine the exact needs of both youth and the local labor market. Community Action Plan (CAPs) in turn will be developed to address those gaps and needs identified by the RCA. Capacity building will draw on a cadre of regional master trainers who, under IYF's portfolio of workforce development programs across the Middle East region, have been trained in effective youth programming, service delivery, and evaluation. Finally, the program will invite proposals for pilot projects to be funded by the program through an RFA process. Rigorous monitoring and evaluation will be a key component of the program and the experts described above. IYF will also support the sharing of experiences and lessons learned between participants in benchmark sites through learning events, exchange visits, and a social networking tool.

While the main goal of the WLI's Youth Work program is to train young people in rural areas for new careers and livelihoods, IYF sees this goal as part of a continuum rather than a set of activities to be performed discreetly. Capacity building activities are part and parcel of our programs because they will contribute to a program's sustainability by assuring that partners have the ability to maintain high quality training and support activities beyond the life of the program.

Youth:Work Jordan (YWJ): YWJ is a five-year, youth-led and community-based program that improves livelihoods and provides support for the long-term development of Jordan's youth. YWJ was developed in partnership with USAID, Jordan's Ministry of Social Development, and IYF. YWJ's Community Assessments studied local labor market demands, identified economic opportunities for young people, and mapped out specific youth-serving institutions. This knowledge became the basis for developing Community Action Plans, which prioritize needs, propose interventions, and identify approaches best suited to each neighborhood for implementation through a network of community-based organizations. YWJ provides life skills, IT, and Business English training to out-of-work and out-of-school youth in the targeted communities.

Summary

Under WLI's Youth Work, IYF proposes to help design and support high quality youth employment, entrepreneurship, and engagement projects to teach young people skills relevant to managing local water, maintaining sustainable agriculture, securing food sources, and building and operating related supply chains across all seven country where WLI currently operations.

32- Info Note: Modernizing Extension and Advisory Services (MEAS) Program

The Modernizing Extension and Advisory Services (MEAS) Project implemented by a University of Illinois-led Consortium has an objective of defining and disseminating good practice strategies and approaches to establishing efficient, effective and financially sustainable rural extension, information, and advisory service systems. Future food security, poverty reduction, adaptation/mitigation of environmental change, and people's empowerment will depend on rural innovation. Improving rural productivity, profitability, and sustainability will require rural people to adopt changes in use of technologies, management systems, institutions, and environmental resources.

Rural Extension and Advisory Systems:

Expanding capacity for rural innovation involves strengthening extension systems, broadly defined as including varied extension, advisory and information services that:

- Provide advice to farmers on problems or opportunities in agricultural production, marketing, conservation, and family livelihood
- Facilitate development of local skills and organizations and links with other programs and institutions
- Transfer new technologies to farmers and rural people



Extension systems throughout the world have been in decline. Many past approaches proved unsustainable or ineffective. Extension must go beyond traditional approaches and integrate the various reform strategies MEAS promotes. These must be tailored to country conditions and program objectives. There are no “silver bullets” in the form of standard program approaches or organizational models. Programs and organizational arrangements must be tailored to fit country and program needs. To effectively serve food security and economic development needs of resource-poor men and women farmers new extension approaches must draw on full breadth of resources in public, private and civil society organizations and utilize available advanced information and communications technologies. MEAS seeks to be a Network of Excellence to promote and support such endeavors.

MEAS Approach:

As a strongly demand-driven service project, MEAS will bring the resources of US universities and their partners to bear on extension system development. The project will help USAID Missions and partners transform and modernize extension systems. The project emphasizes participatory approaches and collaboration with host countries and other development practitioners. Activities fall under three components:

TEACH - Disseminating Modern Approaches to Extension through user-friendly materials for dissemination and training programs that promote new strategies and approaches to rural extension and advisory service delivery.

1. LEARN - Documenting Lessons Learned and Good Practice through success stories, case studies, evaluations, pilot projects, and action research.
2. APPLY - Designing Modern Extension and Advisory Services Program through assistance to selected host country organizations – public and private – for the analysis, design, evaluation and reform of rural extension and advisory services.

Modernizing extension and advisory services may mean different things in different countries. Often, this involves expanding the role of private sector entities, integrating ICTs into rural extension systems, ensuring extension service accountability to farmers/clients, and redefining roles of government. This requires program design for “best fit” of organizations and approaches to the country context.

33 The Hashemite Kingdom of Jordan Ministry of Environment Environmental Compensation Unit Badia Ecosystem Restoration Program Community Action Plan of Badia Ecosystem Restoration Program Prepared by Jordan National Focal Point (JNFP) Program Management Unit of the Badia Restoration Program (PMU of BRP) (55 pages)

Detailed Work Plan of the Community Action Plan (CAP) of the Badia Restoration Program (BRP)

1. Background

1.1. UNCC Environmental Compensation Award to Jordan and Badia Restoration Program

In June 2005, the Governing Council (GC) of UNCC's awarded to Jordan the sum of \$160,582,073 million dollars for the rehabilitation and restoration of its damaged terrestrial ecosystems in the Badia by the influx of refugees with their livestock (1.8 million head of sheep, goats, and camels) (award no. 5000304) during the 1990/1991 Gulf war. The Badia Restoration Program (BRP), housed under the Ministry of Environment, was initiated to implement this UNCC award.

The main goal of BRP is to rehabilitate the ecological productivity of the Badia ecosystems for wildlife and sustainable grazing, by restoring the vegetation composition, structure and sustainability to allow wildlife populations to rebuild, and to provide a foundation for sustainable grazing practices across the entire Badia region. Even though, the program is managed by the Ministry of environment, it is an integral part of the national development efforts to promote agricultural growth, improve the livelihoods of the Bedouin population and reduce poverty with the development of sustainable pastoral and agro-pastoral production systems.

To achieve this goal, the BRP will be implemented in two main phases: a demonstration phase of 5-7 years, and a full implementation phase of about 13 to 15 years. The Program Management Unit (PMU) of BRP, in cooperation with the Independent Reviewers (IRs), developed a road map document for the first phase of BRP. The demonstration phase includes 4 sub-phases: (i) baseline study of the targeted community and demonstration sites, (ii) development and approval of community action plan (CAP), (iii) implementation of the CAP, and (iv) management of the restored sites.

Basic Premises

- The water harvesting and shrub establishment techniques currently under investigation by New Mexico State University and the BRDC in the Jordan Badia are or can be economically viable approaches for rangeland restoration in many areas of the Badia.
- Demonstration of environmentally and economically sustainable grazing management is a critical step for training Bedouins to maintain the productivity of rangelands that have been restored through plantings and water harvesting and enhancing the biodiversity of the Badia.
- The wool currently produced by Bedouins from the Awassi sheep can be a basic input for value-added activities that can significantly increase family incomes and the quality of their rural life style while maintaining cultural values.
- The skills acquired in the value-added wool activities can be utilized in related fiber arts activities further increasing income opportunities, particularly for women. The Bani Hamida Project and the Jordan River Foundation have already started projects like this in other parts of Jordan with much success.
- Developing value-added industries have the potential to reduce rangeland stress, reduce animal numbers to historic levels, and restore rangeland to its historic condition or better as other forms of employment and opportunity are created.

Proposed Plans

- Rangeland Improvement Through Water Harvesting and Shrub Establishment
 - Utilize the knowledge gained from the current demonstration trial, particularly with regard to water harvesting structure design and potential forage species to establish.
 - Develop new rangeland restoration demonstrations in strategic locations as cost effectively as possible by involving the local Bedouin people in the planning, construction and management of the projects.
 - Construct projects, as much as possible, using technology, labor and equipment presently available in the area. Use consultants mainly for planning, education and training to facilitate local “buy in” and keep costs down.
 - Develop alternative livestock stocking level treatments at rangeland restoration demonstration sites to use as training tools for teaching sustainable grazing management. Create demonstration areas where established shrubs are grazed at sustainable and heavy (overgrazed) levels. Establish a sustainable grazing training program for local leaders so that they can teach other Bedouin (a train the trainers approach). Consultants will teach sustainable grazing management and financial management approaches to local Bedouin trainers.

35 Ministry of Environment Environmental Compensation Unit

Badia Ecosystem Restoration Program Community Action Plan of Badia Ecosystem Restoration Program **Prepared by Jordan National Focal Point (JNFP) Program Management Unit of the Badia Restoration Program (PMU of BRP (52 pages)**

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The "Terms of Reference for Conducting Baseline Study at the Demonstration Sites within the Framework of the Badia Restoration Program" was developed for the first sub-phase of the Demonstration Phase in February 2009. The baseline study was conducted in 2009/2010 and characterized the biophysics of five selected demonstration sites and assessed the socioeconomic of the local communities living nearby or benefiting from the resources of the targeted areas. The baseline studies were conducted by five contractors/institutions working in Jordan Badia. These are: the Badia Research and Development Centre (BRDC), the Jordanian Society for Sustainable Development (JSSD), the Ministry of Agriculture (MoA), the National Center for Agricultural Research and Extension (NCARE), and the Royal Society for the Conservation of nature (RSCN).

36 U.S. DEPARTMENT OF STATE *MIDDLE EAST PARTNERSHIP INITIATIVE* LOCAL GRANTS PROGRAM

Project Narrative Instructions Department of State Middle East Partnership

MEPI Mission and Objectives: MEPI works in partnership with civil society organizations, the private sector, and government institutions throughout the Middle East and North Africa (MENA) region to help achieve three overarching goals:

1. Building pluralistic societies in which diversity is reflected in social organizations, politics, business, media, and government, and where all citizens have equal standing, protected by guaranteed rights and by independent and effective judiciaries;
2. Building participatory societies in which citizens play an active role in making decisions that affect their lives and in holding their governments accountable; and
3. Building prosperous societies in which education, specialized skill training, and an environment conducive to business development inspire innovation and create a foundation for long-term economic growth and an internationally competitive private sector.

Local grants promote reform and civic activism at the local and national levels in countries of the Middle East and North Africa, build the institutional capacity of non-governmental organizations (NGOs), and strengthen civil society. Funding is available for projects that protect and advance civil liberties especially political and civic rights, empower women and youth, strengthen the rule of law, develop independent and pluralistic media, foster economic opportunity and economic reform, and promote an educated, active and informed citizenry. Local grants projects are intended to support quick impact activities. They generally are completed in one year and should be designed to carry out proposed activities and make an impact within that one-year period. Proposed local grant projects should involve activities in one or more of the following areas:

- Advocacy by civil society, NGOs, and professional associations, including grassroots level and community organizations, to promote legal or political reforms and raise public awareness of democratic values and processes.
- Development of networks, partnerships, and coalitions that could include local NGOs, civil society organizations, government officials, and/or the business community to promote reform.
- Expansion of opportunities for youth (ages 15-24), particularly those that to provide practical, hands-on experience in civic engagement, public service, and volunteerism, and that help to improve local communities.
- Expansion of women's participation in public life at the local, regional, and national levels.
- Promotion of the rule of law, including rights education, education of legal professionals, and advocacy activities to expand civic rights and to ensure legal systems protect the rights of all individuals.
- Promotion of legal frameworks and processes that expand citizen participation in politics and public life.
- Promotion of good governance, including anti-corruption efforts and initiatives to promote government transparency and integrity.
- Promotion of public awareness of current political issues and processes, including voter education.
- Development of media institutions that defend the public interest and provide credible and diverse sources of information.
- Promotion of economic reform that expands economic opportunity especially for youth, including promoting entrepreneurship and commercial and legal reforms, as well as workforce development training.

- Expansion of educational opportunities, including civic education activities that promote tolerance of different views, respect for democratic values and institutions, protection of ethnic and religious diversity, leadership development, and community service.

37 KAFA'A Future/Potential Markets and Non-traditional On-farm Activities (20 pages)

Future Markets

The recently expanded European Union represents an increasingly attractive market for which numerous crop opportunities are available. Jordan benefits from climatic conditions that allow the production of “off-season” high-quality exportable produce for the EU. These crops include strawberries, seedless table grapes, galia melons, cherry tomatoes, asparagus, okra, fine green beans, and snow/snap peas to name a few.

The Arab gulf countries (GCC) represent readily available and reachable opportunities for similar products. Profit potential will vary dramatically depending, in large part, on the timing of shipments during the marketing window and the position of competitive exporters during these time periods. Volumes and profits will rise to the extent that Jordanian farmers and exporters can capitalize on early (or late) harvest periods before (or after) competitors enter the markets.

KAFA'A predicts that as many as 20 medium to large exporters of high quality produce may emerge if certain constraints can be resolved (for details see KAFA'A Marketing Assessment Report – Phase One). These exporters have the potential of spreading the benefits to many other small farmers who have the willingness and capacity to join in production agreements with exporters.

Non-traditional On-farm Activities

KAFA'A has started fish farming activities with approximately 56 farmers in Ghor Essafi (Jordan Valley South of the Dead Sea). This non-traditional farm activity will bring supplemental income to farmers in a short period of time. By the end of April, fish fingerlings were introduced into the irrigation water collection reservoirs on 46 farms in Ghor Essafi, and in 10 reservoirs on Ghor Madsous. Ghor Essafi Ag Cooperative and Ghor Madsous Ag Cooperative have signed contracts with farmers under the supervision of the KAFA'A technical team. Attached is the program description for this activity. After studying other potential non-traditional on-farm activities, KAFA'A has prepared a proposal for a Date Palm nursery complete with a feasibility study demonstrating sustainability and profits to be generated within four years. Attached is this proposal and economic analysis.

Date Palm Trees Nursery Background

Jordan is relatively a small country, yet the variety of its terrain offers wide and variable climates (including the Jordan rift around 300 m below sea level) allowing suitable conditions for a large range of fruit tree plantations (Tropical and Subtropical trees).

Among these fruit trees is the date palm, which has strongly acquired a spiritual significance for the Muslim and Christian community. In addition to its fruit, the nutritional value and the large quantity production (average about 150 Kg/tree) makes the crop commercially attractive to agricultural investors. Despite that it is relatively new introduced to Jordan (started in early eighties), date palm trees nowadays occupy about 8,000 dunums of area constituting 0.5 % of the total area planted to fruit trees (MoA, 2003) and is still expanding.

38 Contract Farming in Jordan Submitted to Development Alternatives Inc. Prepared by Prof. Samir El-habbab 24 pages

Contract farming has been in existence for many years as a means of organizing the commercial agricultural production of both large-scale and small-scale farmers. Interest in this type of agricultural marketing continues to expand. Changes in consumption habits, such as the increasing number of fast-food outlets, the growing role played by supermarkets in many countries, and the continued expansion of world trade in fresh and processed products; have also provided the impetus for further development of this mode of production/marketing. In an age of market liberalization, globalization and expanding agribusiness, there is a danger that small-scale farmers will find difficulty in fully participating in the market economy. In many countries such farmers could become marginalized as larger farms become increasingly necessary for a profitable operation. A consequence of this will be a continuation of the drift of populations to urban areas that is being witnessed almost everywhere. Attempts by governments and development agencies to arrest this drift have tended to emphasize the identification of “income generation” activities for rural people.

Unfortunately there is relatively little evidence that such attempts have borne fruit. This is largely because the necessary backward and forward market linkages are rarely in place, i.e. rural farmers and small-scale entrepreneurs lack both reliable and cost-efficient inputs such as extension advice, mechanization services, seeds, fertilizers and credit, and guaranteed and profitable markets for their output. Well organized contract farming does, however, provide such linkages, and would appear to offer an important way in which smaller producers can farm in a commercial manner. Similarly, it also provides investors with the opportunity to guarantee a reliable source of supply, from the perspectives of both quantity and quality. Contract farming can be defined as an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices. The arrangement also invariably involves the purchaser in providing a degree of production support through, for example, the supply of inputs and the provision of technical advice. The basis of such arrangements is a commitment on the part of the farmer to provide a specific commodity in quantities and at quality standards determined by the purchaser and a commitment on the part of the company to support the farmer's production and to purchase the commodity. The intensity of the contractual arrangement varies according to the depth and complexity of the provisions in each of the following three areas: •

Market provision: The grower and buyer agree to terms and conditions for the future sale and purchase of a crop or livestock product;

• **Resource provision:** In conjunction with the marketing arrangements the buyer agrees to supply selected inputs, including on occasions land preparation and technical advice;

• **Management specifications:** The grower agrees to follow recommended production methods, inputs regimes, and cultivation and harvesting specifications. 4 The contract farming system should be seen as a partnership between agribusiness and farmers. To be successful it requires a long-term commitment from both parties. Exploitative arrangements by managers are likely to have only a limited duration and can jeopardize agribusiness investments. Similarly, farmers need to consider that honoring contractual arrangements is likely to be to their long-term benefit.

39 Crop Water Use Efficiency by Type of Crop and Farming System in the Jordan Valley. KAFA'A

Data from the KAFA'A farm survey covering the 2002-2003 crop season was used earlier to assess the comparative crop water use efficiency of irrigation water used in the Jordan Valley by crop type and by zone. Cropping patterns among survey sample farms were matched with crop water requirements derived using evapotranspiration data and crop-specific coefficients to generate estimates of the value of production per 1,000 cubic meters of irrigation water. Preliminary results indicated that vegetable crops generate higher values of production per unit of water than either bananas or citrus crops. They also showed that crop water use efficiency in the Central Jordan Valley; where vegetable production predominates, was higher than in the North Jordan Valley where citrus is the major crop.

The validity of these findings has been called into question because crop water requirements have not been established specifically for the Jordan Valley areas. The theoretical values of water consumption requirements thus generated for all three groups of crops exceeded significantly actual water delivered by the Jordan Valley Authority to farmers in the Valley.

The attempt is made in this report to reassess the crop water use efficiency analyses using the regulation for irrigation water delivery estimates provided by the Jordan Valley Authority.

Tables 1-a, 1-b, and 1-c are the schedule of water delivery that the JVA uses to determine how much water to give to farmers, depending on the month and the type of crop. Three crop categories are given – bananas, citrus, and vegetables. For each category JVA stipulates how many millimeters of water to provide the farms for each type of crop per day (bananas, citrus or vegetables). Table 1-d condenses the same information for the three zones in an easy to read format. Bananas in the North Jordan Valley, for example, require 7 mm per day in the hot summer months, but only 3 mm per day in the cool winter months (See Table 1-d and Figure 1-a). Figures 1-b and 1-c provide the same information for the Center and South Jordan Valley.

Vegetable crops occupy the land only a few months each season. In Tables 1-a to 1-c, two separate seasons – autumn and spring – are considered. We note however that in summer months the allowance for vegetables drops to 1 mm per day while for both citrus and bananas water allocation reaches maximum levels. This occurs because JVA is discouraging vegetable production in summer months and reduces vegetable water allowance to a minimum, which most farmers use for soil sterilization. This part of the analysis is introducing a change in the water allocation for vegetables, reflecting a situation of actual needs of crops during the months they are on the ground.

Table 2-a is the same as Table 1-d for bananas and citrus crops but differs in the columns for water allowance for vegetables. We have set water deliveries of all vegetables at the maximum that JVA allows -- 2 mm per day during the entire year.

40 Baseline Assessment On-Farm Water Management, Crop Production and Marketing

KAFA'A is a USAID funded long-term project (Contract No. 273-C00-03-00222-00) aimed at raising the efficiency of water use in Jordan's agriculture. KAFA'A (Knowledge and Action Fostering Advances in Agriculture) is founded on the premise that greater and better knowledge among farmers is the most effective way to impart awareness of opportunities to save irrigation water and to increase the value of production per unit of water.

In order to implement the many tasks aimed to achieve the anticipated results of improving water use efficiency and crop production, KAFA'A has implemented a Baseline Survey with the following objectives:

- Establish a baseline describing the current agricultural situation in terms of cropping patterns, irrigation techniques, water use, and efficiency of water management. Such baseline data will serve as reference points to measure progress during the life of the project;
- Establish baseline data regarding farmers' knowledge, attitudes, and practices about irrigation water and their perceptions about opportunities for raising water efficiency;
- Identify the more efficient uses of irrigation water in agriculture through more appropriate choices of crops and varieties, irrigation techniques, planting times, and marketing options; and
- Identify project initiatives for future interventions, especially for implementation during the early months of the project as part of the demonstration farms.

The baseline survey was designed and conducted between February and April 2004; due to timing of cropping season critical data on production and marketing of the current 2004 crop year was not fully available. Most of the economic analysis in this report is therefore based on the retrospective data provided by farmers for the 2003 agricultural year.

The main finding that emerges out of the baseline survey data is that vegetable crops as a group are many times more efficient users of irrigation water than citrus and banana trees. There are several straightforward reasons for this result: Vegetables short life spans (five months on average) contrast with the perennial nature of citrus and bananas; at any given time, a dunum of vegetables requires half as much water as a dunum of citrus and one third as much as a dunum of bananas; vegetables are grown in the colder fall, winter, and spring months, while citrus and bananas endure the hot summer months when they consume half the water they need over the year. Finally, many vegetables are grown under greenhouse conditions thus raising yields and revenues several fold without a significant increase in water needs.

Farmers can also raise water efficiency by selecting the planting time for their crops in order to take advantage of the cooler months in winter when water requirements are minimal. However, farmers also know that market gluts of particular products can make prices tumble, so they tend to spread out plantings throughout the growing season.

The economic analysis was carried out using gross revenues and water consumption estimates that are subject to potential errors. Gross revenue figures were computed based on reported yields and prices for each crop grown in 2003 by the survey sample farmers. The accuracy of these figures is subject to considerable potential recall error, but there is large enough number of observations and consistency in the sample data to make the aggregate estimates fairly robust.

Net revenues were not computed because it would have been too costly and cumbersome to obtain cost of production data for each crop.

41 POLICY ASSESSMENT REPORT KAFA'A

Executive Summary

To encourage more efficient resource utilization among farmers in the Jordan Valley and Amman-Zarqa Basin, the USAID-funded the Knowledge and Action Fostering Advances in Agriculture (KAFA'A) project seeks to reform the policy and regulatory environment within which farm management decisions are made. Prior to determining appropriate project interventions, an assessment of existing policies related to irrigated agriculture was conducted.

One of the main goals of the KAFA'A project is to revise two existing policies that discouraged water conservation and to formulate two new policies, which would encourage greater water use efficiency in agriculture. These policies will take into consideration the sustainability of resources, integrated water resources management, environmental impacts and governance to support the decision making process at the local and national levels. The purpose of this study was to describe the policy environment of irrigated agriculture in Jordan.

Fourteen proposed policies, five requiring revisions to existing policies and nine policies to be newly formulated, were identified and are presented here in order of priority for policy reform. This list is based on the diagnostic analysis of challenges and constraints facing irrigated agriculture in Jordan, review of the general policy environment, and consideration of existing legislations.

Once the final four policy targets are selected by the MoA and MWI, policy profiles will be developed. Each of these policy profiles shall include background, importance of the issue, current policy framework including gaps, deficiencies and constraints. Specific stakeholders will be identified, and an advocacy campaign will follow to provide sufficient credibility and public support to motivate government decision makers.

Irrigated agriculture in Jordan contributed about 62% of total added value of the agricultural sector in 1990 (Al-Qasem, et al, 1993). Relatively high rainfall (>350mm/year) that used to be under rainfed cultivation of spring and summer vegetables have become urbanized and covered with housing or cultivated with fruit trees.

The total contribution of irrigated agriculture to the GDP was only about 4.7% in 1990, but the environmental impacts (desertification and biodiversity), social consequences (migration from the rural to the urban areas, employment), and political effects (partial food security) cannot be ignored or put in monetary terms. Vegetables have the largest share among the three major crops cultivated in irrigated areas (i.e. 57% of total value of irrigated agriculture output and fruit trees had an average value of 38% followed by field crops of 5%). The total value of vegetables, fruits and field crops at the 1990 prices reached about JD 113 million, i.e. vegetables (JD 64 million), fruits (JD 43 million), and field crops (JD 6 million).

The irrigated areas in the uplands (privately owned land except in Disi and Mudawarra areas) have expanded rapidly, especially since 1987 when more licenses were granted for groundwater well development. The estimated area is about 33,000.ha. mostly fruit tree planting; especially peaches, apples, grapes and olives. More than 85% of upland irrigation water is extracted from privately owned groundwater wells and surface water dominated by drip systems except Disi and Mudawarra where pivot sprinkler is used. Plastic mulch and plastic houses which conserve water are extensively used in the high lands. Serious efforts by the MWI are exerted to monitor and control annual pumping from wells by enforcing metering. In the year 2000, irrigated agriculture in the Highlands consumed about 298 MCM (an average of 700 CM per dunum), of which 198.5 MCM of ground water, 88.5 MCM of surface water (streams and springs), and 11 MCM of treated wastewater.

