BRIEFING / 3.1

June 2013

GLOWA

Socio-economics of water allocation in Jordan

Key findings

We developed a model framework for assessing the impact of changing economic and political conditions on agriculture and the potential agricultural development and how these changes may alter the conditions governing the life and work of farmers. Our most significant findings are:

- Agriculture will gain from potential economic growth whereas regional political developments are less relevant.
- Independent of the social and political development the prize of cultivated land and agriculturally used water will increase resulting in an increased gross margin of crops.
- Water scarcity will be eased by increasing use of treated wastewater as a result of demographic growth.
- Rising temperatures will enable the production of high-value crops earlier in the year.

Overview and Objectives

Socio-economic impacts of water allocation are the outcome of a complex system of inter-dependencies between peoples' livelihoods, resource availability, tenure, economic activities, infrastructure, environmental conditions and respective expectations of the future. The socio-economic research group focused on agriculture, which is the most influential economic sector with regard to the use of natural resources. Local natural conditions, except for water supply, constitute a strong advantage for agricultural production, which holds in particular for the "natural greenhouse" conditions of the lower Jordan Valley. Agriculture is the social and economic backbone of communities in the Jordan Valley. The objective of this research was to develop a model frame work that allows: (1) prognoses of impacts from changes in water, climate and other conditions on the economic performance of agricultural activities and their socio-economic consequences; (2) the comparison of developments in agriculture under different scenario assumptions and (3) the calculation of shadow prices of land and water.

Research Methods

The research area was located at the northern, middle and southern Ghors of the Jordan Valley (Figure 1). The majority of Jordanians agriculture located within the study area depends fully on irrigation. Farming systems in Jordan are primarily family enterprises, where agriculture is inseparably linked to household economics and other alternative ways of employment. Our model of the Jordanian farming systems relies on a matrix, which allowed for simultaneous consideration of household demands to resources and alternative resources used for off-farm activities to provide the shadow price of limiting resources as a result of their sensitivity analysis. The model implements different levels of farming systems (FaSym) which are described as low/ middle family income and high family income from either various different sources or from agriculture only. The model outputs comprised information on (1) the economic success under optimal organization, (2) the extent of activities, such as different types of plant production, (3) the use of resources, such as water and land in different months and (4) the maximal value of the next unit of resources after exhaustion of the existing capacity constraints, i.e. shadow prices of land, water and other resources. The

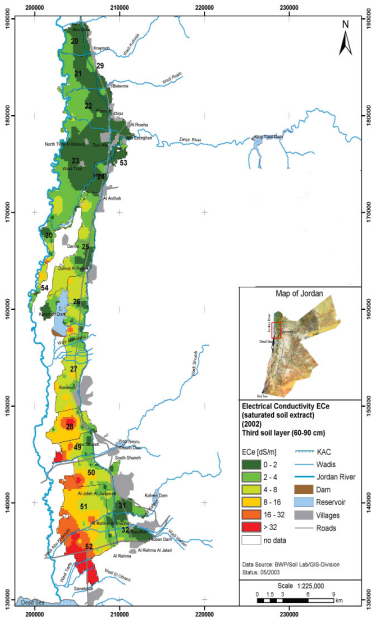

Figure 1: The study Area in the Jordan Valley.

Teams of researchers from Germany, Israel, Jordan and the Palestinian Authority work on how best the hazards posed by global change to the future of the Jordan River basin can be faced and overcome.

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model was run for four scenarios, representing different levels of political and economical achievement (Briefing 1.1 and 1.2).

Scenario 1: "Poverty & Peace" will lead to a disproportional increase of the economic potential of irrigated agriculture. However, Jordanian farming systems would be able to realize only a fraction of this potential under the given structural conditions. Impacts would be significantly different between the four identified types of farming systems. This suggests a structural change towards large areas with irrigation infrastructure (Figure 2).

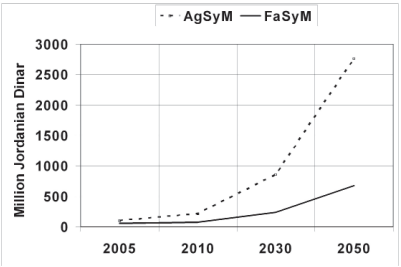

Figure 2: Scenario 1: "Poverty & Peace".
AgSyM: Agricultural System
FaSyM: Farming System

Scenario 2: "Willingness & Ability" shows positive developments in both dimensions and would enhance the economic potential of irrigated agriculture in Jordan, though to a lower degree than in scenario 1. Reasons are, amongst others, the higher freshwater demand of competing economic sectors (Figure 3).

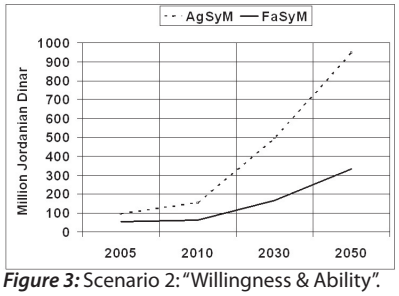

Figure 3: Scenario 2: "Willingness & Ability".
AgSyM: Agricultural System
FaSyM: Farming System

For Scenario 3: "Modest Hope" results show that a lack in progress of the regional peace process has no serious consequences for the development of economic potentials of irrigated agriculture in Jordan, as long as the economic situation is favorable.
However, for Scenario 4: "Suffering" results show that the economic potential of irrigated agriculture in Jordan would develop along a sinuous line with a slight upward trend under the assumption of a negative situation in both dimensions.

Conclusions

The development of the economic potential of agriculture, farm incomes and the related demand to water and land resources varies strongly under the assumptions considered. Agriculture will gain most from a positive economic development. The prize of cultivated areas and water for agriculture will increase under all scenarios and results in an increased gross margin of crops. The water value (US$/m^3) is expected to increase from US$ 2.1/m^3 to US$ 8.1/m^3 for winter vegetables.

Water scarcity is currently the main limiting factor for the expansion of agricultural areas. A 20% reduction of fresh water supply led to a decrease in the total cultivated areas by 14% from 292 to 251 thousand dunums (1 dunum = 0.1 hectare). Cultivation area for spring vegetables decreased by 16%, for fruit tree by 19% and field crops by 48%.
However, the water scarcity in agriculture will be strongly eased in particular by increasing inflows of treated wastewater as a function of the projected demographic growth. Increasing temperatures due to climate change would additionally contribute to this development by enabling production of high-value crops earlier in the year.
Therefore, a shift towards the cultivation of high value crops irrigated with treated wastewater can be expected.
Furthermore, climate change is expected to increase the unemployment rate; the living standards of hired labor in general and women in particular will decrease.

Finally, the developed modelling framework proved its suitability for the assessment of impacts from changing conditions on agricultural potentials and for the identification of gaps between these potentials and their actual impacts under the existing conditions of farming systems and enterprises.

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GLOWA JR Briefings present relevant scientific results of the GLOWA Jordan River project concerning the effects of climate and global change in the Jordan River basin.

Written by Dr. Emad Al-Karablieh &
Dr. Amer Salman
Arab Technologist for Economical and Environmental Consultation (ATEEC), Jordan
karablieh@ju.edu.jo; asalman@ju.edu.jo

Contact: Prof. Dr. Katja Tielbörger
University of Tübingen, Germany
coordination@glowa.uni-tuebingen.de
Tel. +49 7071 29 74246