

INTEGRATED EVALUATION AND MANAGEMENT OF WATER RESOURCES IN THE SOUTHERN ARAVA VALLEY

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The increasing consumption and the growing degradation of natural water sources by municipal, agricultural and industrial users creates a problem of assessing and mitigating the evident danger to public health and the environment in the Arava region. The authorities are required to generate adequate policy to deal with the severe situation, but before doing so, it is necessary for the water stakeholders in the region and the relevant experts to enter into consultation with one another, paying reasonable regard to the rights and legitimate interests of each party, in order to arrive at a scientifically rigorous decisions and equitable plans.

Up to now, the focus of the bulk of water-related research in the Middle East has been on the Jordan River watershed. Little research has been done as yet for the Arava Valley region. However, the Arava Valley provides a unique opportunity for exploring stakeholders and community involvement in water conservation and policy including the trans-boundary aspects of its integrated management. Along the Arava Valley, communities on both sides of the border (Israeli and Jordanian) share common groundwater sources, but differ in livelihood and water supply and wastewater treatment infrastructure. This situation creates an imbalance in water use.

Important steps were already taken to introduce suitable water use systems to the area. For example, adaptation of sophisticated farming techniques to the harsh climatic conditions of the Arava Valley has enabled growing of out-of-season fruit and vegetables, mainly for export. Despite the harsh hydrological realities, Israel pursues exhaustive agricultural practices in the region. With intensive irrigation, field crops such as onions, potatoes and watermelon are grown. Many of the agricultural settlements also pursue dairy farming. The dominant crop in the region is the dates, which is a high salt tolerant crop. It should be noted that the waters of the region are naturally brackish and significant quantity of the water needs is covered by desalination.

Groundwater is thus continually abstracted to meet the needs for current and future agricultural lands. This demand will create added pressure on pumping in the wells and for seeking of new wells. Some of the deepest wells in the world may be found in the Arava. Yet, there is little information on the effects of pumping on the quantity and quality of water in the region and how it should be allocated among competing uses. Annual allocations of water to each farmer/settlement are preset and supplied by the government (Mekorot, the Israel National Water Company). Distribution is according to a centrally managed quota system with built in provisions, for agriculture such as price subsidies.

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The extremely centralized system of water management in Israel in general and in the Arava, in particular, creates an artificial buffer zone between the resource and the public's perception of it. Currently, there is a need for receiving more effective feedback from the public on the acceptance of such a system. National policy and research on alleviating water scarcity have emphasized increasing supply in the face of rising demand rather than on the more obvious solution of conservation programs for existing supplies. Implementing such programs requires linking the needs of local communities with those of national policy makers. There is potential to create such a link at the community level, where components of society, including agriculturists, industrialists and policy makers, interact.

This research aims to explore innovative technologies in water resources protection (such as for example, ecological sanitation, wastewater recycling for irrigation, using rainwater, etc), as well as closed circuit financing leading to water saving/protection at lower costs. These alternatives are compared on the basis of risk-cost-benefit analysis with the help of computer simulation.

The work focuses on two main directions: (1) development of a new methodology for generating policies for efficient water management and protection of water sources at a regional level, and (2) design of a computer-based decision-support system for pollution control and protection of water resources in the Southern Arava Valley of Israel. The study addresses and analyzes multiple interests of water stakeholders in the region aimed to coordinate their organizational and managerial activities in order to mitigate the total environmental risks for all stakeholders related to over-exploitation and pollution of water resources. Original computer models based on a combination of risk assessment techniques, mathematical statistics and factor analysis are used for statistical analysis of water resources reserves in 2005-2020, generating efficient water policies and comparing various scenarios of water utilization in the region.

The computer-aided models and prognoses allow experts, politicians and decision-makers for considering a full realm of water resource policies and evaluate different scenarios of water utilization at both regional and national scales. Once tested and approved, the models will be expanded in the future to include the city of Eilat and the trans-boundary regions in Jordan (Aqaba), Egypt (Sinai) and similar arid and semi-arid regions.

Although there are some good examples of ongoing programs on trans-boundary water cooperation in Europe and, in particular in Germany, in the Mediterranean area such activities are scarce and lack coordination. Lessons can be drawn from the principles of the EU Water Framework Directive on integrated water resource management. The Water Framework Directive is now in the first phase of its implementation. The German partners of the present international research are responsible for revising the international aspects of the transboundary water management regime in the region, evaluating the current status and making recommendations for potential improvement in the foreseeable future. Lessons are learned up to now from the transboundary management regime of European basins such as the Danube and the Rhine. The water policy group of the Technical University of Berlin contributes lessons learnt from the Maas River watershed and the development of a handbook in managing stakeholder relationships. Success factors will be reviewed and discussed concerning their applicability for the study area of the proposed project. In this part of the present study, the objectives, needs and constraints of the stakeholders are defined. Although the Danube and Rhine transboundary agreements are, of course, of a different type than those in the Arava

region, similar features can be outlined, and success factors will be reviewed and discussed concerning their applicability in the study area of the proposed project.

Experience with management tools for monitoring, assessment and management of internationally shared groundwaters is also available at the regional level, especially within ECE (United Nations Economic Commission for Europe). These include frameworks and implementing mechanisms for the ECE Helsinki Convention on the Protection and Use of Transboundary Waters and International Lakes, the Convention on Environmental Impact Assessment (EIA) in the Transboundary Context, and a number of non-binding guidelines (e.g. on monitoring and assessment of transboundary groundwaters). Nevertheless, a comprehensive institutional response to acknowledged transboundary aquifer management problems has not yet emerged. It is therefore important to transfer where relevant and to adapt where necessary, existing experiences from transboundary surface water management to transboundary groundwater management. The cooperation of Israeli and German partners in the framework of this joint work allows for creating a foundation for building the environmental and social aspects of the transboundary water management regime in the Southern Arava Valley.

Bibliography

1. K.-H. Elster, E.V. Levner, et al., *Modern Mathematical Methods of Optimization*, Akademie Verlag, Berlin, 1993, 416 pp.
2. U. Shani, et al., *Irrigation management in a dynamic soil-water-yield system*, OCAM, 2004.
3. V. Hartje, *International Dimensions of Integrated Water Management*, in: I. Al-Baz, W. Scheumann (Eds) *Co-operation on Transboundary Rivers*, Baden-Baden 2002, p.7-34.
4. Kraemer, R. Andreas, Eduard Interwies, and Eleftheria Kampa 2002: *Tradable Permits in Water Resource Protection and Management - A Review of Experience and Lessons Learned. Implementing Domestic Tradable Permits: Recent Developments and Future Challenges*. OECD. Paris, OECD.