BRIEFING / 2.3

June 2013

GLOWA Jordan River

Water management in a complex hydrological basin: Application of WEAP to the Lake Kinneret watershed

Key findings

We were able to show how:

- to incorporate and integrate the main hydrological components of a complicated hydrological system into an integrated water resources management (IWRM) using various, independent models.
- to identify vulnerable partial areas which are more sensitive to extreme conditions; and exemplified how to separate between the effect of "climate change" and the effect of operational decisions on water availability.

Overview and Objectives

Sustainability of fresh water ecosystems and human activities in Mediterranean watersheds under future climate change can be supported with integrated hydrological modeling. The Lake Kinneret Watershed (LKW), which spans over 2730 km^2, is divided between the three countries, Israel, Lebanon, and Syria; and incorporates four different hydrogeological units: Mt. Hermon in the north, the Golan Heights in the east, the eastern Galilee Mountains in the west, and the Hula Valley in the central part of the watershed (Figure 1).

In Sade et al. (2013) we simulated the complex hydrological and water demand system of LKW, focusing on two main objectives:

1) Incorporating the main hydrological components of the LKW into an integrated water resources management (IWRM) tool for a large heterogeneous watershed.

2) Identifying vulnerable areas inside LKW which are more sensitive to climate change.

Research Methods

The complexity of LKW required the integration of several modeling tools, constructed on the basis of a central platform: the Water Evaluation and Planning (WEAP) tool (Briefing 2.1). The other hydrological tools that were used were the Hydrological Model for Karst Environment (HYMKE; Rimmer and Sal-

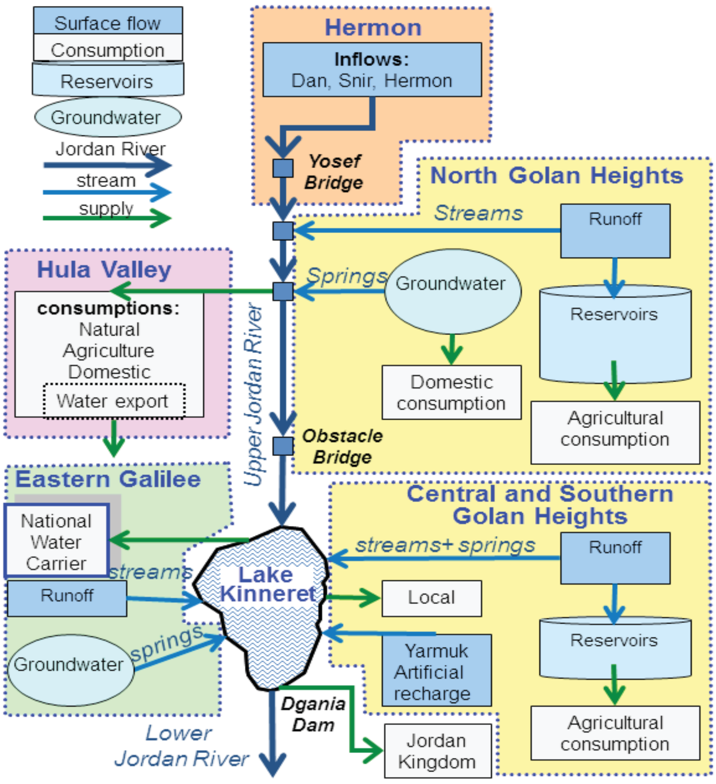

Figure 1: Schematic presentation of the Upper Catchment of the Jordan River (UCJR) water system.

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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The GLOWA Jordan River project is part of a larger research initiative launched by the German Federal Ministry of Education and Research under the title "Global Change and the Hydrological Cycle".

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ingar 2006), lake water balance calculations and artificial rain series based on a stochastic rainfall generation tool.

Simulating Mt. Hermon streams

This region is the source of most of the water in the catchment. Rainfall-runoff procedures were modeled and calibrated separately with the HYMKE. The daily output of the calibrated model formed the calculated discharge of the Jordan River, and was introduced as monthly input to the WEAP.

Simulating the Hula Valley

The information on the land-use was extracted from maps generated by the Survey of Israel and by the Crop Ecology Laboratory, Migal (Israel). For calculation of water demands within the valley, only consumers which directly receive water from the Jordan River were used, i.e. field crops, fruits, water bodies and riparian vegetation (Figure 2). For evaporative loss prediction we used reference evaporation from the Israeli Meteorological Service, which was calculated by the Penman Monteith equation using data from the Kfar Blum meteorological station.

Simulating the Golan Heights

The Golan area was simulated with the rain runoff module (RRM) inside WEAP. We used the monthly time series data of 14 rain gauges to generate the spatial distribution of rain on the Golan. Using the RRM we evaluated the inflow into the local reservoirs. The watersheds which include a reservoir were divided into upstream and downstream reservoirs. The reservoir overflow was linked to the main stream of each watershed so that the total flow from each watershed was flow from both parts excluding the reservoir storage.

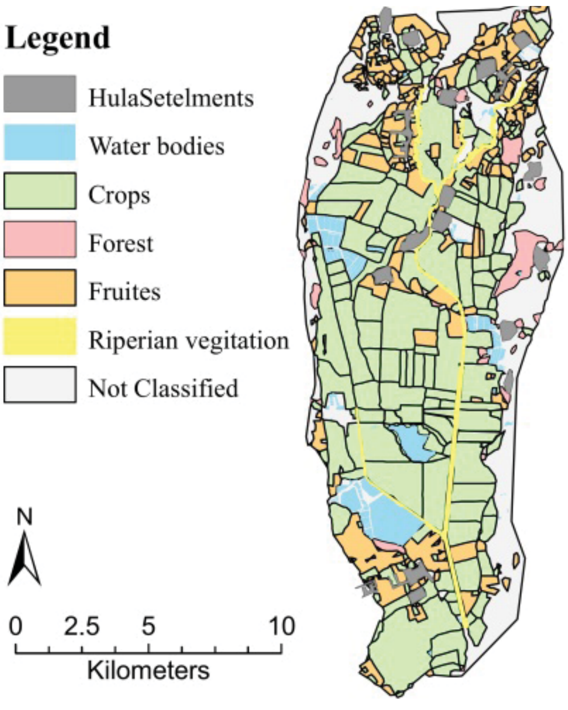

Figure 2: Land use map of the Hula Valley.

Simulating the Lake Kinneret Water balance

The Lake Kinneret Water balance is simulated in WEAP as a reservoir on the Jordan River. Inflows were calculated from the cumulative models of the four upstream units. The pumped outflows were set as monthly measured time series. Both, the evaporative loss and the contribution of the saline springs were introduced as calculated time series, based on the long term solution of the water-solute-energy balances.

Conclusions

The Golan and Hula areas represent two different kinds of water production strategies. The Golan area relies on local reservoir with no long term storage. The Hula area irrigation relies on the supply of water from direct pumping from the Jordan River. The results of regional water supply system analysis imply that the National Water Carrier and the Hula are more vulnerable to the lake operation rules, then to "climate change". This is explained by the large volume of water flow in the Jordan River with respect to total water demand in this area. The Golan is operated almost autonomously, thus is less vulnerable to operation rules and more sensitive to local climatic conditions.

References

Rimmer, A., and Y. Salingar. 2006. Modeling precipitation -streamflow processes in Karst basin: The case of the Jordan River sources, Israel. Journal of Hydrology 331/3-4, pp 524-542.

Sade, R., R. Samuels, Y. Salingar, M. Denisyuk and A. Rimmer. 2013. Water management in complex hydrological basin - Application of Water Evaluation and Planning Tool (WEAP) to the Lake Kinneret watershed (submitted).

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.

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