


# BRIEFING / 2.7

June 2013

GLOWA Jordan River

# A view on current and future water resources

## Key findings

- The hydrological model TRAIN (Menzel & Törnros 2012) was successfully applied to reproduce the water conditions of the region. For the first time, a detailed overview of current water availability has been compiled for the Middle East
- Data from three climate model combinations were fed to TRAIN to generate water scenarios. They show that a clear precipitation decrease can be expected in the coming decades
- A decrease in rainfall leads to significant reductions in water availability and reduces total river runoff while irrigation water demand increases
- Climate change appears to dominate over land-use change impacts on water resources. There is, however, a potential to reduce adverse climatic effects by appropriate land-use planning

## Overview and Objectives

The study aims at the determination of the water balance elements, with special focus on evapotranspiration, water availability (surface runoff and groundwater recharge) and irrigation demand for the Jordan and Dead Sea catchments and their surrounding area (approx. 100,000 km$^2$). Further, simulations for a set of scenarios of environmental change, including both land-use and climate change, are carried out in order to evaluate the related changes in the water balance. For a better management of the scarce water resources of the region and to support the refinement and revision of regional scenarios, the results are both delivered to the Water Evaluation and Planning tool (WEAP) and to the regional scenario building process (SAS) (Briefing 2.1 and 1.1).

## Research Methods and Results

The investigations include hydrological simulations on different spatial scales. Small-scale studies serve to further develop and validate the hydrological model TRAIN regarding the description of the hydrological processes of the region. For example, TRAIN was set up and calibrated to reproduce the runoff of selected wadis draining to the Dead Sea or to simulate the water balance of the semi-arid Yatir forest in Israel.

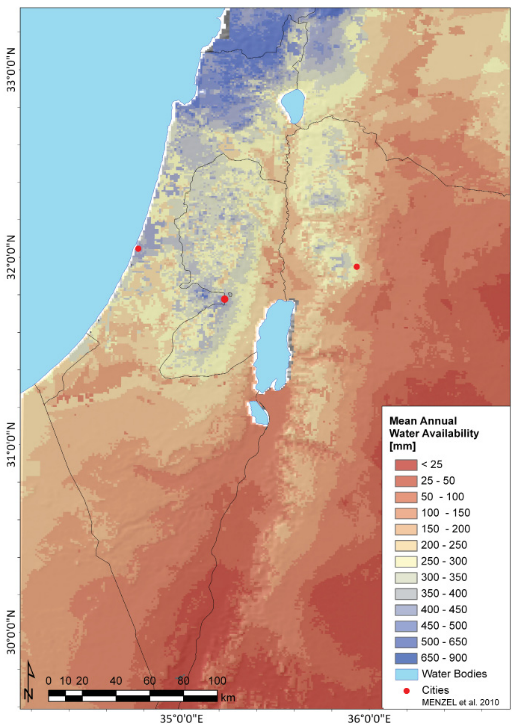


*Figure 1:* Mean annual water availability for the reference period 1961-1990.

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".

http://nbn-resolving.de/urn:nbn:de:bsz:21-opus-69676

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TRAIN was able to successfully represent the observed runoff as well as the evapotranspiration at the investigated sites. After validation on the point scale, TRAIN was applied to cover the whole project region. The model was first applied to simulate the water balance elements and water availability for current climate conditions (1961-1990) on a daily time step, taking into account the varying physiographic conditions (soils, vegetation, land-use) on a 1x1 km grid (Figure1).

Afterwards, data from three combinations of Global Climate Models (driven by IPCC emission scenario A1B; Smiatek et al. 2011), Regional Climate Models and TRAIN were used to determine changes of selected water indicators with reference to current conditions (with land-use remaining unchanged). The climate projections show that precipitation is predicted to drop considerably (Figure 2). As a consequence, water availability shows an over-proportional decrease. Hence, in order to sustain agriculture at its current extent and intensity, a considerable amount of additional irrigation water would be required. Note the uncertainties from the different model combinations (Figure 2).

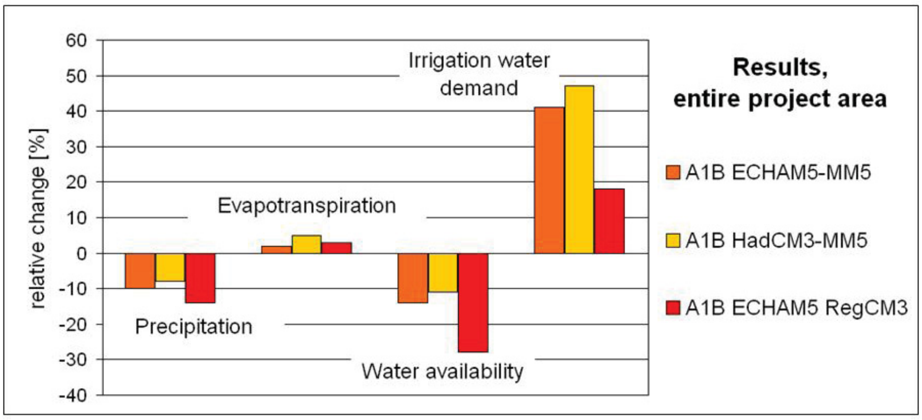


***Figure 2:*** Relative changes in selected water indicators between current (1961-1990) and future (2031-2060) conditions, representing the impact of three climate scenarios.

## Conclusions

Results for the current state demonstrate the scarcity of water resources in major parts of the region. The climate scenarios clearly indicate a deterioration of the water situation. To investigate possible land management options for a mitigation of the expected adverse impacts of climate on water availability, TRAIN was applied with land-use scenarios (Menzel et al. 2009). The simulation study shows that land-use changes have an obvious impact on the amount and distribution of water. But the predicted climate change and its control over water resources is projected to clearly overbalance any efforts to conserve water through land management measures.

## References

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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.

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