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GLOWA Jordan River

The Renaissance of an Ancient Technique: Rain Water Harvesting Potentials in the Lower Jordan River Basin

Key findings

- Urban and rural rainwater harvesting offers significant potential for contributing to decentralized water supply in the Lower Jordan River Basin.
- The degree to which water resources accessed via rainwater harvesting can contribute to the region's overall water supply is dramatically reduced during drought periods.
- When incorporating rainwater harvesting into a water management strategy, downstream impacts and the high temporal variability of available water must be considered.
- Due to population growth and increasing urbanization of land in the Lower Jordan River Basin, opportunities for urban rainwater harvesting will increase.

Overview and Objectives

Two thousand years ago, the Nabateans used rainwater harvesting (RWH) for water supply. They collected water for domestic purposes (urban RWH) and used surface runoff for agriculture (rural RWH). Both types of RWH have gained interest among modern-day water resources planners seeking methods to alleviate present-day water scarcity in the Lower Jordan River Basin (LJRB). In the following, a basin-wide evaluation of the RWH-potential in the LJRB is presented.

Research Methods

We estimate RWH-potentials based on radar rainfall data (5 min) and model results of the TRAIN-ZIN model (Gunkel & Lange 2012, Briefing 2.8). The Jordanian parts of the LJRB outside a 150 km range around the location of the rainfall radar are excluded due to uncertainties in rainfall estimates.

Potentials for Rural Rainwater Harvesting

The maximum amount of water available for RWH is calculated as generated overland flow from the TRAIN-ZIN model, determined by soil properties, land use and topography. As a basin-wide mean for the entire LJRB, this maximum potential is 42 mm during an average season (2002/03) and decreases to 7 mm during a drought period (1998/99). However, not the entire potential can be used. On the one hand, topography dictates applicable techniques (Figure 1): theoretically, slopes between 0% and 5% are suitable for microcatchment systems (small-scale collection sites for catching surface runoff), while slopes greater than 10 % are suitable for hillside conduit systems (small conveyance channels which direct water to fields at the foot of the slope). On the other hand, generated overland flow is captured by reservoirs and used for irrigation, especially in many Jordanian tributaries. In these latter situations, RWH should be restricted to avoid negative downstream effects i.e. water shortages.

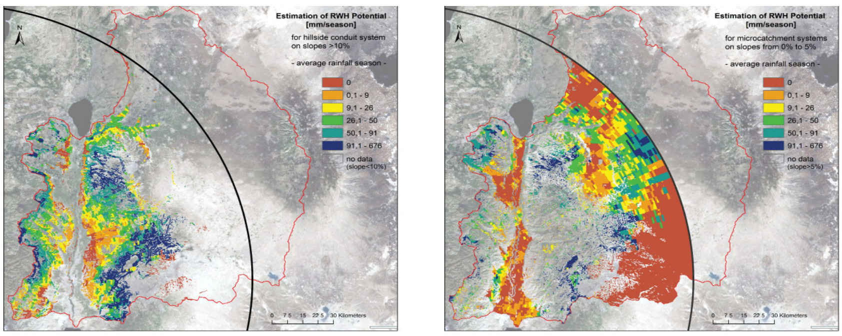

Figure 1: Estimated rural RWH potentials for selected techniques during the average rainfall season 2002/03.

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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http://nbn-resolving.de/urn:nbn:de:bsz:21-opus-69696

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Potentials for Urban Rainwater Harvesting

A contiguous data set of urban areas in the LJRB was derived from different data sources. For the Israeli part, a vector data set delineated buildings as a distinct class. Urban areas of the Palestinian Authority were digitized from aerial photos with a spatial resolution of 1x1 m^2. In Jordan, urban areas were extracted as a distinct pixel value class (78 x 78 m^2) from a land use map and converted to vector data.

Again, rainfall radar data of two selected seasons was used as input. A GIS overlay of 1×1 km^2 annual rainfall volumes and the urban vector data set yielded the annual rainfall that fell on urban areas. This data set was multiplied by the factor 0.2 to account for the fact that approximately 20% of urban areas in the Middle East are covered by roof areas (Grodek et al. 2011). To obtain volumes of actual urban RWH, the data was multiplied by a variable roof runoff coefficient, RC. RC was varied according to a linear regression found between annual rainfall amount and simulated RC of the Palestinian town of Ramallah (Lange et al. 2012). The resulting maximum potentials are given in Table 1.

Conclusions

Both RWH techniques offer high potential for decentralized water supply. This potential is significantly decreased during periods of drought. Techniques of rural RWH must be adapted to topography and should be avoided in areas feeding important reservoirs. Urban RWH is currently a relatively small resource. However, due to population growth and projected urbanization, its potential will increase in future.

Table 1: Potentials of urban RWH in different parts of the LJRB for two selected seasons (from Lange et al. 2012).

Part of the LJRB	Total area [km^2]	Urban area [km^2]	RWH potential [10^6 m^3]	Total area [10^6 m^3]
			Drought (1998/1999)	*Average Season (2002/2003)*
West Bank	1523	39	1.34	4.29
Israel	979	22	0.83	2.27
Jordan*	6877	233	0.87	13.21
Total*	9379	294	3.04	19.77

** only parts inside the 150 km range from the rainfall radar*

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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