GLOWA – Jordan River

AN INTEGRATED APPROACH TO SUSTAINABLE MANAGEMENT OF WATER RESOURCES UNDER GLOBAL CHANGE

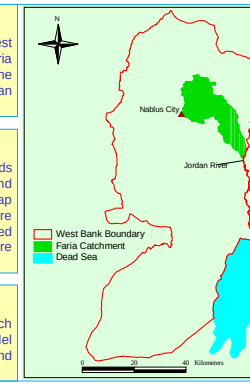
Project 5: Hydrological Modeling, Assessing Water Availability for the Jordan River Basin. Focus Area: Faria Catchment, West Bank

Statement

To obtain dependable estimates of naturally available, regional water resources in the Lower Jordan River Basin (LJRB). Project 5 applies up to date, process based modeling techniques (coupling the models TRAIN and ZIN), integrating novel measurement techniques (volume scanning rainfall radar), existing scientific results and local expert knowledge in a multinational project team. Models will be applied and tested in three focus areas and then regionalized to the entire LJRB. As a focus area, Faria catchment represents the West Bank.

Faria Catchment

The Faria catchment is located in the northeastern part of the West Bank and extends to the Jordan River. It is characterized as a semiarid region with an area of 320 km² (6% of the of the West Bank). The Faria catchment lies within the Eastern Aquifer Basin, which is one of the three major groundwater basins forming the West Bank groundwater resources. Topographic relief of Faria changes significantly throughout the catchment. In less than 30 km there is a 1.25 km change in elevation. The winter rainy season is from October to April and the rainfall distribution within the catchment ranges from 630 mm at the headwater to 150 mm at the outlet. The mean annual temperature changes from 18 ºC at the head of the catchment to 24 ºC in the proximity to the Jordan River. The maximum potential rate of evapotranspiration ranges from 1400 mm/year in Nablus to about 1540 mm/year in the lower part of the catchment.



Faria Water Problems

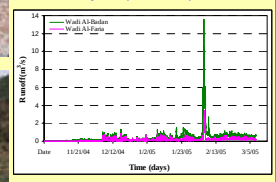
The predominantly rural population in the catchment is growing rapidly, which results in an increasing demand for water and an elevated stress on water resources. The prolonged drought periods in the catchment in addition to the fact that; the water is not properly allocated between upstream and downstream communities have negatively affected the existing obtainable surface water and groundwater resources. The available water resources in the Faria catchment are limited and not sufficient to fulfill the agricultural and residential water demand. The estimated annual water gap between water needs and obtainable water supply is about 20 millions cubic meters. Lack of proper management of water resources causes over utilization of the scarce water resources. More than 40% of the people in the catchment lacks water supply for drinking purposes. There is lack of storage capacity e.g dams to capture flood water during the rainy season in order to be used later. In addition, the discharge of untreated wastewater and unbalanced use of fertilizers and pesticides pollutes water resources. Hence, like the entire West Bank, Faria catchment faces severe water problems that need to be investigated to develop sound mitigation strategies.

Model

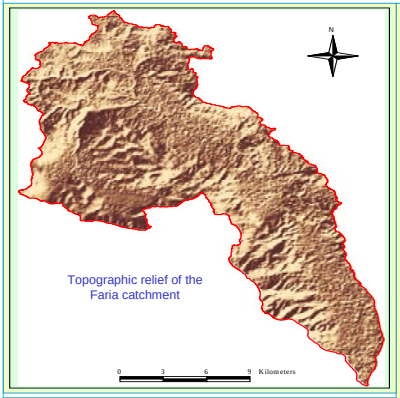
The coupled TRAIN and ZIN models will be used to model the naturally available water resources in the Faria catchment. The TRAIN model is a physically based, spatially distributed approach which has been designed to simulate the spatial pattern of long term water budget components with a special focus on evapotranspiration. The ZIN model is a single event, hydrological model which concentrates on dominant flood generation processes (i.e. infiltration and saturation excess runoff) and can be fully parameterized using existing information from catchment topography and field measurements.

Part of the air photos that used to develop the runoff generation map and to delineate the streams network for the Faria catchment.

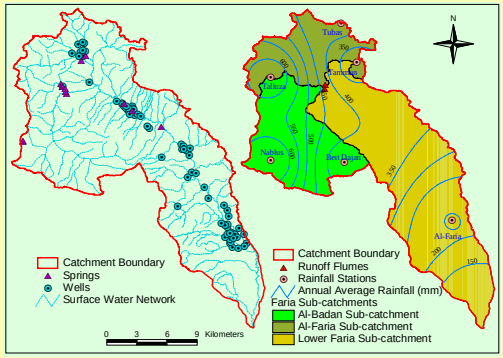
In phase 1 of GLOWA JR two Flumes were designed and constructed together with data loggers to measure and record the flow through Wadi Al-Faria and Wadi Al-Badan. The constructed Flumes are still working and records are available for the two years (2004-2006).



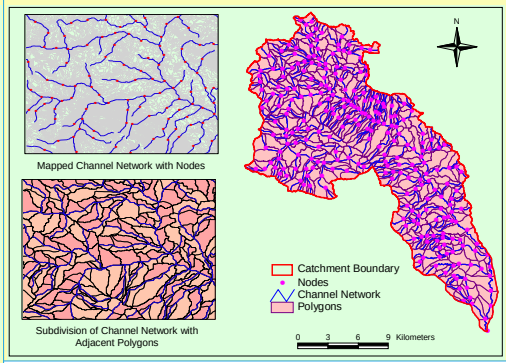
Measurements of runoff in 2004-2005 for Wadi Al-Badan and Wadi Al-Faria. Apart from one major runoff event continuous baseflow is apparent



The Faria catchment is divided into three sub-catchments. The upper part forms Al-Badan (83 km²) and Al-Faria (56 km²) sub-catchments. The lower Faria sub-catchment has an area of (181 km²).

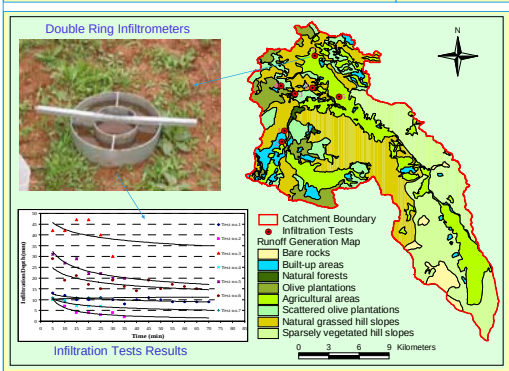


Hydrological network for the coupled TRAIN and ZIN models: Based on GIS-analysis the channel network is divided into segments which are adjoined by small sub-catchments (model elements) delineated according to topography.



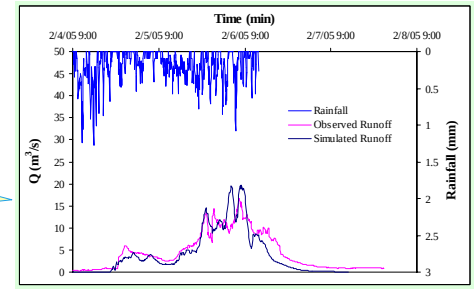
Based on air photos, a runoff generation map was created to describe runoff generation in the ZIN model. Double ring infiltrometers were used to measure the infiltration rates at different characteristic terrain types in the upper part of the Faria catchment.

The Faria catchment contains 13 fresh water springs and 70 wells, of which 62 agricultural wells, 3 Domestic and 5 wells controlled by Israeli. Annual discharge from these springs varies from less than 4 to 42 MCM with an average amount of 13.5 MCM. The total utilization of the Palestinian wells ranges from 4.4 to 11.5 MCM/year, while the total abstraction from the 5 Israeli controlled wells is unknown.



Results

The main rainfall event in the rainy season 2004-2005 was successfully simulated by the single-event version.



Further Steps

- The coupled TRAIN-ZIN-models will be optimized and applied to the entire seasons.
- Additional to the ground measurements rainfall radar data will serve to measure historic extremes (1991/92 and 1998/99 seasons).
- An empirical model will be used to account for baseflow (springs and wastewater discharges).
- With this model, a set of global change scenarios and options for local water resources management in the Faria catchment will be developed.

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