German-Lebanese Technical Cooperation Project

Water balance for the Jeita groundwater catchment using WEAP

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I. Problem statement
II. Objectives of the model
III. WEAP model
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I. Problem statement

• High karstification of the Jurassic (J4) and Cretaceous (C4)
I. Problem statement

- Quantity of Jeita discharge influenced by:
  - Climate
  - Ecosystem
  - Agriculture
  - Domestic
I. Problem statement

- Seasonal variation of discharge of Jeita Spring

Average monthly discharge of Jeita Spring in MCM between 1966 & 1971

Available resources for supply management?
II. Objectives of the model

- Hydrological balance on a monthly basis
- Assessment of hydrological components:
  - Rainfall
  - Evapotranspiration
  - Surface runoff
  - GW recharge
- Domestic & agricultural demand
- Origin of Jeita’s groundwater
- Water management options: MAR
III. WEAP model

- Water Evaluation and Planning
- Non-commercial software
- Developed by the Stockholm Environment Institute
- Used within the MENA region
  - Jordan, Morocco, Tunisia, Palestine, Syria
- Conceptual in- & output model
- Modeling of hydrological budget
- Natural and anthropogenic supply and demand
III. WEAP model

- Discretization
- Sub-division into 11 sub-catchments
  - I. Geology
  - II. Surface runoff
  - III. Spring- & reservoir catchments
- Reflect spatial variability:
  - Topography
  - Rainfall
  - Evapotranspiration
III. WEAP model

### Geology-based
- Aquitard [J5-C3]
- C4
- J4

### Spring- & reservoir-based
- Labbene (8)
- Assal (7)
- Afqa (6)
- Chabrouh Dam (9)
- Rouaiss (10)

### Surface runoff-based
- Aquitard [J5-C3] leaving JSC (4)
- Aquitard [J5-C3] to Daraya (1)
- Aquitard [J5-C3] to Nahr Ibrahim (11)
- J4 leaving JSC (5)
- J4 to Daraya (3)
- C4 (2)

Data basis: BGR, SRTM DEM, Landsat 7
III. WEAP model

- Input parameters:
  - Rainfall
  - ET
  - Landcover
  - Landuse
  - Domestic demand
  - Irrigation efficiency
  - FAO crop coefficients
  - Chabrouh dam
  - Irrigation canals
  - GW abstraction
  - ...

Protection of Jeita Spring
IV. Results

Total annual precipitation leads to:

- Flow to Groundwater: 61%
- Surface Runoff: 26%
- Evapotranspiration: 13%
Natural annual water balance of the Jeita Spring catchment in MCM

- Rainfall: 406 MCM
- Snow: 375 MCM
- GW recharge: 213 MCM
- Natural ET: 164 MCM
- Runoff: 162 MCM
- Snow melt: 78 MCM
- Rainfall infiltration: 213 MCM
IV. Results

C4 contribution: 89.2 MCM/a 51.7% of Jeita’s discharge

J4 contribution: 52.9 MCM/a 30.7% of Jeita’s discharge

Aquitard contribution: 30.3 MCM/a 17.6% of Jeita’s discharge

Afqa & Rouaiss contribution: 69.7 MCM/a 40.4% of Jeita’s discharge

C4 contribution: 89.2 MCM/a 51.7% of Jeita’s discharge
V. Conclusion

• > 50% of Jeita’s annual discharge comes from the C4

• > 40% of Jeita’s annual discharge comes from Afqa and Rouaiiss Spring

• Large quantities of water resources are unused: 164 MCM direct runoff per year

• Potential for MAR: Increasing discharge at Jeita and reducing the water shortage period
& Thank You!

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