German-Lebanese Technical Cooperation Project

Public Awareness Campaign for Schools

WEAP Model for the Catchment of Jeita Spring

BGR
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Protection of Jeita Spring
• Water Evaluation and Planning
• Non-commercial software
• Developed by the Stockholm Environmental 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
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**WEAP model III**

- **Hydrologic equation:**
  - \( P = R + ET + \Delta S \)
  - **Precipitation (P) [MCM]:**
    - \( P_{\text{availEtLc}} = P_{\text{HU}} \times \text{area} \times P_{\text{eff}} \times 10^{-5} \)
  - **Runoff (R):**
    - \( \text{Max} (0, P_{\text{availEtLc}} - ET_{\text{pot}}) + (P_{\text{LC}} \times (1-P_{\text{eff}})) + (1-IrrFrac) \times \text{Supp} \)
  - **Potential evapotranspiration (ET_{\text{pot}}) [MCM]:**
    - \( ET_{\text{pot}} = ET_{\text{ref}} + k_c \times \text{area} \)
  - **Actual evapotranspiration (ET_{\text{act}}):**
    - \( ET_{\text{act}} = \text{Min} (ET_{\text{pot}}, P_{\text{availEtLc}}) \)

- **P_{\text{availEtLc}}:** P available for evapotranspiration [MCM]
- **P_{\text{HU}}:** P on hydrological unit [MCM]
- **P_{\text{eff}}:** effective P [%]
- **P_{\text{LC}}:** P on land cover unit [MCM]
- **ET_{\text{ref}}:** reference ET [mm]
- **ET_{\text{act}}:** actual ET [MCM]
- **Kc:** FAO crop coefficient
- **Area:** area pf land cover [ha]
- **IrrFrac:** Irrigation efficiency [%]
- **Supp:** supplied irrigation

**Protection of Jeita Spring**
• Input parameters:
  • Rainfall
  • ET
  • Landcover
  • Domestic demand
  • GW abstraction
  • Irrigation canals
  • Irrigation efficiency
  • FAO crop coefficients
  • Chabrouh dam
  • …
WEAP model V

- WEAP elements:
  - Catchment node
  - Demand node
  - Groundwater node
  - Reservoir node
  - Spring
  - Diversion
  - Return flow
  - River
  - Runoff/infiltration
  - Transmission link

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Results I

Total annual rainfall leads to [in %]:

- **Groundwater recharge**: 53%
- **Surface runoff**: 27%
- **Evapotranspiration**: 20%

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Annual contribution to Jeita in MCM
- 0.6 - 5
- > 5 - 10
- > 10 - 20
- > 20 - 30
- > 30 - 41.7

Sub-catchment balance
- Precipitation
- Irrigation
- Domestic return flow
- Surface runoff
- ET
- Groundwater recharge

Groundwater leakage & infiltration
- Leakage from Oskhroun dam to GW_C4_North
- Leakage from Nahr Ibrahim to GW_J4
- 30% infiltration from Nahr Ibrahim to GW_J4
- Leakage from surface runoff aquitard, Nahr Ibrahim to GW_J4
- 30% infiltration from Nahr es Sabil to GW_J4
- Leakage from aquitard to GW_J4

Kilometers

Confuence Afpas & Rouaies: 251.1

BGR
• Establishing a water balance is a challenge:
  • Need to establish a data monitoring network
  • Central national database needed
  • Data sharing!
  • Need for expertise in hydrogeology
• Relatively high rates of surface runoff
  • Large potential of usable resources
• Construction of dams may be useful
• WEAP is a proper tool also for Lebanon
& Thank You!

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