Water Supply and Water demand – a model for a better understanding of the Assyrian settlements along the Lower Habur River

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In archaeological projects often rise questions that could be answered with hydraulic or water management

• How was the capacity of a channel or a pipe?
• How do a hydraulic structure work and how do they work together
• Are parts of the system missing
• Is there enough water for people, animals, workshops and agricultural
• and especially in semi-arid regions how many people could live there

Example: Assyrian settlements along the Lower Habur River

• Research focus on channel and settlements of the Assyrian empire starting from 1,300 BC
• Running around 1,000 years
• Habur is the largest tributary river to the Euphrat
• catchment of 36,000 km²
• lower Habur valley extends between Hassakah and Deir ez-Zor
• average runoff: ≈ 50 m³/s

Questions

Modern methods for water management

• Digital terrain model, satellite images and GIS allow an investigation of large areas
• Climate models see no dramatic climatic change in this region near east in the last 5000 years
• Todays climate data could be used for first estimations
• Planning methods for the layout of the route could be used to verify the route of the canal at the Habur
• With the flow of water even for areas there no structure had remain possible routes could be identified
• Estimation of water supply and water demand could help to verify population and irrigated area
• Irrigation water demand was estimated with CropWat (FAO)

Climate

• semi-arid climate
• rain in winter (oct-mar)
• nearly no rain in summer
• unreliable precipitation
• High evapotranspiration
• 3 of 10 years are drought years corresponding

to difficult for irrigation
**Archaeological record**

- First remains of the ancient canal were discovered about 35 years ago by Ergenzinger and Kühne.
- In the lower Halbur valley settled about 24,000 people in Neo-Assyrian times, ~14,000 on the east side (rough estimations).
- About 7,000 lived in the regional capital Dur-Katlimmu – Tall Schech Hamad.
- From the Assyrians a lot of information were available about harvest, ration of grains and workers.
- More discussions are necessary between archaeologists and water experts for a better understanding of the different sources and findings.

**Estimated Water Demand for Dur-Katlimmu – Tall Schech Hamad**

- Water demand for population: $22 \frac{L}{p} \cdot d \rightarrow 160 \frac{m^3}{d}$
- Water demand for craft: $10 \frac{L}{p} \rightarrow 70 \frac{m^3}{d}$
- Water demand for animals: $10 \frac{L}{p} \rightarrow 70 \frac{m^3}{d}$
- Water demand for irrigation session (165 days): $160,000 \frac{m^3}{d}$

**Water demand and supply for irrigation**

- Irrigated area 8,000 ha
- Additional water demand for irrigation 140 mm
- Losses 50%
- Average capacity of the canal 4 m³/s (187,000 m³/d)
- Balance
  - Water demand 22.4 Mio. m³
  - Water supply 30 Mio. m³
- Enough water to irrigate the area between the canal and the river.
General method to compare water demand and supply

- Supply >> Demand: everything OK, the people can exist in the region
- Supply = Demand: risky, especially in drought years, check options to reduce the risk with storages for food or water, additional resources or to import food
- Supply < Demand: Check for other sources to get water, this situation will only work for a short time for a small number of people, not for a city or region

Conclusion

- Information from 80 publications were collected and more is available
- With this small students project it could be shown that it was realistic that one irrigation system exists on the east site
- With the canal (east) enough area could be irrigated to feed the estimated 14,000 people
- Enough water was available for irrigation
- With more data the results could be more precise
- For the source of the water two possibilities exist; it needs more investigation to clarify it
- The developed method must be proved with other projects and with more data

Thank you