

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

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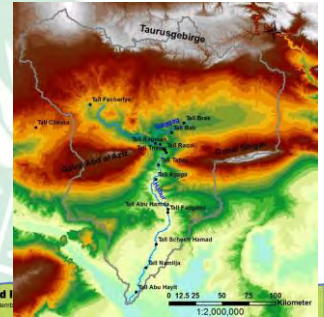
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1

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: $\approx 50 \frac{m^3}{s}$



5



Habur River
2009

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2

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
- Today's 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)

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6

6

Questions

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

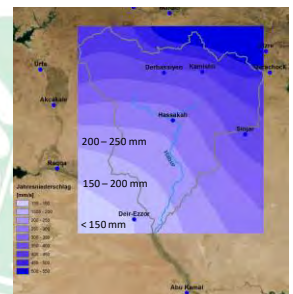
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3

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
- difficult for irrigation



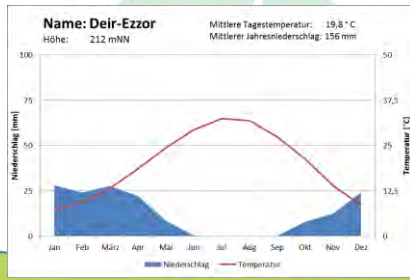
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7

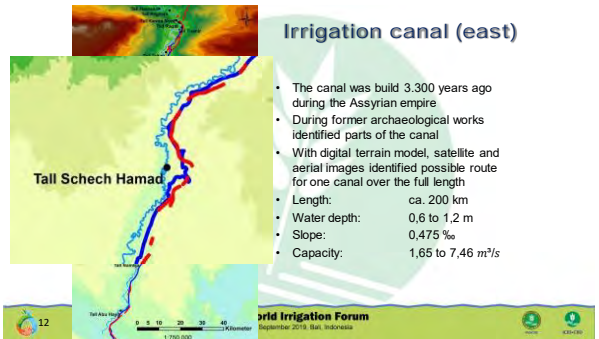
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Precipitation and Temperature



8

Irrigation canal (east)

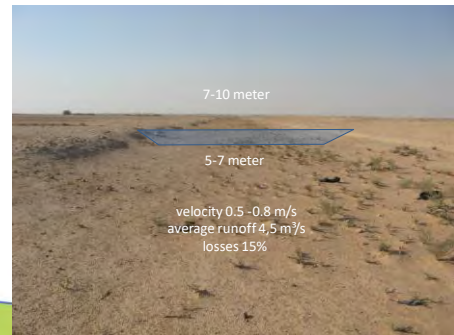


12

Archaeological record

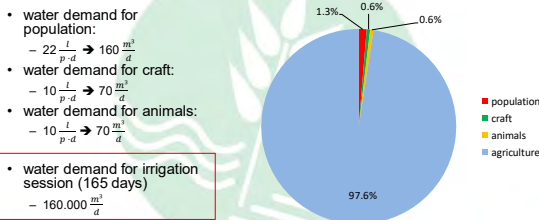
- First remains of the ancient canal were discovered about 35 years ago by Ergenzinger and Kühne
- In the lower Habur valley settled about 24.000 people in Neo-Assyrian times, ~ 14.000 on the east side (rough estimations)
- about 7.000 lived in the regional capital Dur-Katlimmu – Tall Schech Hamad
- 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

10



13

Estimated Water Demand for Dur-Katlimmu – Tall Schech Hamad

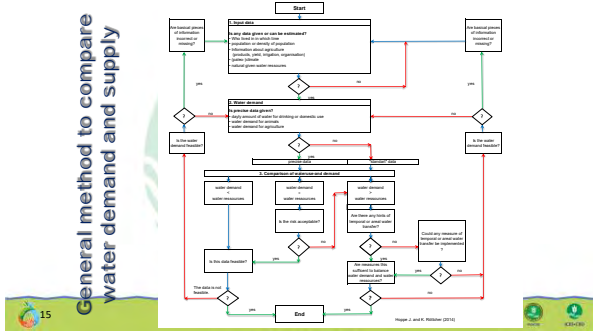


11

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

14



15



18

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

16

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 exist 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 exists it need more investigation to clarify it
- The developed method must be proved with other projects and with more data

17