Integrated Water Resources Management in the Lower Jordan Rift Valley

Sustainable Management of Available Water Resources with Innovative Technologies

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Development of a water quality impact matrix (WQIM)

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Content

The knowledge of quality and quantity of water resources are prerequisite for a proper planning and management of usage of available water. On the other side each usage has an impact on water resources. This impact should be small to negligible if water resources are more than sufficient. In (semi-)arid areas a depletion of available water resources is most often the case, especially in regions like the Levant. The reason for this is manifold, e.g. the rise of population as well as socioeconomic and the political unsolved situation.

Table 1 D408-1: Framework for assessing important degradation types and impacts

Degradation Type	Physical Attributes	Typical potential impacts
Groundwater depletion	Abstraction exceeds recharge Drop of groundwater head and aquifer exhaustion	→ Increase abstraction costs →Scarcity and value increase →Source abandonment →Physical shortages/rationing →Reduced stocks for future needs →Need for high costly replacement →Reduced biodiversity
Groundwater contamination	Decline in water quality	→Reduced usage options →Reduced crop yields → Health risks → Higher treatment costs →Source abandonment →Reduced stocks for future needs →Reduced biodiversity
Induced problems	Associated with depletion: ➢ Saline intrusions ➢ Land degradation ➢ Soil salinity	→see above and possible infrastructural damage and /or increase damage prevention costs

Springs and groundwater in the Lower Jordan valley are an important source for drinking water and play an important role in ecological functions performed by local ecosystems. However the water resources are under increasing pressure due to over exploitation and continuous degradation of quality and quantity of environmentally hazardous activities. The potential impacts are shown in Table D408-1.

There is an increasing need for environmentally sound methods for aiding decision making in water resource impact assessment and protection.

As a base for a Water quality impact matrix (WQIM) procedure we used the DAISY data bank (see WP2) and the results of WP407. In a next phase the implementation of the procedure in the data bank could be realized.

In most cases, they're still not enough data available for a proper regional assay. Therefor up to now only water table fluctuations and trends in groundwater solutes (total dissolved solids (TDS), chloride, nitrate, and sulfate) provide information on regional response.

A thorough literature study showed nearly no reports or publications for a WQIM especially in arid areas. So the development of a water quality impact matrix has been until now a new subject in arid Hydrogeology.

STEPS IN THE PREPARATION OF A WATER QUALITY IMPACT MATRIX (WQIM)

The first step is to define the actual water needs and /or water needs for a planned development in the future and compare it with available resources:

- Identification of available water concerning the quantity and quality on a regional base (surface water, groundwater, reclaimed water)
- Identification of regional water needs (human usage diverted in drinking water, water for agricultural use, minimal water needed to sustain the desired status quo for natural habitats)

Further steps are:

-Identification of effects (e.g. Mixing of groundwater either geogenically driven or anthropogenically induced may change the composition of known reservoirs)

-Prediction of effects (e.g. Desertification of landscapes, salinity hazards on crops)

-Interpretation of impacts (e.g. Socioeconomic effects)

-Communication (e.g. to adequate administrative levels)

-Inspection procedures (e.g. Measures to minimize unwanted effects)

To tackle the problem of accounting for water quality changes typical pollutant compositions (fingerprint) could be identified in water bodies along the water flow path on a catchments base. The pollutant profiles, with appropriate analysis, reflect the current pollution status of particular water sources and infer the transfer process.

One possible approach to water quality scoring is to take the local or international WHO water quality standard regulations for a specific usage (e.g. drinking water, crop irrigation water, tree irrigation water) and assign this a score of 100. Then data sets from the data bank can easily be scored in comparison to the used standard. The percentage of difference can then be shown spatially in a GIS map using (colored) classes of differences.

CONCLUSION

We showed in this theoretical study that up to now a water quality impact matrix is not described in the literature. But the development is a useful add-on for existing databases with quality data of the investigated region and should be incorporated in the DASY-data base for an easy usable via the Internet web page.

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