

»Hessisches Ried«, Germany and »Cuvelai Delta«, Namibia Regional Distinctions and Similarities – Consequences for design of an IWRM

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Cuvelai Delta

The region relates to the Namibian part of the Cuvelai catchment area, designated as the Cuvelai-Etoshia Basin in North-central Namibia. Bordered by Angola to the north, by the Kunene Region to the west, by the Kavango Region to the east and the Etosha National Park in the south, the region is the most densely populated area in Namibia with 780,000 inhabitants (42% of Namibian population; on average 9 inh/km²).

Population dynamics are characterised by high population growth (2.1% in 2001) and urbanisation. 15% of the population in the study area live further than 2.5 km from clean drinking water. 50–80% of households lack sanitation facilities.

Climate:

- semi-arid with 96% of the rainfall occurring in Nov-Apr
- rainfall: 300 mm/a (west), 600 mm/a (east)
- potential evaporation: 2,500 mm/a
- average daily temperature: 17°C (winter) and 25°C (summer)

Hydrological Situation:

- alluvial marshes with source in southern Angola, flowing southwards to Namibia, carry water seasonally
- groundwater: three aquifers of different depth, traditionally accessed by hand-dug wells – especially in rural areas
- salinity: 1,000 mg/l TDS in the periphery till more than 5,000 mg/l TDS in the centre
- long distance pipeline system: serves drinking water to central region, fed from Kunene

Institutional framework:

- four administrative (political) units which exist alongside traditional authorities based on its own legislation and political structures
- processes of Integrated Water Resource Management and Land Reform has been initiated by the Ministry of Agriculture, Water and Forestry in 2004 (Water Resources Management Act 2004)



Critical Issues

- high variability in amount and time of rainfall (quantity of water), risk of drought and floodings and high salinity of soil and groundwater (quality of water)
- important water resources are located in Angola: first, the hydrologically important upper reaches of the Cuvelai Basin (intra-basin) and second, the Kunene river (inter-basin), which feeds a long-distance pipeline system, currently the most important source for drinking water in North-central Namibia
- increasing demands on water (irrigation, households) and energy (hydropower) due to the Angolan recovery after the civil war that is accompanied by economic and agricultural developments; recent plans for irrigation of 250,000 ha land in Angola could reduce the water flow of the Kunene river by approx. 50%
- high population density and growth lead to increasing demand for food and water (irrigation) in North-central Namibia resulting in pressure on soil resources by the overuse of land (degradation); in conjunction with insufficient waste water and sanitation systems this causes severe stress on the ecological system
- land and water reforms are currently insufficiently coordinated and regional development is retarded by missing adequate frameworks for credit standing and investments

Acknowledgement:

The results presented for Namibia are based on a preliminary study conducted by the Institute for Social-Ecological Research (ISOE), Frankfurt/Main/Germany, in collaboration with Dr. Steffen Niemann, University of Frankfurt/Main/Germany. The study was funded by the Federal Ministry for Education and Research, Germany (Funding ID: IWM 04/29, duration 11/2004–07/2005).

While having specific societal, economic and climatic conditions, in both cases water scarcity and water quality constitute a key role in problem dynamics:

- water stress because of climate vs. high groundwater withdrawal rates
- high salinity because of high evaporation rates vs. high nitrate concentrations because of intensive agriculture.
- in addition, both regions affected by dynamic population growth which intensifies water stress
- besides water quantity and quality, soil quality is another important parameter for water management

Water supply and sanitation as well as agricultural activities are focus of analysis and subsequent measures in both cases, but their general conditions differ widely. From today's perspective former regulative measures in water management within the Cuvelai Delta as well as within Hessisches Ried can be evaluated rather as problem shifting than problem solving.

■ Groundwater withdrawal and artificial recharge together with climatic impacts (wet years) in Hessisches Ried caused impacts on infrastructure, land use and ecosystem. In 1999 the first »Groundwater Management Plan Hessisches Ried« has been implemented to mitigate the situation and to regulate withdrawal and infiltration rates by means of groundwater tables. In spite of this adequate approach the plan does not conform to a substantial solution.

■ The problem of salinity in Cuvelai Delta was intensified due to altered water and land use patterns.

The design of an Integrated Water Resources Management for this region is seen as chance to mitigate current problems.

From the experiences and particularly deficits of the »Groundwater Management Plan Hessisches Ried« and the existing situation in Cuvelai Delta new integrative approaches for the IWRM are developed.

Lessons learned

It becomes obvious that in distinctive manners water management is closely connected to questions of land use, energy supply, biodiversity and regional development. Considering such dependencies and finding a balance between multiple demands or conflicting interests builds the basis for resource management. Thus, decisions in water resource management must consider the entanglement of societal and natural processes. But understanding the relevance of particular interactions and their role in problem dynamics needs an understanding of the specific context that is formed by the ecological, economical and cultural conditions.

Strengthening the Integration

Main challenge for implementing IWRM is to resolve the specific problem of integration by developing adopted methods and instruments that match local conditions. With the mentioned dependencies in mind, integration of knowledge, technical innovations and patterns of resource utilisation become crucial. Depending on the context, establishment or fortifying of institutions and organisations as well as capacity building is important for stabilisation of management processes. Summarised in integrated management plans and linked up tools effects could be visualized.

Identifying Options for Action and Stakeholder Participation

Participation processes aim on the one hand on integrating different needs and interests into decision making processes in resource management. On the other hand they can be used as potential for supporting the identification and assessment of alternative ways for action. Bringing together knowledge from different fields, professions and disciplines with practical experiences by cooperation of professionals and laypersons forms the basis for developing these options.

For the Cuvelai Delta it is planned to interlink decision making with participatory scenario building and modelling. Aim is to visualise the effects and dependencies of different possible management decisions for various actors, concerned sectors and the environment.

Adaptability in Regulative Processes

The example »Hessisches Ried« shows that high complexity and uncertainty can not be managed in linear or precasted planning and implementation processes. In different spatial and temporal scales, actual developments must be evaluated and reversal or alternate routes must be enabled, based on auditing objectives and adjustment of objectives in the process.

The cognitions of the Hessische Ried shows that not just regulative processes for groundwater levels are important but also anticipatory planning. For the Namibian example the pipeline system was identified as sensitive issue. Research and development will be done on finding alternative (semi-)central technologies to secure long term water supply for the increasing demand. The selected technologies have to be able to cope with the hydrological situation in order to mitigate dependencies from pipeline water.

Hessisches Ried

The region belongs to the northern part of the Upper Rhine Valley which is located in western middle Germany (southern Hesse). Bordered by the river Main to the north, by the river Rhine to the west, by the border between Hesse and Baden-Wuerttemberg to the south and the Odenwald to the east, the region covers an area of around 1.200 km² and is populated by 800.000 inhabitants (around 666 inh/km²) which makes it a densely populated area.

The regions' dynamics are characterised by population growth, urbanisation and consumption. The region serves the urban agglomerations Rhine-Main Area and Rhine-Neckar Area as water and food supply as well as for recreation. Nearly all households are connected to sanitation facilities.

Climate:

- moderate climate with maxima of rainfall in July-Aug and Nov-Dec
- average rainfall: around 700 mm/a
- average daily temperature: 0.7 °C (January); 18.7 °C (July)

Hydrological Situation:

- former marshland which was regularly affected by floods until river regulations and extensive drainage were initiated
- groundwater: up to three aquifers of different depth, accessed by drilled wells
- high nitrate concentrations, especially in upper aquifer due to intensive agricultural use
- high quantity and easy availability of groundwater led to extensive groundwater use for drinking water supply, for industrial use and for agricultural irrigation

Institutional framework:

- 1979 major water supply companies and neighbouring districts established the »Water Association Hessisches Ried« to secure agricultural irrigation and to improve the groundwater situation through infiltration
- 1999 the »Groundwater Management Plan Hessisches Ried« was implemented
- 2000 the »Regional Plan 2000« defined different priorities for land use



Critical Issues

- periodical change of years with high and low rainfall
- intensive land use by agriculture, forestry, settlements, industry, infrastructure, nature conservation areas
- high groundwater withdrawals due to:
 - low rainfall resulting in increased withdrawals for agricultural irrigation and drinking water supply
 - proximity to urban agglomerations Rhine-Main and Rhine-Neckar Area resulting in withdrawals for drinking water supply and industrial water
 - in dry periods water withdrawals led to declining water tables and to soil and building subsidence, groundwater dependent vegetation was affected
- high nitrate concentrations in upper aquifers
- increasing conflicts arise between water management, landowners, agronomists, forestry and nature conservation
- low water tables were tried to be counteracted by installing infiltration plants
- high water tables, in period of wet years, led to water logging of fields and basements

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