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Analysis of Water Use and Allocation for the Khorezm Region in Uzbekistan Based on an Integrated Economic-hydrologic Water Management and Planning Model

TINA SCHIEDER

University of Bonn, Center for Development Research (ZEF), Germany

Abstract

Water availability and an effective and sustainable management of water resources is an important factor in social and economic development. This applies notably for the case study area. The highly arid area Khorezm is situated in the Central Asian Republic of Uzbekistan and the Amu Darya delta region. Due to historical and recent expansion of irrigation projects the region is highly dependant on water for irrigation purposes. But inefficient water consumption and management result in drastic ecological, social, and economical problems like rise of soil and water salinity, water scarcity, declining yields, health problems and rising groundwater levels. This development and an increasing competition among water users within the region and between up- and downstream areas along the river calls for a more efficient water allocation and management approach.

In the presented study a regional analysis for different spatial resolutions of water allocation and use and effects of alternative water management strategies and policies to hydrologic cycles, plant growth, yields and areas and farmers is carried out for the Khorezm Region. The main objectives of the study will be the detection and determination of water supply and demand and as a consequence thereof the water availability and water use patterns in the region of Khorezm. Based on agronomic, hydrologic and climatologic fundamentals and calculations, economic consequences of alternative more effective water uses, management and allocations shall be determined and analysed and can serve as policy recommendations.

The water allocation model is programmed in Gams (General Algebraic Modelling System) and is made of a system of non-linear differential equations. The development of such a framework of analysis can be a step to integrate different disciplines (natural sciences, economics, social sciences) to find out a better water management including efficient, equitable, and environmentally sustainable water allocation mechanisms for the study area.

Keywords: Gams, integrated hydrologic-economic model, irrigation, optimisation model, Uzbekistan, Water allocation