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Impact of Water Resources Regulation and Crops Diversification in the Zeravshan River Basin

○Temur KHUJANAZAROV, Kenji TANAKA, Yoshiya TOUGE, Kristina TODERICH

In effort to estimate impacts of water resources availability to growth of different crops we analysed how water regulation and quality can be assessed in Uzbekistan.

Demand for the water resources has been increasing over last decades here. At the same time growing population, anthropogenic and climate change impacts have increased pressure on the water resources. In case of Central Asian countries, this has not only food availability issue but also huge economical impact, as it threatens security of water resources availability and possibilities to grow. Most of the rivers in the CA are snow-glacier fed originating in high mountains of one country (upstream) and fully utilized in another (downstream). Such disparity in river usage causes upstream to consider heavy investments in hydropower dams that increase social and political tension between counterparts. Thus water resources have been one of the limiting factors in economical growth in Uzbekistan, as they heavily relies on cash crops.

Over stress of the water resources availability it is important to define water efficiency (crop to water demand) and water availability for agricultural crops. Available productive area and its water demands will assist for planning efficient water management techniques and investigate appropriate irrigation methods to maximize outcomes of the main and market oriented crops. Therefore knowing crop water requirement is important step to water resources management under climate change scenarios. Current research suggests that river flow is decreasing and traditional irrigation strategies could not cover today's irrigation area. The analysis of water consumption by various types of crops will be important in the future projections. In this research water demand and analysis of the possible water resources distribution in the case study of Zeravshan river basin (fig. 1) to achieve positive water management nexus for both countries were analyzed.

The vulnerability of the Central Asian region to the climate change is well known. While sources of the water resources glaciers are decreasing, and may be

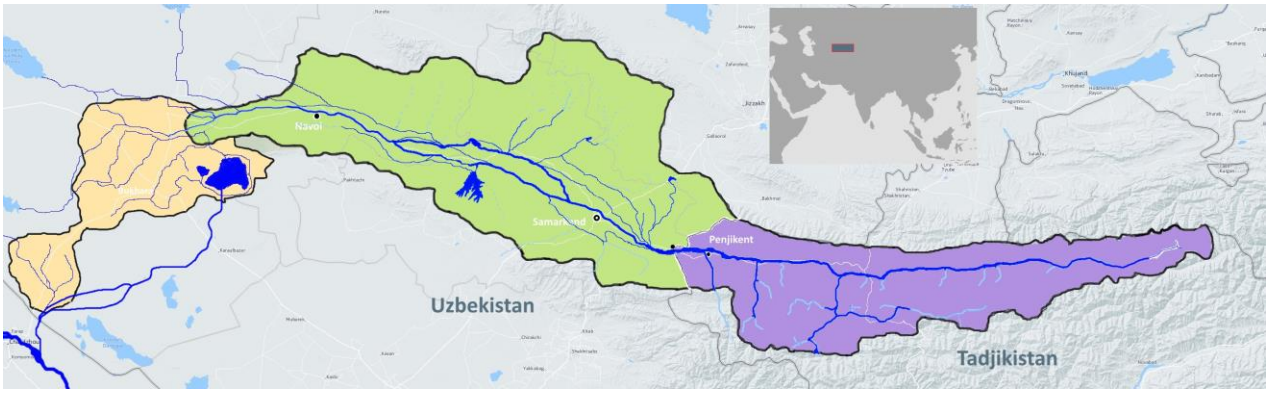

Figure. 1. Zeravshan river basin study area (adapted from Google Maps)

reduced to up to 25% in next 30 years in Central Asia. So, physical aspects of the climate change impact on water resources should be investigated to address future irrigation strategies and crops planting that is why methodology consists of following stages: first irrigation demand and inflow are analyzed; on the second stage scenarios of outflow are simulated; on the third stage results were combined to analyze crop to water demand and spatial distribution of it. Additionally, analysis of the water quality impacts and their connection to crops productions are discussed.

The framework to analyse impacts of the water recourses redistribution includes 3 main blocks (fig. 2): land-surface model - SiBUC, to calculate water balance in the basin; simple Dam operation model block that addresses operation options to maximize hydropower output or irrigation; Policy analysis block focuses on calculation of available options to maximize water distribution for irrigation outputs based on observed discharge data from past to projected future. Crop to water requirements were taken from (MAWR 2012), and spread over the total irrigated area in the Uzbekistan 577400 ha and total water usage is 130%, where excessive 30% comes from reused return flow of the irrigated area. Return flows were analyzed with water quality distribution taken from field surveys.

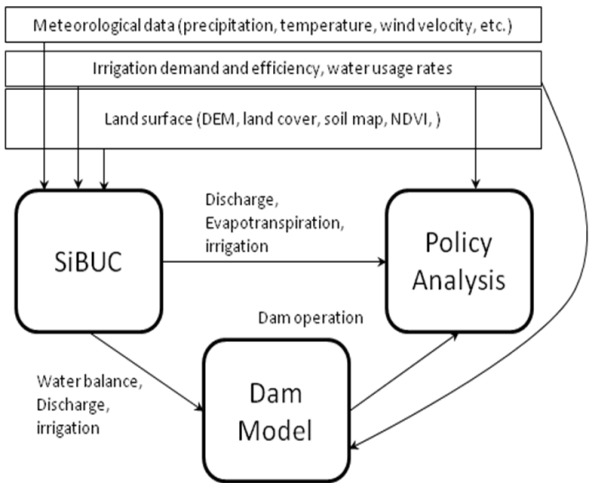

Figure 2. Scheme model for analysis.

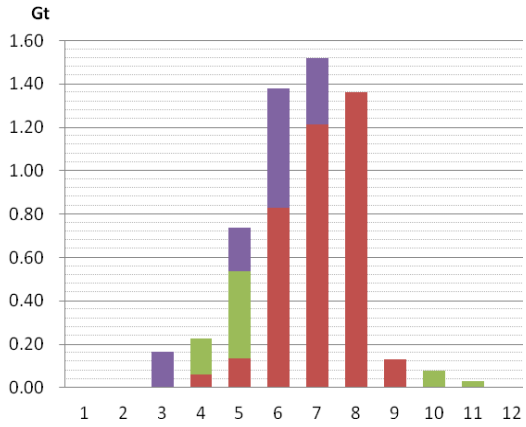

Figure 3. Water to crop demand (red-cotton, green winter wheat, purple wheat)