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**The Thesis Submitted for the Degree of PH.D
(in the field of Irrigation and drainage)**

**Analyzing the Sustainability Production and
Consumption of Agricultural Products in
Khuzestan Province in View point of Water
Footprint: Challenges and Opportunities**

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Abstract

Feeding up the growing population under socioeconomic droughts threatens hydro-environmental sustainability of water resources in water-scarce regions of the world. In this research, a framework was proposed to reveal such hidden jeopardizations and their main roots through a comprehensive water footprint assessment. First, the 30-years pattern of agricultural water footprints, and its hydro-environmental, social and ecopolitical (SEP) consequences were quantified for Khuzestan province, as one of the major food producer regions of Iran. Second, the hydro-environmental sustainability was assessed in terms of blue water scarcity (BWS), groundwater depletion (GWD), and water quality degradation. Climate-induced water scarcity was then assessed by quantifying the evolution of the ratio of precipitation to reference evapotranspiration (P/ET_o) over the study period. Afterward, the enforced impacts of major water/food-related policies on hydro-environmental unsustainability were analysed through an institutional assessment. Along with a 63% increase in crop production, unit blue WF increased from 3700 m³ ha⁻¹ in 1365, to 5660 m³ ha⁻¹ in 1395, which resulted in a 80% increase in overall blue WF over the study period. In this period, BWS and GWD raised by annual average growth rates of 5% and 44%, respectively. Consequently, socioeconomic status in the study area prospered along with a 18% increase in irrigated area, 198% in added-value by crop production and 5% by staple-crop exports, and 51% in the number of agricultural workers. The Pearson correlation analysis revealed a significant tradeoff between self-supplied food availability and SEP. Indeed, the increase in food production over the study period occurred at the cost of 80% overexploitation in blue water resources and quality degradation. This issue caused the implementation of an unsustainable virtual water trade in the study area. The increase P/ET_o with an annual average growth of 1.1% indicates the dominant role of anthropogenic interventions in such deteriorations. Comparing water footprints with the benchmark levels demonstrates that 31-61% of overconsumed water in agricultural sector is due to improper management and could be ceased under improving such practices. In addition, yield gap closure can reduce unsustainable and inefficient VW trade by up to 63% and 27%, respectively. The institutional assessment demonstrated that environmental sustainability policies have never been applied as promoting policies to boost self-sufficiency in food production. According to the results, hydroenvironmental sustainability in Khuzestan province requires a transformative vision in national policies to exploit limited water and soil resources while preserving the environment.

Keywords: Blue water scarcity, food insecurity, hydrological sustainability, inefficient and unsustainable agriculture, Khuzestan, water footprint, yield gap closure,