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Agricultural water demand for agroforestry systems in the Sahel in a changing climate

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Abstract

In many areas of the world, there is a growing pressure on agricultural water demand due to climate change and population growth but the expected amounts are unknown and depend on climatic conditions and respective cropping systems. The Sahel in sub-Saharan Africa is a particular vulnerable region, where water resources are often already overexploited which puts especially pressure on water resources during dry seasons. Many smallholder farmers cultivate their crops in mixed systems, intercropped with other annual plants or perennials (e.g. agroforestry). While water demand of specific (irrigated) single crops is mostly known, this remains still vague for more complex systems. However, the assessment of water demand and water use efficiency is crucial for successful implementation and sustaining production especially under changing climatic conditions. This study will quantify the water demand of a common agroforestry system in the Sahel (e.g. sorghum and *Faidherbia albida*) using the process-based crop model APSIM-X for different development stages during the crop season. We consider interactions that will have a potential effect on the evapotranspiration of the system such as shading, microclimate, and increased organic matter transfer, as well as competition in root water uptake. In a second step we aim to soft couple the outputs with a hydrological model (SWIM) to assess the water availability in the catchment. To shed light on location-specific estimates on agricultural potentials and required water for agroforestry systems in the Niger Basin in future periods, we will feed the model with downscaled climate projections (12.5km) for three different scenarios (SSP1-RCP2.6, SSP3-RCP7.0, SSP5 RCP8.5).

Keywords: Agroforestry, climate change, Sahel, water demand