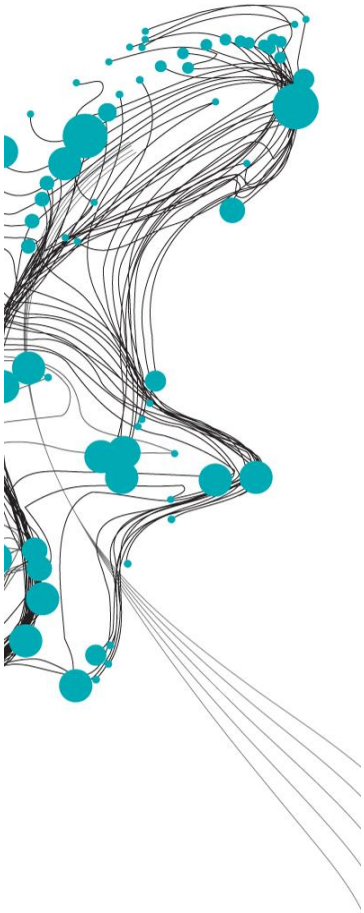
BLUE WATER FOOTPRINT CAPS FOR THE ORANGE RIVER BASIN



The continuous increase in demand for limited freshwater resources leads to overexploitation and violation of environmental flow requirements around the world. This in turn can lead to economic downfall and decreasing health of riverine ecosystems. The Orange River basin is chosen as a case study as the current consumption of water was estimated to violate the environmental flow requirements in many regions for some months of the year (figure 1).

A policy measure to prevent violation of the environmental flow requirements is to limit humanities water consumption. In this thesis this is done by exploring the setting of blue water footprint caps for the Orange River basin, these caps have been set per months and per sub-catchment to account for spatial and temporal variability in blue water availability. This was done by using a water balance model which is able to include reservoirs, water transfers and water consumption. In combination with the WRSM/Pitman rainfall runoff model it is able to model the actual runoff in the river. Detailed environmental flow requirements have been used at the river mouth and have been distributed over the upstream sub-catchments. This showed that to preserve the environment an average of 31% of the natural occurring runoff had to be preserved. Uncertainties in future runoff predictions brought forward the trade-off between violation of the environmental flow requirements and utilizing available flow. This trade-off is quantified on the level of sub-catchments in the Orange River basin by allowing certain levels of violation.

The development of methodology on how water between competing users can be allocated raised two questions, how can water be allocated in an equitable manner and how can an allocation strategy maximize the social and economic welfare. Equity was determined difficult to define and maximisation of the social and economic welfare could be reached by usage of an optimization model with an objective function which determines the social and economic welfare.
A simple allocation strategy was executed and showed that reservoirs can make the trade-off between violation of the environmental flow requirements and utilizing available water less pronounced by reducing inter annual variability in runoff. Despite losses due to evaporation their ability to be able to store the peak flows can make them raise the cap while lowering the violation of the environmental flow requirements.

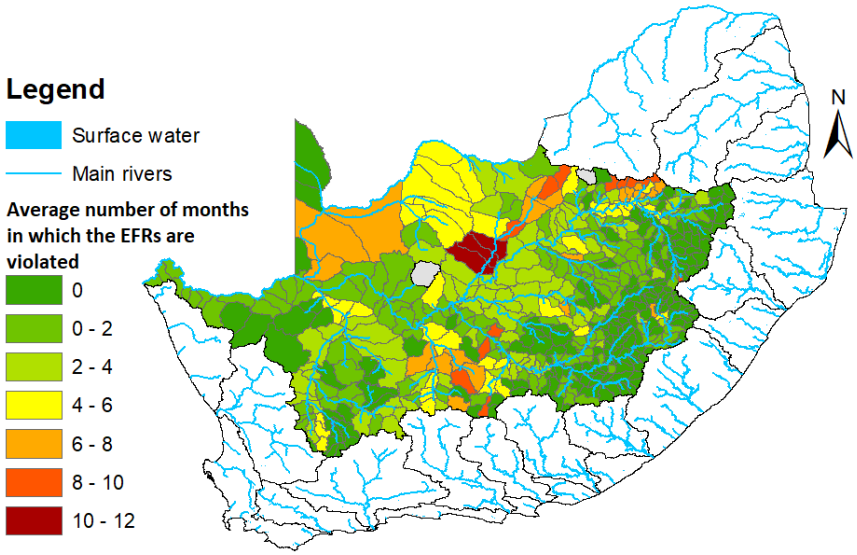


Figure 1: The average number of months per year that the environmental flow requirements in the Orange River basin are violated, for the period 1990-2010. Comparison between modelled actual runoff and the environmental flow requirements.

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