Water Resources in Wami River sub-Basin: Drivers of Change and Future Flow Projections

Executive Summary: The main driver of change is seen as being only climate change and variability. This tends to overshadow other drivers such human and livestock population, irrigated agriculture and industry. Findings from this study show that there will be a slight drop (1%) in rainfall amount by 2040; however, flow in Wami River at Mandera gauging station is projected to decrease by 17% over the same period. The major reasons include abstractions to meet increased demands for irrigated agriculture (124%), livestock (47%), industry (12%) and domestic use (89%). This implies that water resources planning in Wami sub-basin should put less emphasis on future projected rainfall amounts. Also, similar studies should be carried out for the remaining river basins to ascertain the major drivers of change.

Introduction: The effects of climate change and variability are undeniably clear, with impacts already affecting ecosystems, biodiversity and people's livelihoods. This has led to the need for incorporating climate change in developing national programmes and plans. However, in developing the Wami-Ruvu Integrated Water Resources plan, climate change was not factored in due to the assumption that it will have insignificant effects compared to other factors. This study assessed the major drivers of change on future water resources in the Wami River sub-Basin. The study used the latest (CMIP5) projected climate change scenarios.

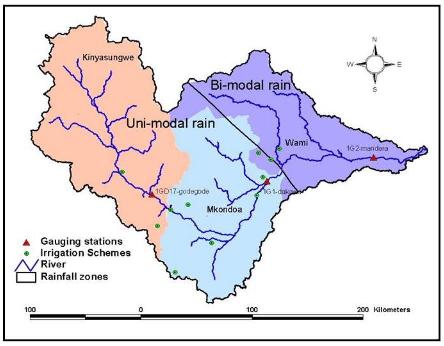
Approaches: The Soil and Water Assessment Tool (SWAT), which is a physically based agro-hydrological model was used to establish the adequacy of future water resources.

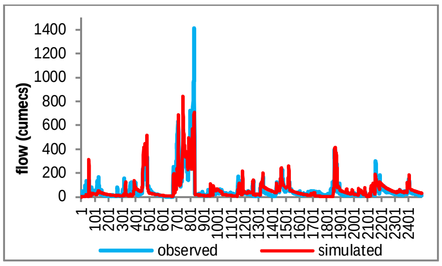
Table 1. Projected water demands for various uses by 2039.

Year	Description	Population	Livestock	Irrigation	Industries
2010	Users	1.5m	0.9m	6,722ha	1
	Demand (l/d)	3.8m	22.6m	1,320m	130m
2039	Users	2.8m	1.3m	18,672ha	2
	Demand (l/d)	7.2m	33.3m	2964m	145m
	Increase	89%	47%	124%	12%

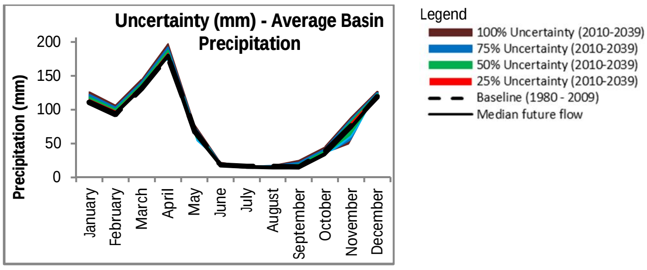
l/d = litres per day

The data collected and analysed include human and livestock population, hydrological data, climatic data, water demands including for irrigation, spatial data, and industrial demands.

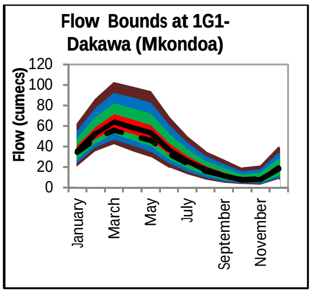


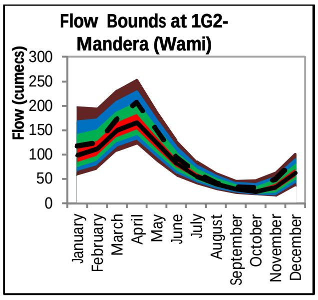


Results: The predicted median of rainfall and average rainfall are very similar.



The 2010-2039 prediction of flow at 1G1-Dakawa (gauging station at the outlet of the Mkondoa catchment) shows decrease and increase in flow depending on the level of uncertainty. The average annual baseline flow is 29 m^3/s and for future it is predicted to reach 32 m^3/s.





For 2010-2039, prediction of flows at 1G2-Mandera (gauging station at the outlet of the Wami catchment), the average annual baseline flow is 98 m^3/s and for future flow is predicted to be 81 m^3/s.

Conclusion: By year 2039 the average water demand in the Wami River Sub-basin is estimated to increase by 113% and the average annual median rainfall across the sub-basin is predicted to decrease by 1%. These lead to decrease in runoff from the Wami River Sub-basin by an average annual median stream flow of 17.1%. Either of the forcing factor leads to decrease in stream flow, although water demand seems to exercise heavier impact.

Recommendations: The water use demand is the only forcing factor which can be easily controlled at the sub-basin level. For the adaptation purposes the Wami River Sub-basin management is advised to plan water uses which will not extend beyond the projected water demand.

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