Impacts of Climate Change on Regulated and Non-Regulated Water Systems in Australia

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Introduction The highly regulated system of the Queensland Murray Darling Basin (QMDB) includes the MacIntyre Brook and Dumaresq River. Land-use is irrigated horticulture, dryland and irrigated cropping and grazing. The largely unregulated system of the Cooper Creek drains into Lake Eyre and land-use is primarily grazing. Both systems have valuable natural resources and biodiversity that rely on periodic flooding. This study identified the impact of climate change of water flows in both catchments.

Material and methods From a combination of nine Global Circulation Models (GCM's) and emission scenarios (SRES and IS92a) obtained from the OzClim database (CSIRO, 2001), the driest, wettest and average scenarios were chosen for both catchments. Percentage changes from the base climate (1961-1990) were used to condition rainfall and evaporation for 2030. Rainfall-runoff (Sacramento) and streamflow (IQQM) models for each catchment were run for the base and climate change scenarios (dry, wet, average) to obtain flows at the end-of-system for the MacIntrye Brook and Dumaresq River, and at Currareva (junction of the Thomson and Barcoo Rivers) in the Cooper Creek system.

Results and discussion Based on these scenarios the change in mean annual flow for the MacIntyre Brook ranged from -25% to +9% by 2030, compared to the base period (Table 1). For the Dumaresq River the change in mean annual flow ranged from -25% to +6% by 2030. The dry scenario was associated with a greater risk of lower water allocations and area of crops planted during dry periods.

The change in mean annual flow at Currareva ranged from -7% to +2% by 2030, compared to the base period (Table 1). The average and dry scenarios were associated with a reduced frequency of low daily flows (<1000 ML/d). The impact maybe associated with reduced waterhole persistence and connectivity during periods of drought.

Conclusion The climate change scenarios used here showed that the regulated system had 1) higher reductions in flows for the dry scenario and 2) a wider range of uncertainity in flow projections compared to the unregulated system. If the dry scenario most closely resembles climate in 2030 the loss of water for irrigators and environmental flows in the absence of useful adaptive strategies may reduce agricultural productivity and biodiversity. The resilience of plant and animal life that depend on waterholes during periods of drought may depend on their ability to move to larger and more permanent waterholes. If the wet scenario most closely resembles climate in 2030 slightly higher annual flows may make more water available. The average changes in flows reported here for QMDC correspond closely with the best estimate of climate change in 2030 of 10% reduction in surface water availability (CSIRO 2007).

Table 1 *Percentage change in mean annual stream flow the for dry, average and wet climate change scenarios in 2030 compared to the base period of 1961-1990.*

Catchment	Dry scenario	Average scenario	Wet scenario
MacIntyre Brook - QMDB	-25	-9	+9
Dumaresq River - QMDB	-25	-10	+6
Thomson and Barcoo River junction at Currareva	-7	-4	+2

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