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Impacts of land use and climate change on baseflow in catchments along the south coast of Western Australia

Keith Smettem (1), Stacey Underwood (1), and Nik Callow (2)

(1) University of Western Australia, Civil, Environmental and Mining Engineering, Perth, Australia (keith.smettem@uwa.edu.au), (2) University of Western Australia, Earth and Environment, Perth, Australia

Baseflow is the sum of deep subsurface flow and delayed shallow subsurface flow. It sustains river flow between precipitation events and represents the groundwater recession component of runoff. Understanding how baseflow is influenced by climate and land use is critical for managing both water resources and in-stream ecohydrological health.

This study investigates the influences of climate and land cover change on baseflow across the major south coast rivers in Western Australia using long-term records of runoff, rainfall and land cover. Baseflow was partitioned from daily streamflow data using a baseflow separation algorithm and land cover changes were derived from Landsat satellite imagery using ArcGIS. Statistical techniques were then applied to test for randomness in the baseflow time series (median crossing test and rank difference test) and to detect any step changes (Distribution free CUMSUM test to determine year of step change and Rank Sum test for significant change in medians before and after change). Linear regression was also used to identify significant long term trends.

Results show that in forested catchments baseflow has been significantly declining over the entire period of record, despite relatively steady rainfall since the mid-1970s. In many of the catchments significant downward step change points were detected in 1975 and 2000. Conversely, annual baseflow steadily increased in catchments cleared in the middle of the last century but there are now significant reversals in three catchments that have undergone substantial revegetation over the last thirty five years. The statistical methods used in this study can be applied to any catchment in order to aid land and water managers assess the impacts of climate change and land cover manipulation on baseflow response.