

Runoff non-recovery of ACT water catchments

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Abstract: Recent studies have revealed that catchments may not always recover from drought conditions (Peterson et al., 2021). Such runoff non-recovery results in less runoff per unit rainfall under comparable catchment conditions and therefore potentially has significant implications for water resource planning. Given that the ACT water is sourced from three main catchments (Cotter, Queanbeyan, and Murrumbidgee) it is imperative to understand if these catchments also display non-recovery and thus a finite catchment resilience to droughts.

In this study, non-recovery was analysed at 18 stream gauges using linear regression between rainfall and Box-Cox transformed streamflow (Saft et al., 2015). Pre-drought, drought and post-drought periods were defined a priori and within the regression, each had a different intercept. This resulted in each period having the same slope, as shown in Figure 1. For the gauge (Cotter River at Gingera) shown in Figure 1, in the period following the millennium drought, the rainfall-runoff relationship resembles that from during the drought. This suggests that the catchment has not recovered from the drought. Figure 2 shows that out of the 18 gauges examined, 94% (n=17) present evidence of a runoff shift during droughts. Of these, 35% (n=6) show minimal recovery after the millennium drought. Examining the magnitude of the shift in the rainfall-runoff relationship (at mean annual precipitation), 56% (n=10) of the gauges show a downward shift greater than 14.6 mm/year of runoff. All the gauges observed in the Queanbeyan and Murrumbidgee Rivers and five gauges in the Cotter River exhibit signs of non-recovery (Figure 2). Overall, these findings suggest that the ACT water supply catchments do experience shifts and non-recovery in their rainfall-runoff relationships. Future research will (i) use Hidden Markov models to avoid the a priori definition of drought periods and will (ii) explore possible causal factors for the runoff non-recovery and (iii) how these factors can be adapted into deterministic rainfall-runoff models.

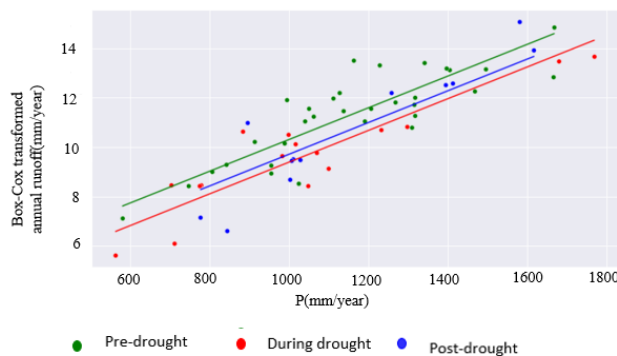


Figure 1. Linear regression plot between Box-Cox transformed flow and rainfall (All units in mm) for station at Cotter River at Gingera

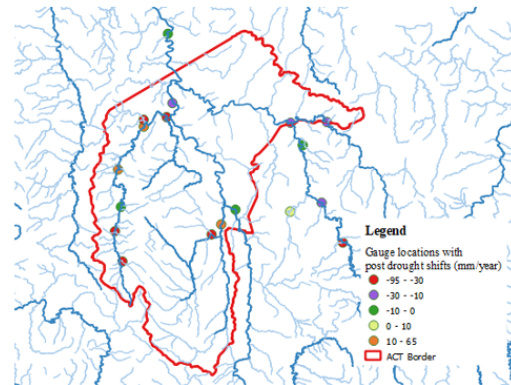


Figure 2. Map showing the locations of gauges and their hydrological shift after the millennium drought

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