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1 Variable channel responses following land clearing of a dryland catchment, Dalyup River, southwestern Australia

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Southwestern Australia serves as an interesting partner to other dryland settings in investigating and understanding the impact of humans on hydrological processes. Massive land clearing in the last half century and replacement of over 95% of native, deep-rooted vegetation with shallow-rooted seasonal crops has profoundly transformed hydrology in the Dalyup River catchment. Runoff as a proportion of rainfall has increased, and recent flood events have resulted in significant channel impacts. In order to understand how to best manage these changes there is a need to determine whether alterations to channel morphology are part of a shift under altered landscape conditions, or part of natural variability in response to extreme events. The transition from low-gradient headwaters on a semi-arid sandplain, to a Mediterranean-type climate with more perennial flow conditions and steeper sloped channels in the lower catchment, results in significant downstream variation in channel morphology and erosive potential. Additional to this inherent variability that existed prior to clearing is the impact of water quality changes that have accompanied land clearing (increased stream salinity), resulting in severe degradation of riparian vegetation and a consequent increase in erosive potential.

In-field investigation, together with landscape modelling and analysis of aerial photography from the time of land clearing (1960s) and before and after a recent large flood event (March 2000), identifies variable channel responses. While responses in-

cluded channel avulsion, widening and significant floodplain deposition, the response of individual channel reaches does not necessarily correspond to areas with the greatest change in erosive potential or absolute erosive potential (stream power). Rather, a more complex reach-by-reach change is observed that is also influenced by the erosive threshold and volume of available material that is directly coupled with the river channel (i.e. in-channel or on the floodplain). Reaches in the mid and lower catchment with floodplains constructed from easily-erodible, sandy material display major post-clearing changes in response to riparian vegetation degradation and increased discharge. Elsewhere, the high erosive thresholds of materials, lack of available material coupled directly to the channel, and very low gradient reaches have resulted in relatively minor, or indistinguishable changes to the altered hydrological regime.