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# Using High Resolution Vegetation Images to study Ecogeomorphologic Thresholds in Semiarid Australia

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Arid and Semiarid sites are very sensitive to climatic or anthropogenic pressures. Several previous studies argue that ecosystem function in these areas tends to display critical degradation thresholds which make rehabilitation efforts considerably difficult. This threshold behaviour is linked to coevolving eco-geomorphic processes triggered by climatic or anthropogenic disturbances. A common trigger is the removal of vegetation (by grazing or harvesting activities) which increases landscape hydrological connectivity and can induce a substantial loss of water and soil affecting ecosystem function (e.g. decreasing the rainfall-use efficiency of the landscape).

Here we present results exploring the impact of degradation processes induced by grazing pressure on rainfall-use efficiency along a precipitation gradient (250 mm to 490 mm annual average rainfall). The sites were carefully selected in the mulga lands bioregion (New South Wales, Queensland) and in sites of the Northern Territory in Australia, and display similar vegetation characteristics and good quality rainfall information. Vegetation patterns and percentage cover are derived from high resolution remote sensing images (IKONOS, QuickBird and complement this information with high resolution images obtained from Google Earth). We compute rainfall use efficiency and precipitation marginal response using local precipitation data and MODIS vegetation indices. The analysis of the NDVI MODIS data shows the presence of a clear critical degradation threshold, associated with loss of vegetation cover in the drier sites. Below this threshold we found what we call “functional landscapes” with high vegetation cover that display high rainfall use efficiency. Above this threshold, we found “dysfunctional landscapes” with much lower rainfall use efficiency. We compare the different behaviours for several sites along the precipitation gradient, and find that the wetter sites do not tend to display this threshold behaviour. We further discuss implications for ecosystem resilience.