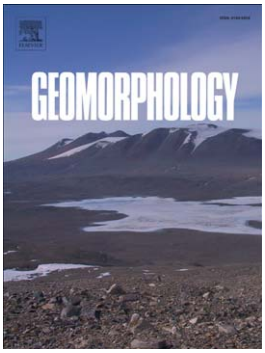

The impact of fire on sand dune stability: Surface coverage and biomass recovery after fires on Western Australian coastal dune systems from 1988 to 2016

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The impact of fire on sand dune stability: surface coverage and biomass recovery after fires on Western Australian coastal dune systems from 1988 to 2016

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Abstract

This study aims to determine the common response of coastal sand dunes in Western Australia (WA) to fire on decadal time-scales, in terms of ecological-geomorphic-climatic interactions to test the hypothesis that fire plays a role in coastal dune destabilisation. Fires are commonly suggested to have contributed to widespread dune reactivation in Australia and globally, a hypothesis that is relatively untested. We used data from the Landsat Thematic Mapper, Enhanced Thematic Mapper Plus, and Operational Land Imager missions to monitor changes in surface coverage on coastal sand dunes in south-west WA after fires. We analysed 31 fire scars from 1988 to 2016 in two Landsat scenes on the west and south coast of WA. Recovery ratios derived from the Normalised Difference Vegetation Index (NDVI) were used to monitor patterns in post-fire biomass and surface cover. Recovery ratios are correlated with indices of burn severity, and meteorological data to investigate relationships. We also used Maximum Likelihood Classification to monitor changes in bare sand area. Results suggest that recovery followed a strongly consistent pattern, and is characterised by rapid vegetation cover re-establishment within six to twelve months. Prior to this, some aeolian activity may have occurred but without substantial surface changes. Initial germination and/or resprouting was followed by steady growth up to seven years, where NDVI typically neared pre-fire values. Some variation in early recovery occurred between the west and south coast, possibly owing to relative proportions of reseeding and resprouting plants. A log regression explained 75% of the recovery pattern (79% on the south coast). Precipitation had some ability to explain recovery up to nine months post-fire (r^2 = 0.29 to 0.54). No relationships were observed between estimates of burn severity and recovery. After nine months, the biggest cause of spatial variation in recovery was the pre-fire community composition and related seedbank or resprouting density. Image classification did not identify any new blowout features except where fires were not the primary cause. Results suggest that fires are not presently contributing to the destabilisation of coastal dunes in south-west WA.