



Recent trends in remotely-sensed vegetation cover in Australia: effects of CO₂ and climate, and implications for water resources

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Anthropogenic climate change and rising atmospheric CO₂ are expected to change vegetation distribution, particularly in water-limited regions – which includes most of Australia. Vegetation dynamics are expected to have further consequences for carbon and water cycling. The importance of water-limited (semi-arid) regions in controlling these fluxes has been increasingly recognised. Recent studies have reported greening across much of the continent, mainly due to changing precipitation patterns and enhanced water use efficiency as a result of increased atmospheric CO₂ concentrations. Significant changes in water fluxes (evapotranspiration and runoff) have occurred concurrently, together with increases in CO₂ uptake by semi-arid vegetation. These processes are understood in a qualitative sense but there remains a need for better quantitative understanding of vegetation dynamics and its interactions with the carbon and water cycles.

We aimed to quantify the effect of climate variability and rising CO₂ on green vegetation cover and to investigate the coupling of vegetation dynamics with hydrology. We used remotely sensed green vegetation products from the Advanced Very High Resolution Radiometer (AVHRR) for the period 1982-2012, and vegetation indices from the Moderate-resolution Imaging Spectroradiometer (MODIS) for the period 2000-2012. We compared observed changes in vegetation cover to variations in water-balance evapotranspiration (the difference between precipitation and streamflow at a multi-annual, catchment scale) and gridded climate variables (precipitation, air temperature and solar radiation) across mainland Australia and Tasmania, excluding croplands. Results point to a small but significant (precipitation-independent) effect of rising CO₂ in increasing vegetation cover, which would be expected to counteract any effect of reduced stomatal conductance on evapotranspiration and streamflow.