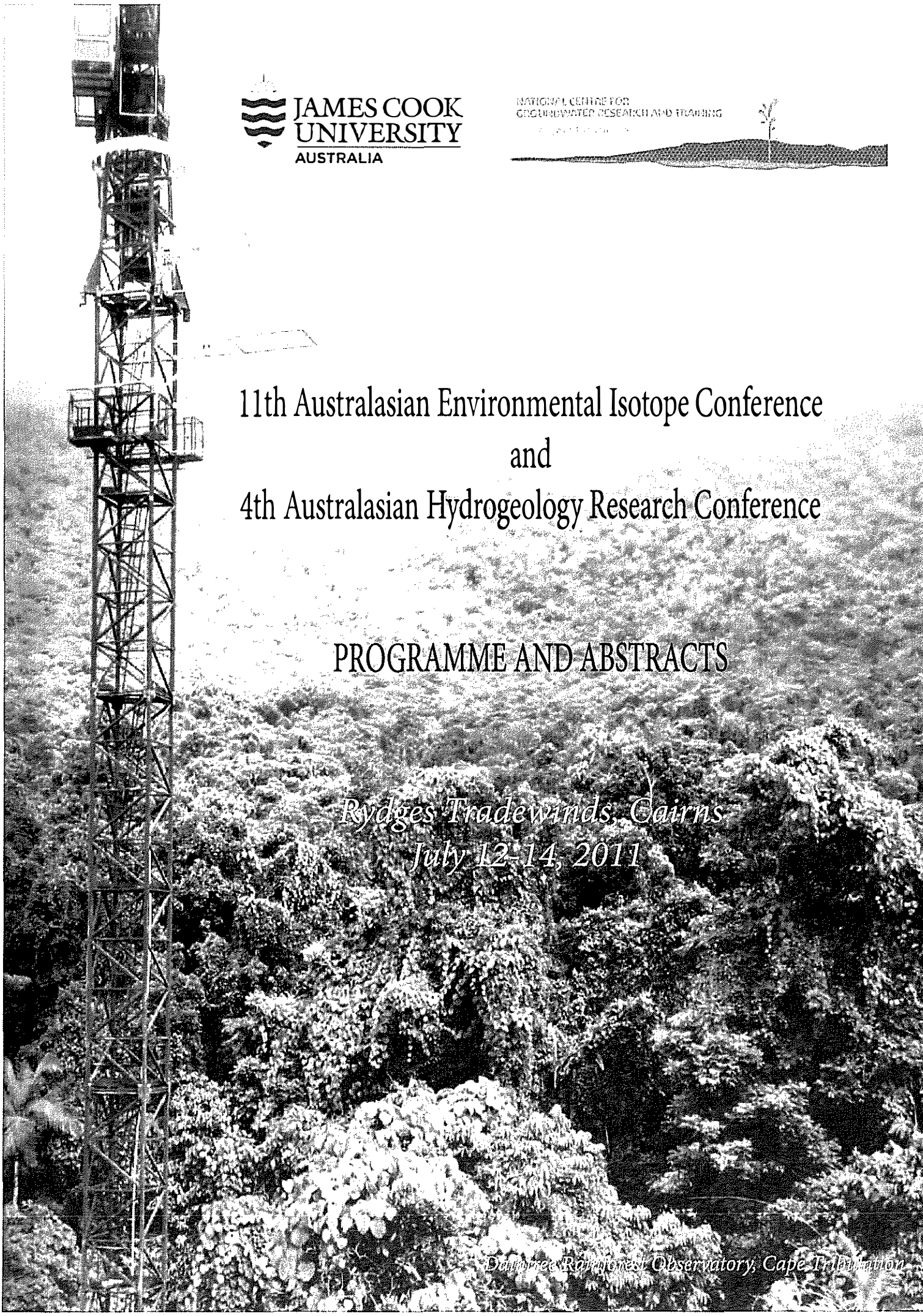

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Dynamic surface-groundwater interactions in a humid tropical riparian zone

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Riparian zones in temperate regions have been widely recognised for their capacity to remove nitrogen from groundwater by denitrification. However, little is known about this riparian function in humid tropical environments. The ability of a riparian zone to remove nitrate is highly dependent upon its hydrology. We studied the hydrology of a forested riparian zone, 150-170 m wide, in an agricultural landscape (sugarcane) in the Australian humid tropics from November 2008 to March 2010. Rainfall was 2978 mm in 2009. Low-lying parts of the site were inundated for up to 5 months of the year and the whole site was inundated at least twice. The deepest measured water table was 4 m below the surface at high locations during the dry season. Across the whole site, water table gradients ranged from 0.01 in the wet season to 0.002 in the dry season, resulting in low calculated lateral velocities. However, rapid fluctuations in water table levels (e.g. 2 m rise in 6 hours) during the wet season suggested faster groundwater flows. Rapid rises were attributed to high in-situ recharge, low air-filled pore space in the unsaturated zone (due to its shallow depth and high antecedent water content) and air entrapment. Recharge from the creek also occurred occasionally. Rapid falls in water tables were attributed to steep short-range hydraulic gradients. The amounts of water taken up by vegetation from the unsaturated zone and from groundwater (calculated using a new method for determining specific yield) were related to soil water content and depth to water table. The high spatial and temporal variability in hydrology presents a range of conditions likely to influence transport and transformations of nitrogen as it moves through the riparian zone.