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# Spatial and temporal dynamic of flooding and vegetation response to flooding using remotely sensed data in the Murray –Darling Basin, Australia

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Australia is the driest inhabited continent and river systems have highly variable flows in space and time. The Murray-Darling Basin (MDB), a catchment covering 14% of the continent contains the nation's largest rivers and important groundwater systems. The basin has highly variable rainfall patterns in space and time and is home to several wetlands of high hydrological and ecological value. However, variation in surface and ground water availability exacerbated by a long period of drought, combined with high water demands for irrigation, human use, and ecosystem health led to the need of managing water resources in an integrated fashion. Flushes of water, stored in dams, are being released during dry periods as environmental flows. Assessment of water resources and understanding of the effectiveness of environmental flows requires knowledge of long term trends in occurrence and extent of surface water and vegetation response to flooding and environmental flows. Satellite remote sensing is the only viable way for synoptically mapping and monitoring the extent and dynamic of flooding and vegetation response to flooding. Recent La Nina –induced extreme flooding broke a decade long of drought and made 2010 the wettest calendar year on record in the MDB. This represents a unique opportunity to develop predictive models relating flow regime to vegetation response and identify trends over long term and across a large space in a drying yet highly variable climate.
Using an internally consistent method, Landsat TM and ETM+ data were used to synoptically map the extent and dynamic of surface water bodies and track the response of vegetation communities to flooding in space and time at Barmah-Millewa, the largest river red gum forest in the world and one of the icon sites in the MDB. Per pixel trajectory of surface water and vegetation index time series were used. Results show high interannual variability in number and size of flooded areas and a strong relationship with inter annual rainfall variation. Response of vegetation communities to flooding varied in space and time and with vegetation types and densities. Knowledge of the spatial and temporal dynamic of flooding and the response of vegetation communities to flooding is important for investigating effectiveness of environmental flows and flow regimes in the MDB. Flood inundation extent maps can also be used for calibrating and/or testing hydrological models and used in conjunction to hydrological models to create long histories of flood maps that precede satellite imagery. When linked with hydrological models, maps of flood inundation extent through time and across different flow ranges can provide the requisite information on whether modelled predictions of floods reached target vegetation communities and can be used to underpin water management decisions. The approach presented here represents a proof of concept approach that will be applied across the Basin and can be transferred to other river systems around the world.