Towards dynamic high resolution mapping of cropped areas in Australia

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Abstract: Accurate and timely water accounts need spatially explicit and temporally dynamic estimates of water used by agriculture, seasonal changes and inter-year variations total cropped area and water used per unit of area. A desired but yet nonexistent data product to inform water accounting systems is a high resolution (i.e. tens of meters) map of irrigated crops and area of on-farm water storages which is also updated seasonally. We present preliminary results of a Landsat-based map at 30 meter spatial resolution of summer irrigated crops in the Colleambally irrigation district (NSW).

We used Landsat data from the GA/CSIRO "DataCube" project which made historical Landsat data (from 1987 to 2012) for the entire Australian continent available (GA, 2013). In a first pre-processing step we generated monthly Landsat composites using the medoid (multidimensional median) of cloud-free pixels and filled remaining gaps with linear interpolation. We used training samples from visual interpretation of Landsat data in the summer months where area with irrigated crops and non-cropped areas were identified. Monthly values and rates of change of the Normalised Difference Vegetation Index (NDVI), the Enhanced Vegetation Index (EVI) where used as predictive variables in a Random Forest classification model to map summer irrigated areas for the water-years 2004/05 to 2011/12. All the predictive variables are presented and the algorithm produces a series of ensemble models to predict the resulting variable (crop or non-crop). The algorithm also generates an estimate of the relative merits of each explanatory variable and therefore, a more parsimonious model (i.e. one which produces the best results with the lowest possible number of explanatory variables) can be selected.

The approach produced annual maps of irrigated summer crops for the region which look consistent with visually interpreted spatial patterns. We also used a water detection algorithm for identifying water persistence in each growing season (i.e. the frequency in which water was observed in each pixel) to identify on-farm storages.

Current and future research focuses on expanding this approach to the entire Murray-Darling Basin and using water diversion data, statistics of irrigated areas and production volumes to further validate the results presented.

Keywords: *Remote Sensing, Landsat, Datacube, cropping, on-farm storages, irrigation*