Mapping cropland extent and areas of Australia at 30-m resolution using multi-year time-series Landsat data and Random Forest machine learning algorithm through Google Earth Engine (GEE) Cloud Computing*

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ABSTRACT:
Mapping accurate, precise, and consistent cropland products is crucial for global food security analysis. Mapping croplands, including fallow areas, is an important measure to determine the quantity of food that is produced, where it is produced, and when it is produced (which season). Satellite based earth observation provides the best opportunity for globally consistent, spatially explicit, cost effective, objective, and efficient way to map croplands at various spatial resolutions. However, mapping cropland extent at finer (e.g., 30-m or finer) spatial resolution over very large areas such as continental, and global extent is challenging. This study developed a precise Landsat 30-m cropland extent map and calculated cropland areas of the Australian continent for the nominal year 2015 using a random forest (RF) machine learning algorithm (MLA) through Google Earth Engine (GEE) cloud computing platform. The process involved the use of 8 bands (blue, green, red, NIR, SWIR1, temp, NDVI and NDWI) of Landsat-8 every 16-day data for the years 2014 and 2015. Each band was a composited over 2-4 time-period using mean value compositing. Overall, there was a 48-layer data-cube on which we generated knowledge of croplands *versus* non-croplands, coded the knowledge into RF MLA and run on the GEE cloud to obtain cropland extent for all of Australia. An external independent evaluation team conducted an accuracy assessment using an independent validation data set collected from field survey and sub-meter to 5-m very high spatial resolution imagery. Results showed an overall accuracy of 97.56% with high producer's accuracy of 98.7% and user's accuracy of 89.0% for the cropland class. The study also determined how the cropland areas change with spatial resolution of imagery at 30-m, 250-m, and 1-km. We established that cropland location precision and map accuracies were significantly higher for 30-m. We also established that areas determined using 30-m were much more precise and reliable.

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