

Automatic Mapping of Crop intensity and Seasonal Dynamics across South Asia using 15 Years of MODIS Imagery

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Abstract:

South Asia is still predominantly an agrarian society. Agriculture is the main sources of livelihood for the majority of the population; food demand is continuously increasing and expects to continue for many years. To meet the increasing demand, intensifying existing cropland is more sustainable than converting more natural areas. Unfortunately, a little is known about cropping patterns and intensity in this region. Knowledge about where and when crops grow or remain fallow land and their length is very crucial to plan sustainable agriculture management and infrastructure development. Remote sensing offers a unique opportunity to detect this set of information.

In this study we characterized and mapped the cropping systems in South Asia automatically using four indicators (a) cropping intensity (number of crops per year), (b) fallow cycle (c) crop duration ratio (actual time under crops) and (d) seasonal extension based on timeseries MODIS images from 2003 to 2018.

We developed and implemented a method to 15 years of moderate resolution remote sensing (MODIS) data (utilizing 250m resolution 16 days' composites from Terra and Aqua) over South Asia to detect cultivated areas, and Start and End dates (SoS and EoS). The detected crop seasonality and intensity were compared to published data, static crop calendars, to check that the detections were valid. Then, these detected indicators were implemented to compute crop intensity, fallow cycle, crop duration ratio, and seasonal extension maps. We further divided the fifteen years period into three distinct durations (2003-2005, 2008 – 2012 and 2013 - 2017) to monitor the changes in crop pattern over the years.

We observed a variation in intensity, fallow cycle and the crop duration ratio in various locations, generally that is higher in the plain areas having irrigation facilities. And the fallow cycle has a longer duration in the dry season and hilly regions. In Ganga, the Brahmaputra and Sindh flood plain, South East India and part of Sri Lanka have a very small fallow cycle but in the mountainous regions of Nepal, India, Pakistan, and Bhutan have long fallow cycle during winter. In overall, the crop duration ratio is more than the fallow ratio and it is higher during 2013 – 2018 than 2003 – 2008 in a number of places in every country of South Asia. However, the crop duration ratio is decreased in some mountainous area of Nepal, India and Pakistan.

Keywords: Remote Sensing; MODIS, Crop Intensity, Agriculture, South Asia