REMOTE SENSING

Improved crop mapping in China

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Accurate information on the spatiotemporal distribution of croplands is still lacking in most of the world. Remote sensing with ground truth from field surveys is usually employed to generate this information, with phenological traits (for example, crop calendar and growth characteristics) aiding crop classification from large-scale satellite imagery. Yet, considerable uncertainty remains, as this method requires training samples for different land cover classes that are hard to collect continuously and over a large area.

Yuchuan Luo, from Beijing Normal University, and colleagues have proposed a phenology-based approach to map major crops over the long term and at a large scale more easily and precisely. Using leaf area index (LAI) data from the Global Land Surface Satellite (GLASS), the authors generated a dataset of annual harvesting areas for rice, wheat and maize in China from 2000 to 2015 at a 1-km resolution. Phenological stages were derived from crop-specific LAI time series using inflection- and threshold-based methods. Crop-cultivated grids were determined for each crop on the basis of key phenological stages, namely green-up, emergence, transplanting, V3 (that is, the early vegetative stage of maize when the third leaf collar develops), heading and maturity dates.

The new mapping technique revealed detailed spatiotemporal trends. For instance,

harvesting areas of paddy rice expanded significantly in northeastern China but decreased in the south (particularly in economically developed coastal provinces); those of wheat declined, except in the main wheat production areas; and maize harvesting area increased in most of the country. As argued by the authors, such patterns could be explained by factors such as urbanization, climate change and farmland abandonment. Interannual variations in total harvesting areas differed among crops and subregions. County-level comparisons of harvesting areas between GLASS LAI-based estimates and agricultural census data in 2008 indicated the high accuracy of their crop classification ($R^2 > 0.8$).

The crops analysed here represent over 40% of China's food calorie supply. Thus, understanding how their harvesting area evolves is critical for effective land-use planning, with direct implications for agriculture and the environment. The dataset generated in this study can be used in future modelling research, just like the proposed crop mapping method may be replicated in other contexts to capture the diversity and complexity of farming systems and land conversion.

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