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Crop-Type Mapping in an Urbanizing Agricultural Landscape in India

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Abstract

Global agricultural land is increasingly under pressure due to factors like climate change or urbanisation. The Indian megacity Bengaluru is one of the fastest growing cities in the world. Urbanisation is connected to a change in the agricultural practice around the city. To verify this idea, a large-scale mapping of crop types is needed. Satellite remote sensing offers the tools to identify crop types in an objective manner.

To evaluate the potential of high-spatial resolution satellite data to identify crop types, the grown crops in 20 1 km^2 subplots along a 50 km long transect spanning from urban to rural areas in Bengaluru were determined. Simultaneously, a WorldView-3 satellite image with a spatial resolution of 1.4 m was collected.

A model was calibrated for the classification of the pixels belonging to the sampled field areas (n=3358 fields). The model is based on a random forest classification (RFC) in combination with an unsupervised K-means classification (Kmeans). Due to the sensitivity of RFC to unequal sample size three separate models were developed. First, crops with more pixels than 40000 are randomly trimmed to equal the sample number. Secondly, crops are divided to groups with number of pixels higher and lower than the threshold of 4000 pixels. Crops with number of pixels lower than the threshold are merged and classified by Kmeans. Generated classes and original crops classes are finally used to calibrate the first RFC, classified pixels are then separated. This process is repeated once again with threshold 1000 pixels, and last time only RFC is used.

The resulting model will be used to map the crop type distribution along the transect. The information can subsequently be used as indicator for developments and drivers of agricultural land use change in the context of urbanisation.

Keywords: Crop types, India, random forest classification, remote sensing, urbanisation, WorldView-3

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