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Sub-pixel crops mapping using random forest by integrating multi-source remote sensing and agricultural inventory data

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Accurately mapping the spatial distribution information of crops in a large region is of great improtance for addressing the agricultural socio-economics, food security, and environmental impact challenges. We present a new strategy for sub-pixel crops mapping by integrating multi-source remote sensing and agricultural inventory data using random forest (RF) machine learning algorithm, reflecting the proportion of each crop area in a "1km×1km" grid cells. Taking the sub-pixel crops mapping of Gansu province, northwest China in 2010 as a typical case, we assume that the agricultural inventory data in county unit were the “truth” value and two-step procedure was used, 1) the agricultural inventory data in county unit were disaggregated at the level of "1km×1km" grid cells as a function of a series of spatial covariates (i.e. land-use and land-cover change, and topography data with the resolution of 100m×100m), and 2) adjusting the predicted crops value in each pixel by a provincial level factor so that the summed values of the pixel match the total number of crops area registered in inventory data. After two steps, the percentage maps with 1km×1km resolution of the seven principal crops (including wheat, maize, other grains, oil plants, vegetables, orchard, and other crop) of Gansu Province in 2010 were obtained. Compared the aggregated crop percentage maps with the agricultural inventory data in county unit, preliminary 1000 bootstrap procedure results show that the relative error of crop mapping is 1.32%. The above performances indicated that the sub-pixel crops mapping by combining remote sensing and inventory data using random forest was a effective and feasible to accurately obtain the spatial distribution of crops in a large region.