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TITLE: Mapping forest plantations in Mainland China: combining remotely sensed land cover and census land use data in a land transition model

ABSTRACT BODY: Forest plantations have played an important role in shaping the coverage and compositions of China's forests. Maps characterizing the spatial and temporal patterns of forest plantations in china are essential to both identifying and quantifying how forest plantations are driving changes to the countries ecosystem structure and terrestrial carbon cycle. At this time there are no detailed spatial maps of plantations in China accessible to public. Land transition model that employs Metropolis simulated annealing optimization has been demonstrated effective in land use mapping when land cover observations and land use census data are available. This study aims to map forest plantations in Mainland China by linking remote sensing observations of land cover and census statistics on land use in land transition model.

Two models, a national model and a regional model were developed in the study. National model depicted a universal relationship between land cover and land use across the whole country. One of the land use data sources came from the 7th National Forest Inventory (NFI) that depicted forest plantation area in the period of 2004-2008 in each provincial jurisdictions of China (Data from Taiwan, Hongkong and Macau is not available). In accordance with land use data, MODIS yearly IGBP land cover product that contains sixteen-land cover types has been averaged upon the same time period and summarized for each province. The pairwise correlation coefficient between modeled value and reported value is 0.9996. In addition, the 95% confidence interval of true population correlation of these two variables is [0.9994, 0.9998]. Because the targeted forest plantations cover much less area compared to the other land use type of non-plantation, model precision on forest plantations was isolated to eliminate the dominance in area of non-plantation and the correlation coefficient is 0.8058. National model tends to underestimate plantation area.

Due to distinct geographic and climatic natures along the north-south gradient in temperature and east-west gradient in precipitation in China, forest plantation species and land management strategies vary considerably by regions, which create unique connections between land cover and land use. In consistency with previous studies, we divided our model into six regions: Northeast, North, Northwest, Southwest, Southeast and Eastern plains of China. Parameters of six regional models were subsequently estimated by Metropolis annealing procedure. Regional models estimate forest plantation area of 611992 km² in national total against NFI's report of 616884 km² for the same period. For the whole country, the pairwise correlation coefficient between modeled value and reported value is 0.9999. By examining forest plantations solely, the modeled value is significantly correlated with reported value at a correlation coefficient of 0.9624. Regional model has a better estimation in the area of forest plantations at provincial level than national model. Final forest plantation map of Mainland China was generated from the model at quarter degree, which is favorable to regional ecosystem modeling and carbon cycle simulation.

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INDEX TERMS: 1632 GLOBAL CHANGE Land cover change, 1640 GLOBAL CHANGE Remote sensing, 0428 BIOGEOSCIENCES Carbon cycling, 0414 BIOGEOSCIENCES Biogeochemical cycles, processes, and modeling .

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