The Role of Topographical Factors in Classification of Land Cover

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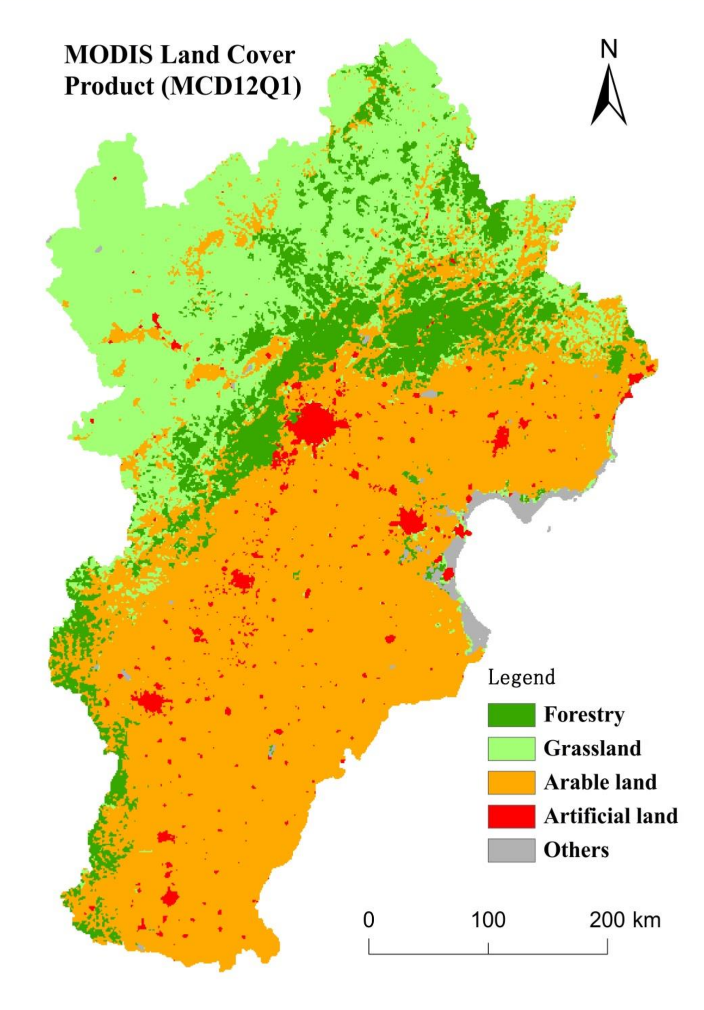
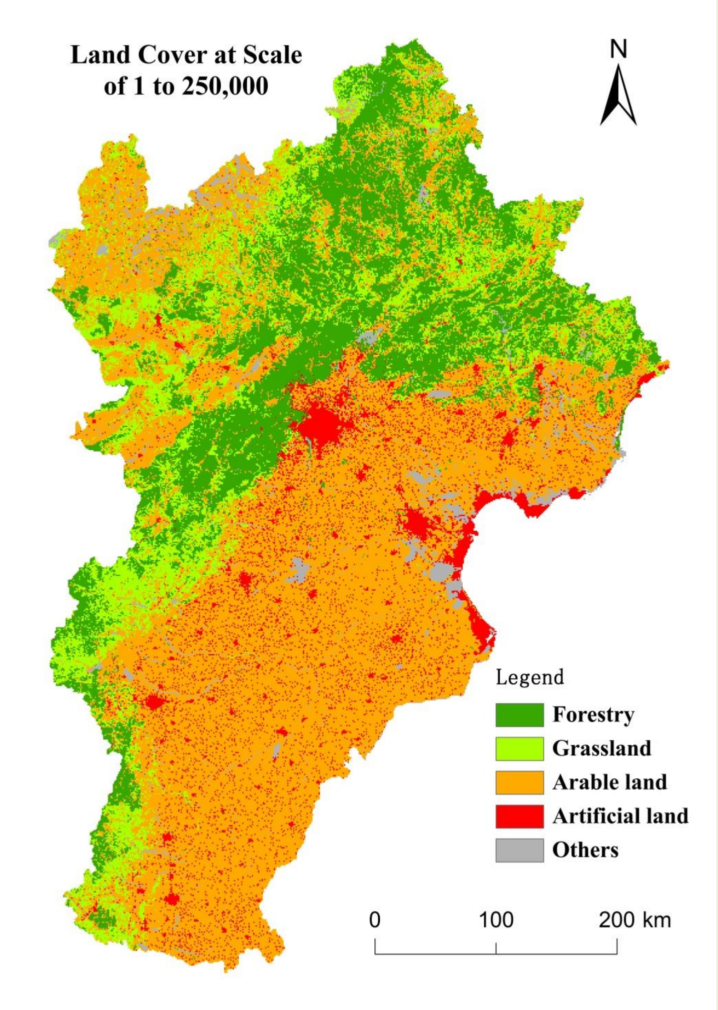
1 Introduction

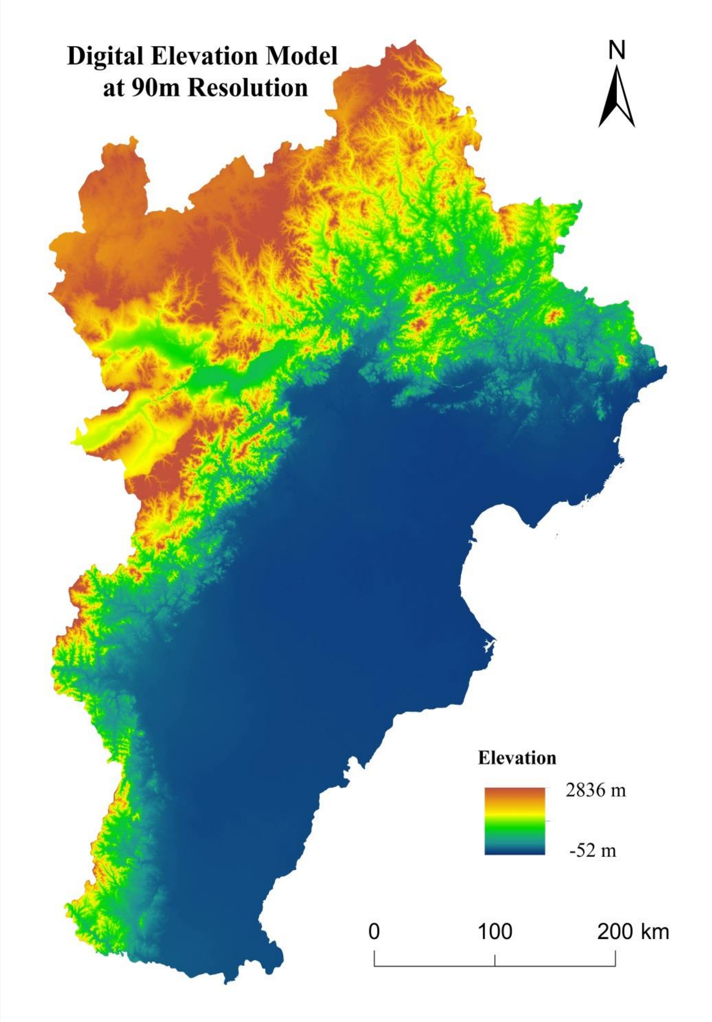
Land cover is not only an indicator of global change but also essential data for research on global environment change. So accuracy and timeliness of land cover data are fundamental to its application. Generally land cover data retrieved from remote sensing images with high spatial resolution have low temporal resolutions and vice versa. There is usually contradiction between accuracy and timeliness of land cover. Therefore mutual complementation of information with high spatial and temporal resolution is an effective way to improve accuracy and timeliness of land cover.

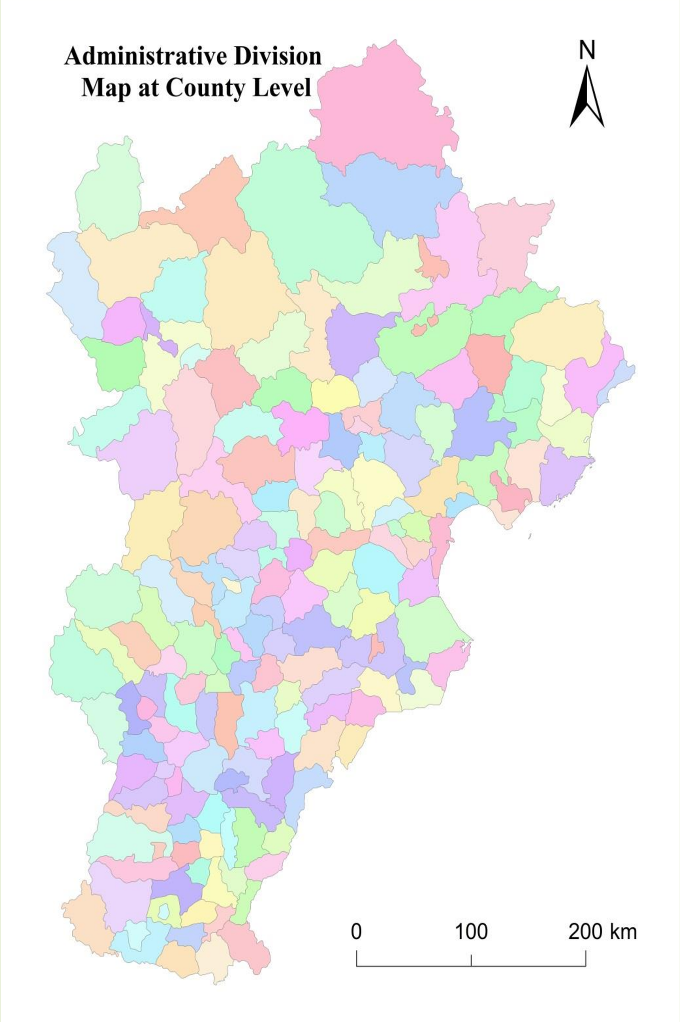
2 Data

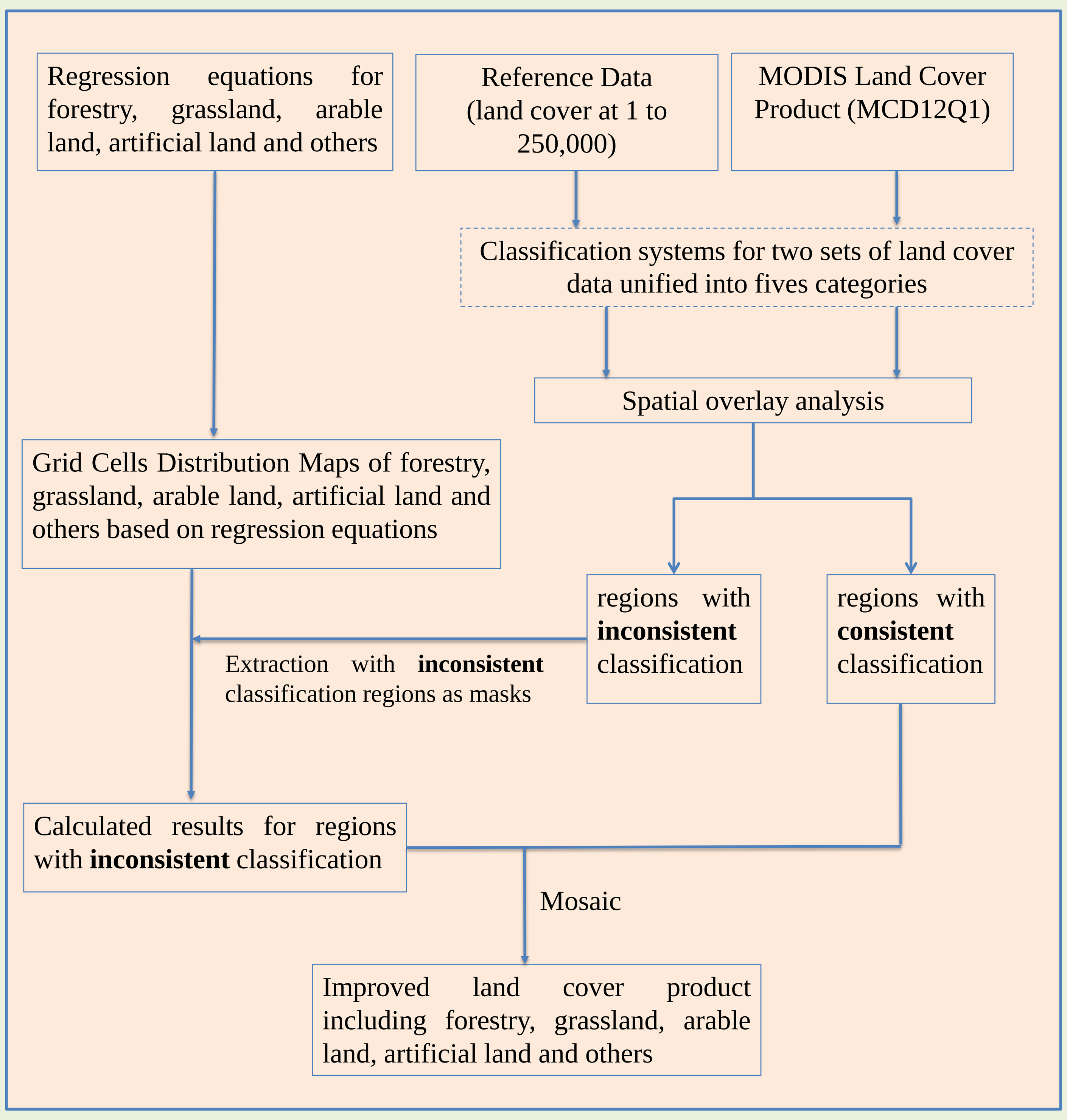
Beijing-Tianjin-Hebei Region was taken as the study area. The used data included: (a) MODIS land cover product (MCD12Q1) at 500m resolution, which was used as the object to improve classification accuracy, (b) Land cover at scale of 1 to 250,000 as the reference data, (c) Digital Elevation Model at 90m resolution, which was applied to extract topographic information, such as slope, aspect, and so on, and (d) Administrative division map at county level, which was used as spatial samples for statistical analysis.











3 Methods

(a) Classification systems for two sets of land cover data was unified into forestry, grassland, farmland, settlement and the other. (b) The two sets of data were overlaid. The results were divided into two parts. One is the grid cells with the same categories in two sets of data, and the other includes the grid cells with the different categories in two sets of data. (c) Administrative divisions at county level were used as statistical analysis samples to establish correlation models between categories of land cover and terrain factors, with area proportion of land cover categories in a county as dependent variable and terrain factors as independent variables. (d) The land cover categories of the grid cells in MCD12Q1, which were inconsistent with the reference data, were replaced with calculated results based on the models. An improved land cover product was generated.

Categories of land cover	Regression equation without constant	Regression equation with constant
Forestry	$y = -0.7x_1 + 391.7x_2 - 1.3x_3$	$\mathbf{y = -226.5 - 0.7x_1 + 392.7x_2}$
Grassland	$y = 1.1x_1 + 101.3x_2 + 0.5x_4$	$\mathbf{y = 1211.3 + 1.3x_1 + 155.2x_2 - 7.1x_3}$
Arable land	$\mathbf{y = -459.7x_2 + 47.5x_3}$	$y = -2617.3 - 468.8x_2 + 63.3x_3$
Artificial land	$y = 9.6x_3 - 3.2x_5$	*
Others	*	$y = 6514.7 - 36.4x_3$

In the equations, y represents percentage of area of a category of land cover, and it is multiplied by 100 so that coefficients in right of the equations are not too small. x_1 represent elevation (unit: meter), x_2 represents slope (unit: degree), x_3 represents aspect (unit: degree), x_4 represents terrain undulating degree (unit: meter), and x_5 represents surface cutting depth (unit: meter).

4 Results

Compared with the original MODIS land cover product (MCD12Q1), the spatial consistency, producer's accuracy and user's accuracy of the improved products with corresponding land cover categories in the reference data were obviously enhanced, and overall accuracy and Kappa coefficient increased by 17.14% and 0.25 respectively.

5 Conclusion

It can effectively enhance the accuracy of land cover classification to use the quantitative models between land cover distribution and terrain factors to improve existing land cover products.