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Research on the Temporal and Spatial Distributions of Standing Wood Carbon Storage Based on Remote Sensing Images and Local Models

编号	010033401
推送时间	20220314
研究领域	森林生态
年份	2022
类型	期刊
语种	英语
标题	Research on the Temporal and Spatial Distributions of Standing Wood Carbon Storage Based on Remote Sensing Images and Local Models
来源期刊	forest
期	第334期
发表时间	20220218
关键词	remote sensing; GWR; MGWR; TWR; GTWR; standing wood carbon storage;

摘要 Background and Objectives: It is important to understand the temporal and spatial distributions of standing wood carbon storage in forests to maintain ecological balance and forest dynamics. Such information can provide technical and data support for promoting ecological construction, formulating different afforestation policies, and implementing forest management strategies. Long-term series of Landsat 5 (Thematic Mapper, TM) and Landsat 8 (Operational Land Imager, OLI) remote sensing images and digital elevation models (DEM), as well as multiphase survey data, provide new opportunities for research on the temporal and spatial distributions of standing wood carbon storage in forests. Methods: The extracted remote sensing factors, terrain factors, and forest stand factors were analyzed with stepwise regression in relation to standing wood carbon storage to identify significant influential factors, build a global ordinary least squares (OLS) model and a linear mixed model (LMM), and construct a local geographically weighted regression (GWR), multiscale geographically weighted regression model (MGWR), temporally weighted regression (TWR), and geographically and temporally weighted regression (GTWR). Model evaluation indicators were used to calculate residual Moran’ s I values, and the optimal model was selected to explore the spatiotemporal dynamics of standing wood carbon storage in the Liangshui Nature Reserve. Results: Remote sensing factors, topographic factors (Slope), and stand factors (Age and DBH) were significantly correlated with standing wood carbon storage, and the constructed global models exhibited fitting effects inferior to those of the established local models. LMM is also used as a global model to add random effects on the basis of OLS, and R2 is increased to 0.52 compared with OLS. The local

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and GTWR, all have good performance. Compared with OLS, the R2 is increased to 0.572, 0.589, 0.643, and 0.734, and the fitting effect of GTWR is the best. GTWR can overcome spatial autocorrelation and temporal autocorrelation problems, with a higher R2 (0.734) and a more ideal model residual than other models. This study develops a model for carbon storage (CS) considering various influential factors in the Liangshui area and provides a possible solution for the estimation of long-term carbon storage distribution. View Full-Text

服务人员 王璐

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