Analyzing Deforestation and Reforestation Causes in the Central Ecuadorian Amazon Using Geographically Weighted Ridge Regression and Dasymetric Mapping

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Abstract

The tropical Andes region encompasses an endangered biodiversity hotspots with high conservation priority. Deforestation due to population growth and agriculture expansion thereby is one of the leading threats to this region and therefore highlights the importance to understand the drivers of this process on multiple scales. Beyond that on the other hand drivers for reforestation and their role in forest recovery are less known. Therefore, we propose an interdisciplinary approach to analyse both deforestation and reforestation drivers by applying geographically weighted ridge regression. This method evaluates spatial nonstationary and provides surface representations of local parameter estimates to identify regions where drivers show higher significance for either deforestation or reforestation. Our analysis included nine different variable groups and two predictors using socio-economic data from population censuses, accessibility models and biophysical features. Information on deforestation and reforestation were based on remote sensing input data. We used dasymetric mapping in conjunction with land cover maps to downscale areal-based data and improve the spatial resolution of our analysis. We conduct our research in the Tropical Andes of the Ecuadorian Amazon, a highly heterogeneous region, within the time period 2000–2010. Areas were highlighted where improved accessibility to palm oil, coffee, cacao and milk production facilities motivated deforestation, while reforestation seems to follow the opposite. Moreover, gender, ethnicity and household structure, showed high influence for untangle population dynamics and its relationship with forest change. This approach demonstrates the benefits when remote sensing derived products and socio-economic data are integrated for understand coupled socio-ecological systems from local to global scales.

Keywords: Coupled socio-ecological systems, drivers of land use change, ecosystem monitoring, forests dynamics

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