

Investigating the compounding effects of environmental factors on ecosystem services relationships for the ecological conservation red line areas

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Abstract

Exploring the driving factors of ecosystem services (ESs) trade-offs/synergies is crucial for ecosystem management, especially in ecological conservation red line (ECRL) areas that maintain regional and national ecological security. Soil conservation (SC), water yield (WY) and carbon sequestration (CS) were simulated in the Beijing ECRL areas. Geographical weighted regression was used to explore the trade-offs/synergies, and the geographical detector was applied to quantitatively identify their driving factors. Results show that (1) the SC and CS show marked synergy which characterized more than 80% of each ECRL area; the proportion of the space area of trade-off and synergy between SC and WY, and WY and CS was roughly 3 to 7 and 4 to 6 in each ECRL area, respectively. (2) The synergy of the three pairs of ESs was most sensitive to terrain factors. The precipitation erodibility of soil and its necessity for vegetation make it a determinant of the trade-off between SC and CS; temperature was the determinant in the trade-off between WY and CS, with an explanatory power of 32.8%; potential evapotranspiration was best able to explain the spatial distribution of the trade-off between SC and WY. (3) The interaction between precipitation and other factors had the greatest explanatory power on the spatial relationship between SC and WY. Precipitation and relief amplitude are the main interactive factors respectively affecting the spatial trade-off and synergy between SC and CS. The trade-off and synergy between WY and CS were most sensitive to the interaction between climate factors and terrain factors.

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