The relationship between soil heavy metal contamination and landscape pattern at the urban fringe of Changchun City

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Different intensities, categories and spatial configurations of land use are the crucial characteristics of landscape pattern, and are also one of the important factors affecting how agricultural land is cultivtated. To reveal the relationship between landscape pattern and soil heavy metals in the black soil region, 200 top-soil samples were taken at the urban fringe of Changchun City. Based on landscape theory, geostatistics and multivariable statistics were performed to analyze the characteristics of eight heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn). Also, single-factor pollution index and Nemerow's comprehensive pollution index were adopted to evaluate the contamination status. Furthermore, the landscape pattern characteristics in relation to soil heavy metal contamination were analyzed.

First, the single factor pollution index and comprehensive pollution index of most soil heavy metals indicated a relatively clean soil environment, except for Cd, which showed slight contamination in several soil samples. The spatial distribution of soil contamination showed that the middle and the eastern area of the studied urban fringe was a hotspot for comprehensive soil heavy metal contamination, meanwhile, it was also the place that was distributed with more industrial land and rural settlements. The PLAND indices associated with the single factor pollution index indicated that there were significant differences between soil soil heavy metals. Moreover, the COHESION indices for different levels all exceeded 95. The landscape indexes associated with comprehensive concentration index revealed that the landscape with soil heavy metal contamination in the study area were evidently less fragmented, e.g. better landscape connectivity. This research explored the soil contamination associated with heavy metals at a typical urban fringe situated in the black soil region, and the results suggested that the contamination was somehow related to the landscape indices.