

Contribution of Vegetation Restoration to Carbon Sequestration Driven by Ex-situ Poverty Alleviation and Relocation in Ecologically Fragile Areas—Taking Guizhou, China as an Case

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Abstract

Vegetation restoration in ecologically fragile areas has a significant carbon sequestration effect, and the driving factors affecting it are complex. In particular, it is usually difficult to achieve quantitative assessment at the regional scale for this part of human activity intervention in the ecological environment. The Chinese government's ex-situ poverty alleviation and relocation project has relocated approximately 10 million people from areas with a fragile ecological environment to urban centralized resettlement, which is a typical case of weakened environmental intervention by human activities. Guizhou Province, an ecologically fragile region in southwest China, was selected as the study area, with a relocated population of 1.92 million, accounting for approximately 20% of the total relocated population in China. The carbon sequestration (CS) model of vegetation photosynthesis and spatial analysis of geographic information were used to quantify the contribution of human activities to the natural restoration of vegetation carbon sequestration at the regional scale caused by the weakening of environmental interventions, based on the data of net primary productivity (NPP) of vegetation from 2000 to 2020. The results show that the implementation of the ex-situ poverty alleviation and relocation project acts as an external force to drive vegetation restoration and carbon sequestration, which increases the slope of the carbon density change trend (from $k=30.9$ to $k=57.41$), resulting in an overall carbon density increase of 26.51 tCkm^{-2} . The results of the regional spatial analysis showed that the correlation coefficients between carbon density and relocation intensity in the 5-year and 10-year change intervals before and after relocation were $r=0.976$ ($p<0.01$) and $r=0.949$ ($p<0.05$), respectively, indicating a significant positive correlation between vegetation carbon sequestration and relocation intensity. Based on this, the carbon sequestration contribution of vegetation in 84 counties (districts) in Guizhou Province that implemented ex-situ poverty alleviation and relocation projects was calculated, showing that 79 counties (districts) contributed positively, accounting for 94%. The average contribution of carbon sequestration by vegetation restoration in each county (district) was 0.0556 Tg , and the CO_2 emissions during the emission reduction period were 0.2059 Tg . The other five counties (districts) with a negative contribution to carbon sequestration were distributed in regions with relatively stable ecosystems and mature forests. This shows that human intervention in the environment changes significantly in fragile ecological areas.

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