

Human–desertification coupling relationship in the karst region

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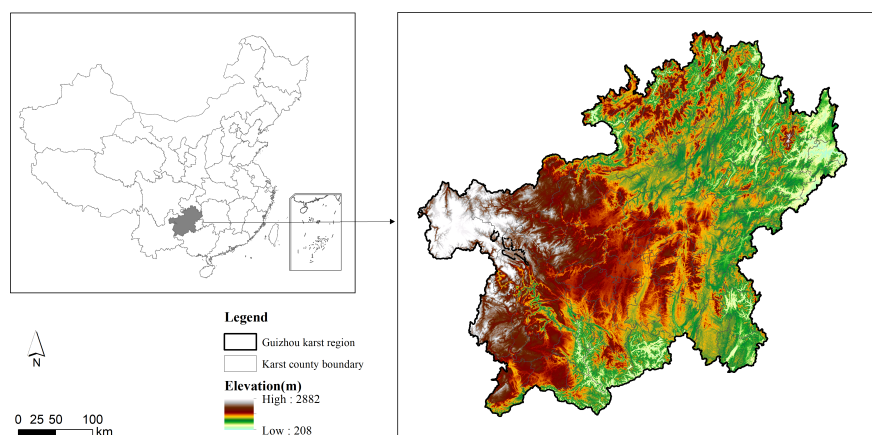
September 24, 2020

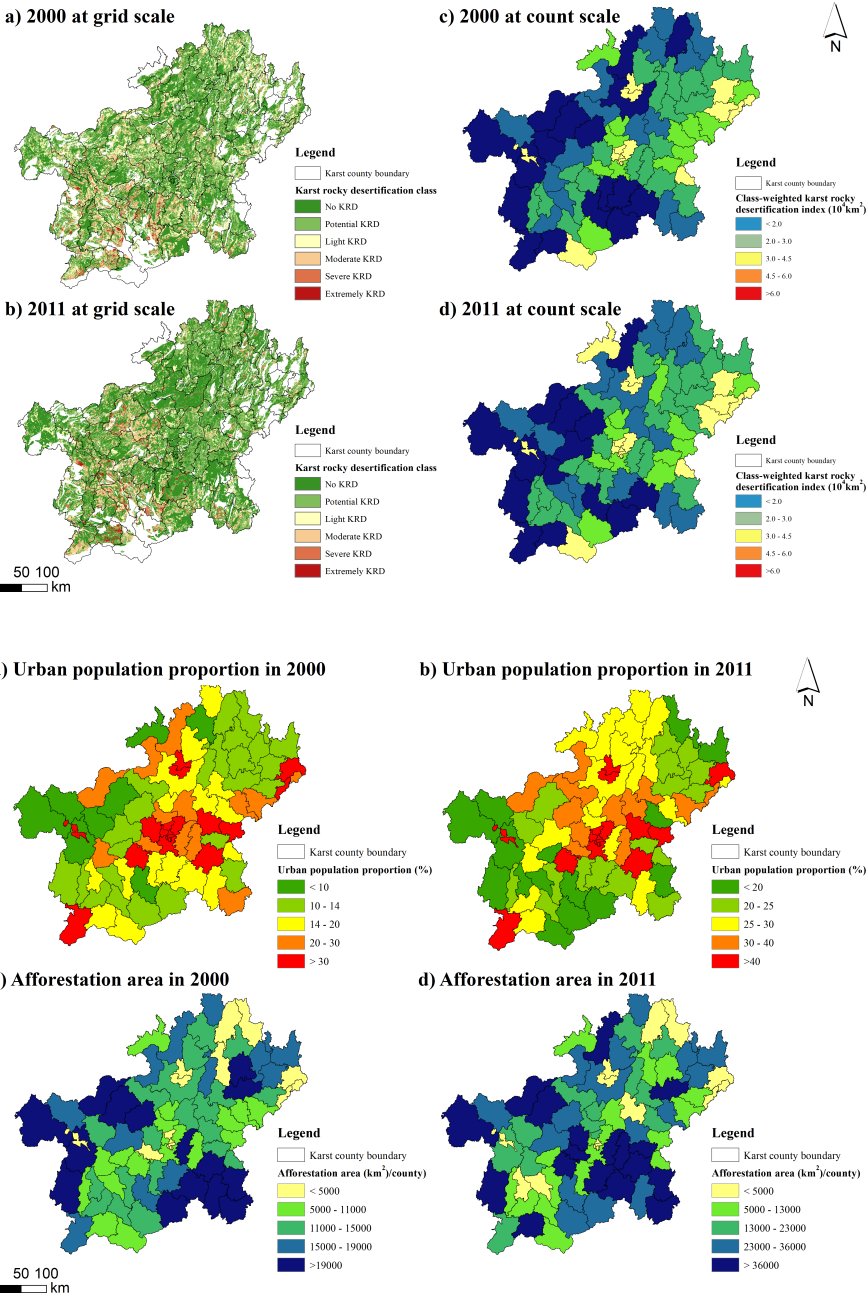
Abstract

Forward and reverse successions of karst rocky desertification (KRD) occur simultaneously, and are linked to human activity, thus presenting a mutual feedback loop. Previous studies have focused on the unilateral human-driven mechanism of KRD or the impact of KRD on social-economic activities. These lack quantitative measurement and in-depth understanding of interactions involved. Therefore, this study builds and applies a novel model for measuring the coupling relationship and degree between KRD and social-economic activity in the Guizhou karst region of China. Results show an overall improvement but local deteriorations in KRD from 2000 to 2011; conversely, social-economic activity intensities increased during that time period. With their spatio-temporal variations, positive and negative human–desertification coupling relationships with an increased coupling degree are found. Different coupling relationship types between KRD and social-economic development, including urbanization, economic development and household income, are shown. KRD is found to be high positively coupled with specific human behavior intensities such as population movement, steep slope cultivation and ecological restoration. An inverted U-shaped curve is observed in the coupling index of KRD and urbanization within different development levels. Negative coupling at a low urbanization level indicates the limitation of the karst physical environment on social-economic development. Positive coupling with increasing urbanization implies a conflict between environment protection and social-economic development. A return to negative coupling in several counties with high urbanization levels indicates a win-win for ecology and economy. The effectiveness of the proposed coupling model is demonstrated, informing differentiated strategies for combating KRD and improving social-economic development.

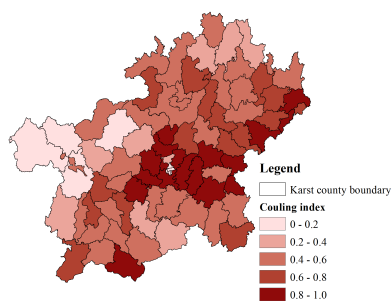
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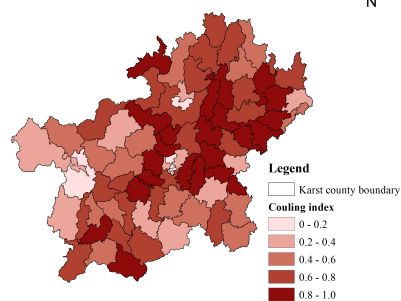




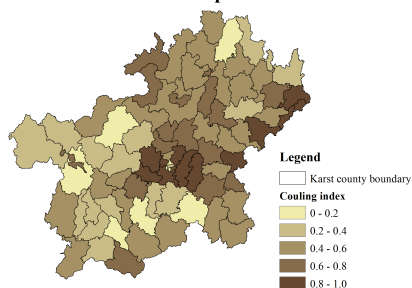
a) Coupling relationship between KRD and urbanization in 2000



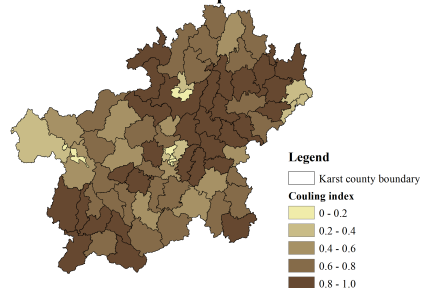
b) Coupling relationship between KRD and urbanization in 2011



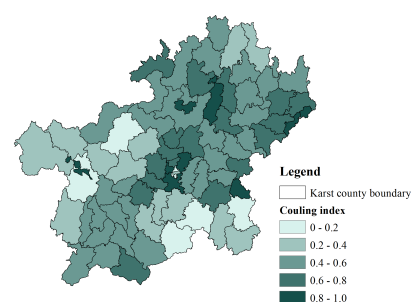
c) Coupling relationship between KRD and economic development in 2000



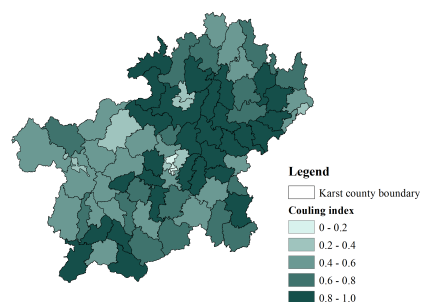
d) Coupling relationship between KRD and economic development in 2011



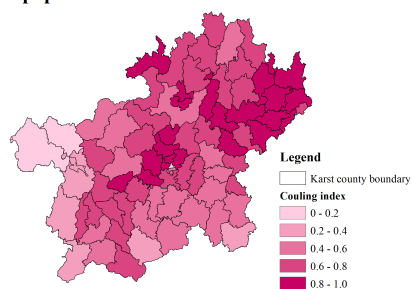
e) Coupling relationship between KRD and household income in 2000



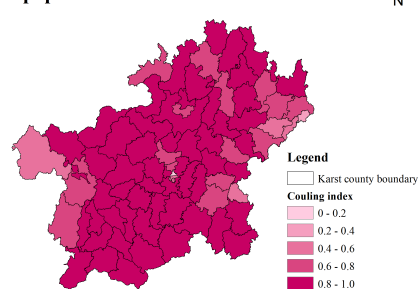
f) Coupling relationship between KRD and household income in 2011



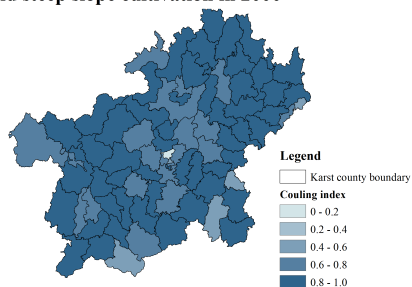
a) Coupling relationship between KRD and population movement in 2000



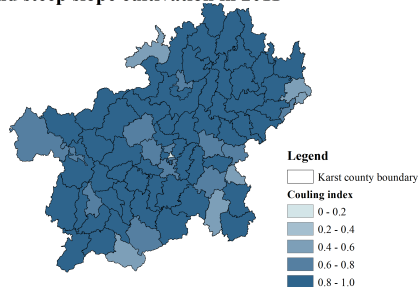
b) Coupling relationship KRD and population movement in 2011



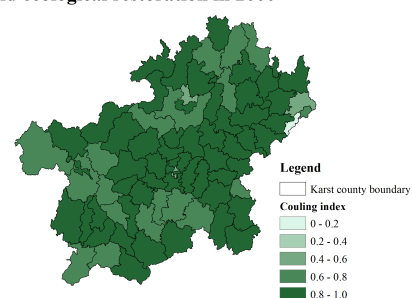
c) Coupling relationship between KRD and steep slope cultivation in 2000



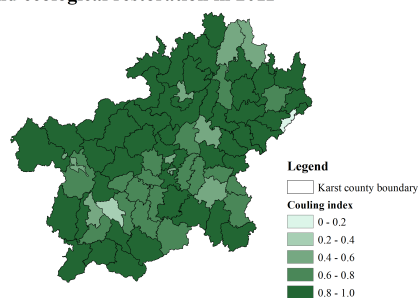
d) Coupling relationship between KRD and steep slope cultivation in 2011



e) Coupling relationship between KRD and ecological restoration in 2000



f) Coupling relationship between KRD and ecological restoration in 2011



0 50 100
km

