



Forest recovery and its driving forces in karst areas of southwest China

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Abstract: Globally, the loss of forest is of great concern as forest plays many key roles in the earth system, for example, it contributes to biogeochemical cycles and rural livelihoods. Forest could provide ecosystem services such as soil retention and flood regulation and is especially critical in mountain environments. Deforestation in such regions further results in carbon emission and biodiversity loss and may reduce agricultural productivity and increase the poverty rate. In China, recognition of these problems has prompted a series of ecological construction programs, including “Returning Farmland to Forest” (RFF), which advocates stopping farming on sloping land that is prone to soil erosion and promotes afforestation and recovery of forest vegetation and was initially implemented in 1999. The program has been widely applied in Guizhou Province, a typical fragile karst mountain area of southwest China. There is, however, a lack of knowledge of the effectiveness of the RFF policy, and the relative roles played by possible factors that lead to forest change. Here we analyze the pattern and process of forest change in the karst mountain regions of Guizhou province between 1980 and 2018 and evaluate how RFF and other driving forces contribute to these changes. Based on a temporal sequence of satellite images, we develop a Markov model to examine the forest change, and found that most of the forests grow on the slopes of 15-25°, the forest cover has increased by 1,410 km² between 1980 and 2019, and 36% of cropland in Guizhou province has been converted to forest since 1980. Out of nine municipalities in the province, the most significant increases in forest cover occurs in Qiandongnan, which accounts for 20% (583 km²) of the increased area. we also found that the RFF program has had a marked positive impact on forest cover and has also improved hydrothermal conditions in the region. However, population, GDP, and traffic accessibility have a negative impact on forest cover. Climate factors appear to have the least impact on forest change during the period of 1980 to 2018. The findings offer useful information for resource managers to engage in forest protection, deforestation prevention, and ecological restoration in regions with similar conditions.

KEYWORDS: forest; restoration; RFF; GDP; karst areas