

GIS-based detection of land use transformation in the Loess Plateau: A case study in Baota District, Shaanxi Province, China

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Abstract: During the past decade, great efforts have been made to boost the land use transformation in the Loess Plateau, especially for reducing soil erosion by vegetation restoration measures. The Grain-for-Green project (GFG) is the largest ecological rehabilitation program in China, which has a positive impact on the vegetation restoration and sustainable development for the ecologically fragile region of west China. Based on the Landsat TM/ETM images for three time periods (2000, 2005 and 2010), this study applied the GIS technology and a hill-slope analytical model to reveal the spatio-temporal evolutionary patterns of returning slope farmland to grassland or woodland in Baota District, Yan'an city of Shaanxi province. Results showed that: (1) from 2000 to 2010, the area of farmland decreased by approximately 35,030 ha, which is the greatest decrease among all the land-use types, whereas grassland, woodland and construction land increased, of which grassland expanded rapidly by 26,380 ha. (2) The annual variation rate of land-use dynamics was 1.98% during the period 2000–2010, of which the rate was 1.05% for the 2000–2005 period and 2.92% for the 2005–2010 period, respectively. Over the past decade, returning farmland to woodland or pastures was the main source of increased grassland and woodland, and the reduction of farmland contributed to the increase in grassland and woodland by 97.39% and 85.28%, respectively. (3) As the terrain slope increases, farmland decreased and woodland and grassland increased significantly. Areas with a slope ranging from 15° to 25° and less than 15° were the focus of the GFG project, accounting for 85% of the total area of farmland reduction. Meanwhile, the reduction in farmland was significant and spatially correlated with the increase in woodland and grassland. (4) Between 2000 and 2010, the area of destruction of grass and trees in grasslands and woodlands for the reclamation of farmland was approximately 4596 ha. The area subject to the GFG policy was 4456 ha with a slope greater than 25° over the decade, but the area of farmland was still 10,357 ha in 2010. Our results indicate that there has still a great potential for returning the steep-slope farmlands to woodlands or grasslands in the Loess Plateau.

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