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## Temporal and spatial variation of soil erosion rate in the Loess Plateau and its main controlling factors in the past 40 years

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Soil erosion is a very complex physical and geographical phenomenon, which is affected by both natural and human activities. Based on theoretical and technical methods such as CSLE model, Classification and Regression Tree (CART) and Google Earth Engine (GEE), on the basis of obtaining medium and high resolution soil erosion factors, this study systematically analyzed the temporal and spatial variation of soil erosion rate on the Loess Plateau in the past 40 years and the changes of the main controlling factors of soil erosion before and after “returning farmland to forest (grass)”. The main conclusions are as follows: (1) The soil erosion rates of the Loess Plateau in 1980, 1990, 2000, 2010, and 2017 were 2207.57, 1725.13, 981.18, 727.79, and 640.00 t/(km<sup>2</sup>·a), showing a decreasing trend overall. As the most serious soil erosion area on the Loess Plateau, the Loess Hilly and Gully region has a significant weakening trend in its soil erosion rate, but its five-phase average soil erosion rate is still more than twice the average of the whole region, 4414.77, 3485.19, 1884.37, 1296.21, 1135.04 t/(km<sup>2</sup>·a). (2) Before returning farmland to forest (grass) (before 1999), rainfall erosivity (R) was the main controlling factor for soil erosion. After the large-scale implementation of various soil and water conservation measures, the influence of biological measures (B) on soil erosion rate increased; in the sandy region of the Loess Plateau dominated by low-coverage grasslands, soil erosion was significantly affected by rainfall erosivity (R). The main controlling factors of soil erosion in the loess hilly and gully area changed significantly around 2000, from the combined effect of terrain (LS) and vegetation (B) to the combined effect of rainfall erosivity (R), gully erosion factor (g) and vegetation (B). (3) The average soil erosion rate under different land use types on the Loess Plateau is characterized by cultivated land > grassland > forest land. From 1980 to 2017, the soil erosion rate from cultivated land to forest land decreased the most, and the change slope was -74.84 (t/(km<sup>2</sup>·a))/a, followed by cultivated land to grassland and grassland to forest land, both of which changed the slope of soil erosion. They are -51.88 (t/(km<sup>2</sup>·a))/a and -49.05 (t/(km<sup>2</sup>·a))/a, respectively. This research can provide a scientific basis for the needs of future comprehensive management planning and soil and water conservation construction in the basin.