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Changes in watershed soil erosion and sediment sources by converting cropland to forest: identified by 137Cs and CSSI fingerprinting techniques

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The large-scale converting cropland to forest or grasses in the Loess Plateau, i.e. Revegetation Program (RP), since 1999 has significantly reduced soil erosion and consequently the sediment load of the Yellow River. However, how the watershed erosion processes change and where the hotspots of current sediment occur in erosive Loess Plateau remains unclear. Our focus for this study is to identify erosion processes and sediment sources at watershed scale. The study site is in a representative catchment (Yangjuangou catchment), which located in Chinese Loess Plateau. Repeated 137Cs fingerprinting technique was used to identify the contribution of different soil erosion processes, i.e. surface and gully/rill erosion, to watershed sediment production before RP (1996) and after RP (2014), and CSSI sourcing technique was used to identify the current watershed sediment sources from specific land use types. Before RP, surface and gully/rill erosion from cultivated slopes and collapse of gully wall were major soil erosion processes, accounting for 35±15%, 30±12% and 20±8% of the watershed sediment production, respectively. After RP, collapse of gully wall and rill erosion on check-dam farmland become into dominant erosion processes, contributing to 70±15% and 19±8% of the total sediment production from the watershed. Soil erosion from revegetated areas (Carex filipes, Hippophae rhamnoides and Robinia pseudoacacia) within the catchment only contributed about 11±3% of the total sediment production. The changes in soil erosion processes and sediment sources before and after RP were mainly caused by land use changes but less by climate. Our findings suggest that the collapse of gully wall and check-dam farmland erosion cannot be ignored in the sustainable management of revegetated region of Chinese Loess Plateau, especially in the case of catastrophic flooding such as torrents which would cause tremendous soil erosion and sediment production. Our study also emphasizes the importance of combinative use of CSSI and 137Cs fingerprinting techniques in identifying changes of both soil erosion processes and sediment sources by land use changes at watershed scale.