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Effects of precipitation, vegetation and land preparation techniques on surface runoff and soil erosion in a typical hilly watershed, Loess Plateau of China

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Soil and water loss is a world-wide problem that determines the fate of soils, landforms, vegetation and the humankind. Vegetation restoration is one of the most effective way to reduce water erosion. On the other hand, in many fragile regions where are susceptible to natural disasters, land preparation techniques (e.g., leveled ditches, leveled benches, adversely graded tableland and fish-scale pits) were frequently used during revegetation in order to conserve water, fight erosion and restore degraded ecosystems. However, detailed hydrological responses and erosion characteristics under the jointly effects of precipitation, vegetation and land preparation techniques remained poorly understood to date. Consequently, this study investigated the influence of different land preparations on surface runoff and erosion during vegetation restoration processes in a typical hilly catchment in the Loess Plateau of China. Rainfall characteristics, vegetation morphology and the dimension of each land preparation techniques were monitored, runoff coefficient and soil loss rate were calculated after each rainfall event during 2014-2015. Network analysis was applied to build the correlation pathway for rainfall features, vegetation and specification of the land preparations. Redundancy analysis was used to quantify the impact of explanatory variables (rainfall features, vegetation characteristics and dimension of land preparation techniques) on runoff and soil loss rate. Our results showed that different land preparations have different responses to each rainfall event. The mean runoff coefficient of fish-scale pits- P. *tabulaeformis* was highest (3.9%), whereas leveled benches combined with C. *microphylla* exhibited the highest soil loss rate (0.036 t ha^{-1}). Specifically, rainfall intensity and duration rather than rainfall amount were the most important factors affecting the underlying surfaces, followed by vegetation type and technique specifications. Moreover, the relationship among the dimensions of land preparations, runoff coefficient and soil loss rate were investigated, we found the length of leveled ditches, the height or the length of the fish scale pits and the length of platform in adversely graded tableland were the key parameters for soil and water conservation. Negative correlations were detected significantly between these structure parameters and runoff coefficient, except for the adversely graded tableland-*P. tabulaeformis* combination. These results suggest that future vegetation restoration will need to consider both optimizing the specifications of different land preparation techniques and site-specific plant selections with the maximum runoff volume as the precondition.