

Runoff change and sediment source during rainstorms in an ecological construction watershed on the Loess Plateau, China

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The sediment problem is a globally occurring problem that has long been a focus of research. The sediment-reducing effect of check dams and the safety problem after check dam breaks have always been a common concern of the society. This study analyzed the runoff change and sediment source during rainstorms in a small watershed using a multivariate mixed model and a comparative analysis of watersheds. The problem of sediment loss from dammed farmland after check dam break during rainstorms was evaluated. The results showed that the flood peak lag time (PLT) was significantly influenced by pre-soil moisture in case of small amounts of rainfall but not during rainstorms. Ecological construction significantly reduced the linear correlation between rainfall and runoff modulus (RM). The reduction of sediment delivery modulus (SDM) by check dam was stronger than that of the RM. The reduction in RM and SDM under rainstorm conditions were 16%~74% and 53%~93%, respectively. The contributions of inter-gully and gully lands to the sediment deposited in dammed farmland during the large rainstorm on July 26, 2017 were 38.07% and 61.93%, respectively. The increase in vegetation coverage in hillslope increased the proportion of sediment from gully lands. Check dam breaches have accounted for a loss of only 1.2% of the total area of the dammed farmland, and thus have not caused a large loss of sediment. However, the breaches of the check dams clearly increased the coefficient of variation of RM and SDM. Therefore, Check dams have a critical effect on controlling sediment delivery in watershed scale. Dam break will not result in a large percentage of sediment loss from the dammed farmland.