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Evaluating the eco-hydrologic impacts of soil and water conservation in the Jinghe River Basin of Loess Plateau, China, using an eco-hydrologic model

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Since the 1950s, soil and water conservation has been widely applied in the Loess Plateau in China. We examine the eco-hydrologic responses to soil and water conservation in the Jinghe River Basin of Loess Plateau in two scales—catchment scale and basin scale, using Regional Hydro-Ecologic Simulation System (RHESSys). In the catchment scale, we apply the model to disentangle the relative roles played by inter-annual variation and longer-term trends in climate drivers and re-growth following reforestation. Our model-based analysis of trends in forest water use highlights the differences in the response of control and reforested catchments to similar declines in annual precipitation in this region over the past decades. Model estimates show that while reforestation does increase vegetation water use, the impacts on streamflow are small relative to the impact of precipitation trends on streamflow, and forest water use. Results also show that the greatest impact of reforestation is likely to be on groundwater recharge but also suggest that evaporation rather than transpiration is a significant contributor to hydrologic change. In the basin scales, we applied the modified model to evaluate the impacts of soil and water conservation measures on streamflow. Results demonstrate that the soil and water conservation decreased annual streamflow by 8% (0.1 billion m3), with the largest decrease occurring in the 2000s. Model estimates also suggest that soil and water conservation engineering has greater impacts than vegetation recovery. This study offers scientific support for soil and water conservation planning and management in this region.