

Effects of terracing on soil and water conservation in China: A meta-analysis

Die Chen (1,2) and Wei Wei (1)

(1) State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing, China, (2) School of Resources and Environment, University of Chinese Academy of Sciences, Beijing, China

Terracing has long been considered a powerful strategy for soil and water conservation. However, the efficiency is limited by many factors, such as climate, soil properties, topography, land use, population and socioeconomic status. The aim of this critical review was to discuss the effects of terracing on soil and water conservation in China, using a systematic approach to select peer-reviewed articles published in English and Chinese. 46 individual studies were analyzed, involving six terracing structures (level terraces, slope-separated terraces, slope terraces, reverse-slope terraces, fanya juu terraces and half-moon terraces), a wide geographical range (Northeastern China, Southeastern hilly areas, Southwestern mountain areas and Northwestern-central China), and six land use types (forest, crop trees, cropland, shrub land, grassland and bare land) as well as a series of slope gradients ranging from 3° to 35° . Statistical meta-analysis with runoff for 593 observations and sediment for 636 observations confirmed that terracing had a significant effect on water erosion control. In terms of different terrace structures, runoff and sediment reduction were uppermost on slope-separated terraces. Land use in terraces also played a crucial role in the efficiency of conservation, and tree crops and forest were detected as the most powerful land covers in soil and water conservation due to large aboveground biomass and strong root systems below the ground, which directly reduces the pressure of terraces on rainwater redistribution. In addition, a significant positive correlation between slope gradients ($3^\circ\sim15^\circ$ and $16^\circ\sim35^\circ$) and terracing efficiency on soil and water conservation was observed. This study revealed the effectiveness and variation of terracing on water erosion control on the national scale, which can serve as a scientific basis to land managers and decision-makers.