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Modeling the erosion risk potential induced by terraces and their condition in a highly dynamic watershed close to the Three-Gorges-Dam

S. Schönbrodt, T. Behrens, S. Imbery, and T. Scholten

Eberhard Karls University Tuebingen, Institute of Geography, Department of Geomorphology and Soil Science, Tübingen, Germany (sarah.schoenbrodt@uni-tuebingen.de)

Globally, the Three-Gorges Ecosystem is currently one of the most anthropogenic influenced regions. Due to the Three-Gorges Dam large areas in the upper catchment of the Yangtze and its major tributaries become inundated. Consequently, high land-use dynamic with resettlements, construction of infrastructure, and new land reclamation for smallholder agriculture and cash crops characterize this area. Therefore, ecological impacts are expected in an unforeseeable dimension. Soil loss is one of the major threats and its control an enormous challenge. Even existing erosion control measures like dry-stone walling bench terraces have to be adapted to this new situation in order to keep their effectiveness. In the highly dynamic watershed of the Xiangxi, a first class tributary to the Yangtze, this study aims to assess and predict the spatial and temporal varying dam-caused soil erosion risk potential. Using a multi-level and multi-scale approach this study seeks to develop an integrative data-based methodology for soil erosion assessment by means of GIS-based erosion modeling using relevant digital terrain data, field investigations and remote sensing. The different scales considered cover the Xiangxi watershed (3.100 km^2), the highly dynamic backwater area (500 km^2), and two micro-scale study sites (3 km^2 and 88 km^2) subject to flooding and high land-use dynamic.

Central features of the Xiangxi watershed are steep slopes artificially fractured by terraces. A preliminary erosion survey has shown a strong connection of the frequency and intensity of erosion and the quality of terrace-maintenance. Terraces with wall disorders and technically poor constructed design show higher soil loss and runoff than well-maintained terraces. Their condition is regarded as a driving erosion factor. Therefore, a conceptual Terrace-Condition-Erosion model (TerraCE) was developed in order to assess to what extent soil erosion depends on the quality of terraces. Central aspects are the distance to the inundated area, to the road network, and to the settlements. Four classes of terrace-maintenance are analyzed: well-maintained (20 %), badly-maintained (48 %), partially collapsed (15 %), and completely collapsed (6 %). Unterraced farmland (7 %) is regarded as an extra class. First results of TerraCE indicate that with increasing distance from the highly dynamic inundated area and the main roads the better is the quality of terrace-maintenance with less wall disorders and less soil erosion potential. It is concluded that the construction of infrastructure and the artificially fluctuating water level at the dam lead to a degradation of terraces within close distances to the Xiangxi and the main road network. Terraced farmland that is more remote to the main transportation routes seems to be less influenced by the high land-use dynamic. The mean distance of (a) well-/badly-maintainedand(b)partially-/completely collapsed terraces from the Xiangxi is(a) 613.8 m with SD 318.2 m/474.4 m with SD 291.6 m and (b) 208.6m with SD 292.1 m/127.6 m with SD 81.7 m. In average, unterraced farmland is 261.9 m (SD 286.2 m) located from the new shoreline of the Xiangxi.

By combining the model results with DEM-analysis and remote sensing data a high-resolution soil erosion risk model will be computed using spatial regression approaches. It aims to assess the soil erosion as a function of natural factors and anthropogenic impacts in an increasingly complex system. Especially against the background of global change and the increasing demand for water and energy the study aims at enhancing the understanding of the ecological consequences of large dam projects.