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GIS-based assessment and analysis of soil erosion by water in the Three-Gorges ecosystem

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

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

The Three-Gorges Dam (TGD) is widely expected to threaten the catchment's ecology by river and habitat fragmentation and rapid land-use changes alongside the Yangtze and its tributaries. Close to the TGD the catchment of the first class tributary Xiangxi is subject to flooding, artificial water level fluctuations and resettlement. Typical after-effects of TGD at such tributaries are enforced slope instability, mass movement, soil erosion, the expansion of the road network and settlements as well as land reclamation for smallholder agriculture and cash crops further upslope of the inundated areas. Within the Sino-German YANGTZE project this study aims to assess and predict the spatial and temporal varying dam-caused soil erosion risk and sediment transport pathways into the reservoir.
Central features of the Xiangxi catchment are steep slopes which are artificially fractured by terraces. Topsoil has often been moved upslope during resettlement. In the highly dynamic and mountainous Xiangxi catchment our study seeks to develop a real-time, integrative data-based methodology for soil erosion assessment using a multi-level and multi-scale approach. The combination of GIS-based erosion modelling using relevant digital terrain data, field investigations and remote sensing forms the conceptual framework. The different scales considered cover (a) the Xiangxi catchment with 3.100 km^2, (b) the highly-dynamic backwater area with 500 km^2, and (c) two micro-scale study sites with 3 km^2 and 88 km^2 subject to flooding and high land-use dynamic. In a preliminary erosion survey, data on soil erosion forms and characteristics, soil properties and terrain were collected for a set of plots showing representative types of land-use and terrain such as orange orchard and slope angle of 25-35°. The survey has shown that the frequency and dimension of erosion is closely linked to the condition of farmland especially the quality of maintenance of the terraces. Thus, a Terrace-Condition-Model is developed to indicate to what extent soil erosion is dependent from the farmland's condition by considering central aspects like distance to inundated area, road network, the dominant land-use, the erosion-effective surface (e.g. vegetation and stone content), the cultivation technique and the physical infrastructure of terraces. By combining the model results with DEM-analysis and remote sensing data a high-resolution soil erosion risk model will be computed. It aims to assess the soil erosion as a function of natural and anthropogenic erosion factors.