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Landslide Hazards in the Xiangxi Watershed / Three Gorges Reservoir, China: Assessing internal biophysical Vulnerability

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The Three Gorges dam construction was completed in 2006. Besides the international media, also the responsible authorities and various scholarly communities pay close attention to potential and actual environmental impacts related to the impoundment and development activities. The geo-environment within the Three Gorges region is highly conducive to landslides. Consequently, a scientific monitoring and risk mitigation system was established and is still under development.

Risk analysis with regard to gravity driven mass movements is highly complex and strongly site specific – several aspects hamper a universal methodology applicable for landslide risk and site assessment. The interdisciplinary Sino-German Yangtze-Project Research co-operation aims, among others, to support the sustainable cultivation of the newly developed ecosystems within the Yangtze catchments. Land use change and increasing population growth are causing severe pressure on the scarce land resources. Landslides are acknowledged as important threat, hence vulnerability of certain landscape components have to be identified, quantified and monitored. A nested quantitative approach for vulnerability analysis is developed. The applied risk and vulnerability model understands risk as the product of hazard and vulnerability. Whereas vulnerability is characterized by: mass movement intensity and susceptibility of the respective element at risk. The watershed of Xiangxi river serves as study area. In general, catchment approaches intent and proved to be a functional geographical unit for successful integrated resources management. Several limitations with regard to data accessibility, availability and accuracy have to be considered due to restrictions of feasible scales. Comprehensive large-scale site investigations are confined to training areas for model calibration and validation.

Remote sensing potentials are utilised for land use/ land cover change analysis and localization of selected elements. Dwellings and road infrastructure, chosen as high priorities, are captured based on various data like: high resolution satellite imagery, topographic information and field investigation. Currently demo-graphic data is available only at administrative county level – buildings will serve as spatial proxy for population density.

Elements at risk will be classified into categories and susceptibility factors will be identified for sampled groups. The envisaged model defines the susceptibility of a certain element at risk not only by the element itself – it assumes that the specific susceptibility is also strongly influenced by the particular surroundings. The susceptibility of a certain building, as for instance, will be defined by the structure type and condition, and in addition or asproxy, specific site characteristics like: slope angle and aspect, soil type and erodibility, lithology, proximity to streams, proximity to the Three Gorges reservoir, depth to groundwater, land use change and dissect intensity, if feasible. Each factor with potential influence on susceptibility will go through a GIS based factor weighting procedure as part of the quantitative vulnerability model. Holistic, “cross scale integrated” vulnerability assessment models need to integrate environmental, social/ cultural and economic aspects. Therefore the proposed vulnerability assessment model must be seen as a starting point for a conceptual framework, and might serve as stimulus to local disaster- and resources management systems. Furthermore the GIS based model enables the opportunity to be linked and refined within the local spatial data infrastructure initiatives.

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