



Tropentag, October 7-9, 2008, Hohenheim

“Competition for Resources in a Changing World:
New Drive for Rural Development”

Charcoal in Sediment Layers: A Way to Estimate Impact of Land Use Intensification on Reservoirs Siltation?

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Abstract

Worldwide erosion and runoff are filling up reservoirs rapidly, decreasing the buffer capacity and resulting in irrigation water deficiency or flooding. The degree of sedimentation, however, is not only depending on rainfall patterns and topography but also on the land use around the reservoir. Therefore soil erosion and sediment transport studies in regions with intensive agricultural practises are essential for environment protection. The objective of this study is to understand the impact of land use intensification on sediment transportation and delivery by reconstructing a cultivation chronosequence. Around the Chieng Khoi Lake, Son La province in North West Viet Nam, three fields with various land use systems such as maize/cassava intercropped, agroforestry and secondary forest were selected and augering cores were taken from upper, middle and lower slope position. Below each field, on the lake bank two profiles, one directly underneath and one at 10 m distance, were dugged up to 2 m. Visible distinguishable sediment layers were investigated regarding thickness, colour, pH, particle size distribution, and total organic carbon (TOC) to examine sediment transport capacity. To reveal the fire history attention was paid to charcoal composition of diverse land uses by using differential scanning calorimetry (DSC). For measuring erosion and runoff throughout the rainy season of 2008, Gerlach troughs in upper, middle and lower slope were installed at all three fields. A bathymetric survey of the lake was performed so that the overall sedimentation in the lake over 40 years could be estimated. It is hypothesised that charcoal can be linked to land use history and by its occurrence in sediment layers it can, together with the thickness of the layer, reveal the contribution of different land use systems to the silting up of the reservoir. These findings can be used for model validation, sensitisation of the local population and policy makers and used in decision making processes to develop a more sustainable land use system that is still economically attractive.

Keywords: Charcoal, lake sedimentation, land use history