Geophysical Research Abstracts
Vol. 17, EGU2015-9221, 2015
EGU General Assembly 2015

Methodological issues and preliminary results from a combined sediment fingerprinting and radioisotope dating approach to explore changes in sediment sources with land-use change in the Brantian Catchment, Borneo.

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This paper reports some methodological issues and early results of a project investigating the erosional impacts of land use changes (multiple selective logging and progressive, partial conversion to oil palm) over the last 25-40 years in the 600km2 Brantian river catchment in Sabah, Borneo. A combined sediment fingerprinting and radioisotope dating approach is being applied to sediment cores taken in stream hierarchical fashion across the intermediate catchment scale. Changes in sediment sources and sedimentation rates over time can be captured by changes in the relative importance of geochemical elements with depth in downstream sediment cores, which in turn can be linked to parallel changes in upstream cores by the application of unmixing models and statistical techniques. Radioisotope analysis of the sediment cores allows these changes to be dated and sedimentation rates to be estimated. Work in the neighbouring Segama catchment had successfully demonstrated the potential of such an approach in a rainforest environment (Walsh et al. 2011).

The paper first describes steps taken to address methodological issues. The approach relies on taking continuous sediment cores which have aggraded progressively over time and remain relatively undisturbed and uncontaminated. This issue has been tackled (1) through careful core sampling site selection with a focus on lateral bench sites and (2) deployment of techniques such as repeat-measurement erosion bridge transects to assess the contemporary nature of sedimentation to validate (or reject) candidate sites. The issue of sediment storage and uncertainties over lag times has been minimised by focussing on sets of above- and below-confluence sites in the intermediate zone of the catchment, thus minimising sediment transit times between upstream contributing and downstream destination core sites. This focus on the intermediate zone was also driven by difficulties in finding suitable core sites in the mountainous headwaters area due to the prevalence of steep, incised channels without even narrow floodplains.

Preliminary results are reported from (1) a field visit to investigate potential sampling sites in July 2014 and (2) initial analysis of a sediment core at a promising lateral bench site. Marked down-profile geochemistry changes of the core indicate a history of phases of high deposition and lateral growth of the channel caused by mobilisation of sediment linked to logging and clearance upstream. Recent channel bed degradation suggests the system has been adjusting a decline in sediment supply with forest recovery since logging in 2005, but a renewed sedimentation phase heralded by > 10 cm deposition at the site in a flood in July 2014 appears to have started linked to partial forest clearance for oil palm. These preliminary results support the ability of a combined fingerprinting and dating approach to reflect the spatial history of land-use change in a catchment undergoing disturbance.

Walsh R. P. D. , Bidin K., Blake W.H., Chappell N.A., Clarke M.A., Douglas I., Ghazali R., Sayer A.M., Suhaimi J., Tych W. & Annammala K.V. (2011) Long-term responses of rainforest erosional systems at different spatial scales to selective logging and climatic change. Philosophical Transactions of the Royal Society B, 366, 3340-3353.