

Long-term responses of rainforest erosional systems at different spatial scales to selective logging and climatic change

Abstract

Long-term (21-30 years) erosional responses of rainforest terrain in the Upper Segama catchment, Sabah, to selective logging are assessed at slope, small and large catchment scales. In the 0.44 km² Baru catchment, slope erosion measurements over 1990-2010 and sediment fingerprinting indicate that sediment sources 21 years after logging in 1989 are mainly road-linked, including fresh landslips and gullying of scars and toe deposits of 1994-1996 landslides. Analysis and modelling of 5-15 min stream-suspended sediment and discharge data demonstrate a reduction in storm-sediment response between 1996 and 2009, but not yet to pre-logging levels. An unmixing model using bed-sediment geochemical data indicates that 49 per cent of the 216 t km⁻² a⁻¹ 2009 sediment yield comes from 10 per cent of its area affected by road-linked landslides. Fallout ²¹⁰Pb and ¹³⁷Cs values from a lateral bench core indicate that sedimentation rates in the 721 km² Upper Segama catchment less than doubled with initially highly selective, low-slope logging in the 1980s, but rose 7-13 times when steep terrain was logged in 1992-1993 and 1999-2000. The need to keep steeplands under forest is emphasized if landsliding associated with current and predicted rises in extreme rainstorm magnitude-frequency is to be reduced in scale.