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Hill-slope instability and sediment delivery: discerning geomorphological intensity from a lake sediment sequence.

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An extensive database of radiocarbon dated alluvial fan and hill-slope gully systems identifies three phases of extensive hill-slope gullying after 2200, between 1250 and 700, and after 500 cal. BP in the uplands of northwest England. Regional pollen records reveal co-incident phases of increased human activity in these uplands, with small scale temporary clearances during the late Bronze Age / early Iron Age and more substantial clearances during the late Iron Age and Romano-British times (2300–1500 cal. BP), and later more substantial woodland clearances from c.1200–900 cal. BP, after which there has been little woodland recovery. This temporal pattern is similar to that in the geomorphology, and suggests that human activity is a critical factor mediating the late Holocene geomorphological record. To assess the linkages between geomorphic activity and adjacent lake basins a record of sediment delivery from a catchment to lake basin is provided by two c. 5.8 m long sediment cores from Crummock Water (NW England). A robust chronology for the sediment record is provided by parallel optical and 14C ages. The lake sediment magnetic and geochemical properties indicate a series of changes in sediment composition during the late Holocene, which correlate well with sediment lithology, water content and weight-loss-on-ignition. A comprehensive grid-based approach characterising the surface soil/sediment magnetic and geochemical properties has enabled a better understanding of source-sink linkages. In the upper 3-2 metres a suite of changes corresponds to the regional onset of human activity after 2000 BC, and particularly to the intensification of human activity at around AD 900. A comparison of the lake sediment magnetic properties and those of the catchment soils shows clear linkages for the period after AD 900. In contrast, detailed magnetic measurements of the early- through mid-Holocene sediments suggest that their magnetic properties are dominated by bacterial magnetosomes.