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Geomorphic control on the delta-15N of mountain forest: Implications for N cycling in terrestrial ecosystems

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Mountain forests are subject to high rates of physical erosion which can export particulate nitrogen from ecosystems. However, the impact of geomorphic processes on nitrogen budgets remains poorly constrained. We have used the elemental and isotopic composition of plant and soil organic matter to investigate nitrogen cycling in the mountain forest of Taiwan, from sites with distinct geomorphic (topographic slope) and climatic (precipitation, temperature) characteristics. The carbon to nitrogen ratio of soil organic matter decreased through time (^{14}C age). A mass balance model can be formulated to describe the observed trend, predicting a net nitrogen loss similar to contemporary measurements of nitrogen export across the landscape. We have found $\sim$6‰ variability in δ^{15}N of the ecosystem, not related to the local soil ^{14}C age or climatic conditions but instead to topographic slope, with forest on the highest slopes characterised by the lowest δ^{15}N. We demonstrate that the observed negative correlation is consistent with an increase in nitrogen loss via non-fractioning pathways on steeper slopes, where physical erosion should remove particulate nitrogen at the greatest rates. Published data from tropical and temperate forests elsewhere are consistent with this trend, underlining that physical erosion can influence the isotopic composition of soils and that particulate nitrogen export can be a first order term in the nitrogen budget of mountain forest.