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Particulate organic carbon export from soil and vegetation in temperate mountain regions

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In assessing the significance of terrestrial particulate organic carbon (POC) export in the global carbon cycle, it is essential to be able to predict the POC yield and its make-up (broadly, fossil versus non-fossil) from any given setting. Because mountains vastly dominate the physical erosion load, an understanding of the processes operating in mountains of different kinds, and what controls them, is necessary. In particular, the dynamics of POC harvest in temperate forested uplands are poorly constrained, despite the large area covered by these zones.

C and N concentration and isotopic composition data (for both riverine suspended sediment and carbon stores) are presented from two contrasting temperate mountain regions with vast stocks of soil organic carbon. In the northern Swiss Alps, as discharge increases, POC is initially diluted by lithic material through in-channel clearing, but beyond a threshold POC is added. This happens under moderate flow conditions when hillslopes are activated and rain- induced overland flow delivers soil POC to channels. As a result, the proportion of non-fossil POC increases significantly as discharge and suspended sediment load increase.

In contrast to the Swiss Alps, overland flow occurs rarely in the Oregon Cascades and Coast Range. There, hillslope soil is decoupled from the channel, due largely to riparian vegetation that both prevents extensive mobilisation and traps sediment before it reaches the stream. Where channels are aggrading, there is no other input mechanism for soil or bedrock, resulting in very low total sediment and POC yields (and correspondingly high POC concentrations). In the Coast Range, with largely sedimentary rather than volcanic substrate, there is some evidence for hillslope soil mobilisation, but not (under moderate meteorological conditions) on the scale observed in Switzerland. Instead, nearly all POC exported comes from vegetation. Initial dilution of POC through in-channel clearing is still evident, and without subsequent activation of the soil reservoir, Oregon's POC export (per unit area) is around an order of magnitude less than the Swiss system.