

Publication

'Local gradient' and between-site variability of erosion rate on badlands in the Karoo, South Africa

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Siteaverage values of local gradient, defined as the steepest slope angle measured at a point, are a powerful predictor of longterm rates of soil loss as measured by erosion pins on the nonchannel floor portions of ten badland study sites in the Karoo area of South Africa. Local gradient may be easily measured using a smartphone clinometer. The successful use of local gradient here is in strong contrast to the previous failure of other sitespecific attributes, including other measures of gradient and relief, to explain between-site variation in erosion rate on these study sites. Each measurement of local gradient may be thought of as a sample of the site's microtopography. Microrelief is a strong determinant of the emergent patterns of interchannel overland flow, and hence of the patterns of interchannel erosion by flow. Local gradient changes most rapidly during the initial stages of channel incision. When channels are established, local gradient changes more slowly leading to almostparallel retreat of channel side-walls. A sensitivity analysis suggests that measurements of local gradient are not all equal with regard to prediction of longterm erosion rate. A greater share of predictive power is contributed by measurements made on very steep or vertical channel side wall areas, and a lesser share is contributed by measurements made on interfluvies.

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