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Badland development in South Africa

John Boardman

Oxford University, ECI, Oxford, United Kingdom and Department of Geographical and Environmental Sciences, University of Cape Town, South Africa (john.boardman@eci.ox.ac.uk)

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John Boardman
Environmental Change Institute
University of Oxford, UK
and Department of Environmental and Geographical Sciences
University of Cape Town, South Africa

Badlands have been described in the Eastern Cape and KwaZulu-Natal. They are almost certainly under-reported since they are often regarded as 'normal features' of the landscape. Since the term 'badland' is not widely used in South Africa some areas that have been classified as 'degraded' are likely to be badlands. The influential hypothesis of Acocks (1953) claimed that vegetation was changing across the Karoo from a grass-shrub mix to a shrub-dominated ecosystem. This change inevitably led to the expansion of bare ground with a potential for erosion and ultimately the development of badlands. The hypothesis is controversial but there is evidence for vegetation change at some time in the past and physical degradation is seen in the Karoo landscape.
Topographically badlands occur on valley-side footslopes and valley bottoms and are developed in colluvial sediments of late Pleistocene or Holocene age. Most seem to be relatively recently developed but cut-and-fill sequences studied by Botha and co-workers in KwaZulu-Natal have developed over a longer time period: buried palaeo-badlands are reported from this area.
In the Eastern Cape, many areas of badland are developed on formerly cultivated land and are of 20th century origin. In these areas badlands with relief of $\sim$2m are geomorphologically active although some have been colonised by invasive shrub species. Initiation and development of one area of badland occurred between $\sim$1925 and 1945.
Badlands which are unrelated to cultivated land are likely to result from overgrazing. Stock numbers peaked around 1930 but had been high for the previous 100 years. Since the 1930s stock numbers in the Karoo have declined and there is some evidence of a regeneration of vegetation. However, erosion rates on badlands remain high and recovery from extreme degradation appears to a take decades, if at all. Part of the reason for slowness of recovery is likely due to a steady increase in the number of geomorphologically effective rainfall events per year. It is not known if this is a local or regional trend. However, climate models suggest that this is expected to continue into the future.
Runoff and erosion on badland surfaces has been observed, measured and sampled. Rainfall events as low as 10mm generate runoff and erosion and these are increasing in frequency.
Rates of erosion on badlands in the Sneeuberg Range, eastern Karoo, have been measured for $\sim$10 years and give values between 7 and 17mm y-1, equating to 119 – 289 t ha-1 y-1. Erosion rates show significant correlation with numbers of rainfall events >10mm. There is huge spatial variability in terms of transfer of this material to fluvial systems. Much is stored (temporarily?) on footslope fans though some onward transport occurs in extreme events (e.g. 100 mm day-1). Rates of sediment accumulation in small farm dams near to these badlands are <10 t ha-1 y-1.
The wider impact of badlands relates to how well connected they are to gully systems and therefore to rivers and ultimately to storage reservoirs which are vital tools in the supply of water to South African society.