Geophysical Research Abstracts,
Vol. 11, EGU2009-2643, 2009
EGU General Assembly 2009

Vegetation and erosion: comments on the linking mechanisms from the perspective of the Australian drylands.

D. Dunkerley

Monash University, Building 11, Clayton Campus, School of Geography and Environmental Science, Melbourne, Australia (david.dunkerley@arts.monash.edu.au)

John Thorne's wide-ranging research included an emphasis on the diverse roles of vegetation in modifying erosion processes under Mediterranean conditions, with primary field studies in Spain. Different global drylands reflect some differences in the nature or strength of the mechanisms linking vegetation and erosion. In Australia, low topographic gradients and plants adapted to water scarcity have facilitated the widespread development of contour-aligned vegetation groves. In these landscapes, the role of individual plants in modifying raindrop impact energy or overland flow erosivity is secondary to the community-level effects of the grove structures. Erosion in common rain events is limited to quite local redistribution of soil materials on metre scales. This highlights one of the unresolved issues that warrants more attention in drylands globally: under what range of rain events does the protective role of individual plants (or of groves) operate, and what is the threshold event size beyond which their effect is swamped by integrated overland flow arriving from upslope? In contrast with, for example, the well-understood role of bankfull flows in river architecture, general principles underlying dryland hillslope and channel responses to events of various magnitudes remain obscure. Clearly, however, there is no single role for plant cover; rather, that role varies with event magnitude and related properties such as the time since the last rain event. An important conclusion is therefore that context is important when evaluating the links between vegetation and erosion.

The developing view of overland flow generally, but particularly relevant in drylands where plant cover is sparse, is that the connectedness of runoff flowpaths is a key parameter. It partly determines the extent to which the downslope movement of resources (soil, water, organic matter) is free or constrained, and this conception has the potential to support the formulation of some general models of overland flow behaviour. In such analyses, the role of vascular plants has to be seen as one component of the system that also includes organic litter and non-vascular plants. A gap in understanding here relates to splash dislodgement of soil materials. This is known to depend on the depth of water lying above the mineral soil, being reduced for both shallow and deep water layers, and maximised at depths of a few incident drop diameters. Resolving how vegetation modifies surface water depths, and how splash dislodgement responds, across the spectrum of event sizes, remains a significant research challenge.

Australian dryland streams exhibit abundant channel-associated vegetation. This exhibits diverse roles, again depending on context. Trees growing in the channel, together with associated barriers formed from floating woody debris, reduce flow speeds. On the other hand, deflector jams can result in locally intensified erosion of the banks. But the mechanisms linking vegetation and erosion are again complex. For instance, by reducing flow speeds and creating backwater effects, debris barriers promote mud deposition over channel margin sediments. This in turn reduces transmission losses, and sustains peak flow and associated sediment transport capacity further downstream than would otherwise be the case. As for hillslope processes, much remains to be learned about how these various processes play out across the spectrum of event magnitudes.

Clearly, therefore, in a time of ongoing environmental change, the informed management of the global drylands requires continued research effort of the kind so well championed by John Thornes.