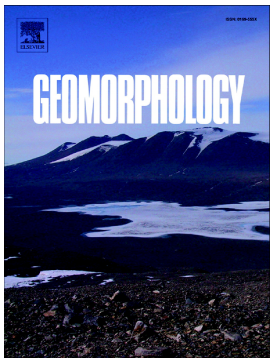

Post-fire hillslope debris flows: Evidence of a distinct erosion process

Christoph Langhans, Petter Nyman, Philip J. Noske, Rene E. Vandersant, Patrick N.J. Lane, Gary J. Sheridan

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Authors:

Christoph Langhans[1], Petter Nyman[1], Philip J. Noske[1], Rene E. Vandersant[1], Patrick N. J. Lane[1], Gary J. Sheridan[1]

Affiliation: [1] School of Ecosystem and Forest Sciences, University of Melbourne, 3010 Parkville, Victoria, Australia

Corresponding author: Christoph Langhans (christoph.langhans@unimelb.edu.au)

Abstract:

After wildfire a hitherto unexplained erosion process that some authors have called 'miniature debris flows on hillslopes' and that leave behind levee-lined rills has been observed in some regions of the world. Despite the unusual proposition of debris flow on planar hillslopes, the process has not received much attention. The objectives of this study were to (1) accumulate observational evidence of Hillslope Debris Flows (HDF) as we have defined the process, to (2) understand their initiation process by conducting runoff experiments on hillslopes, to (3) propose a conceptual model of HDF, and to (4) contrast and classify HDF relative to other erosion and transport processes in the post-wildfire hillslope domain. HDF have been observed at relatively steep slope gradients (0.4 – 0.8), on a variety of geologies, and after fire of at least moderate severity and consist of a lobe of gravel- to cobble-sized material 0.2 – 1 m wide that is pushed by runoff damming up behind it. During initiation, runoff moved individual particles that accumulated a small distance downslope until the accumulation of grains failed and formed the granular lobe of the HDF. HDF are a threshold process, and runoff rates of 0.5 L s^{-1} 2 L s^{-1} were required for their initiation during the experiments. The conceptual model highlights HDF as a geomorphic process distinct from channel debris flows, because they occur on planar, unconfined hillslopes rather than confined channels. HDF can erode very coarse non-cohesive surface soil, which distinguishes them from rill erosion that have