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Coupled dynamics of soil erosion and banded vegetation in arid ecosystems: A cellular automata approach

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In many flat, arid ecosystems bands of vegetation, oriented perpendicular to the surface gradient, emerge in response to limited water availability. While surface runoff helps form and sustainin these bands little is understood about the role of fluvial erosion. In order to better understand the soil-vegetation feedbacks that may influence the stability of these landscapes we applied an eco-geomorphic cellular automata model to assess the dynamics of such a system. The model simulates the self organisation of banded vegetation from an initially random vegetation distribution as well as the observed micro-topogoraphy. A rich dynamic of erosion and band migration is revealed. In contrast to expectations fluvial erosion and deposition, locally altering surface flow pathways, in conjunction with vegetation facilitation and competition interact to provide some dynamic-stability to the functioning of the landscape.