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Signal and noise in vegetation patterns in drylands: distinguishing the baby from the bath water

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Patterns, and particularly banded patterns, are widely reported in dryland vegetation, and have been the subject of considerable modelling effort. However, much of this modelling effort is predicated on a mathematical approach that is designed to produce patterns and relies on physical processes that are unreasonable. In consequence, whereas in nature dryland vegetation patterns are irregular, disjointed and discontinuous, those produced by such models tend to be regular, continuous and even. The question, therefore, arises "Is it the irregularity, disjointed and discontinuous character of these patterns that holds the key to their formation rather than any apparent, human-imposed semblance of regularity and continuity?" By focusing on this apparent patterning have such models rejected as noise the key to understanding the signal? Models that produce regular vegetation patterns, typically do so by imposing global rules (largely for the distribution of water). Is it not more likely that vegetation responds to the local supply of water, nutrients and propagules? Here, we present a model for the growth of vegetation in deserts that is predicated on the local conditions of input of water, nutrients and propagules and output, such as loss of biomass by herbivory. The approach represents our best quantitative understanding of how desert ecosystems work. Patterns emerge that show the irregularity and discontinuity seen in nature. By focusing on the process rather than the patterns per se our model has the ability to address specific questions of the role of such patterns in land degradation. Further, it has the potential to provide quantitative estimates of the response of the landscape to specific management strategies, as well as the identification of the key thresholds and tipping points that are so important to the management of drylands. In providing a way to understand and predict the vegetation patterns that may develop during desertification, the approach also represents a crucial potential tool for its management and even reversal.