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Modelling Emergent Patterns of Dynamic Desert Ecosystems as a Function of Changing Landscape Connectivity

J. Stewart (1), G. S. Okin (2), A. J. Parsons (1), J. Wainwright (1), B. Bestelmeyer (3), E. Fredrickson (3), W. H. Schlesinger (4)

(1) Department of Geography, University of Sheffield, UK, (2) Department of Geography, University of California, Los Angeles, USA, (3) USDA-ARS, Las Cruses, New Mexico, USA, (4) Nicholas School of the Environments, Duke University, North Carolina, USA (Jill.Stewart@Sheffield.ac.uk / Fax: +44 (0) 114-2797912 / Phone: +44 (0) 114-2227927)

A characteristic of desert vegetation is the emergence of multi scale spatial patterns that arise from complex, poorly understood relationships between plants, soils and transport processes. The model described here accommodates previous mathematical and conceptual models, and is designed to probe causes of spatial complexity and predict specific responses to a variety of disturbances. The environment is considered as spatially related locations that are inhabited by different vegetation types. Material can move across the landscape under the action of impelling forces (vectors) whose magnitude and direction depend on external factors. Connectivity quantifies the effectiveness of vectors to move material (primarily due to advection) in the direction of flow, and depends on the spatial arrangement of these connected pathways. Aeolian pathways are aligned in the direction of the wind and terminated when the wind intersects a plant. For water, gross pathways follow the aspect and terminate in sinks. Animals move material according to their species specific foraging strategies: This redistribution of material is the main driver for changes in biomass that are species specific functions of growth, recruitment and mortality, and can be modified by competition/facilitation between species or direct disturbances such as drought. The model is used to investigate conditions that would result in observed vegetation patterns, and the contribution of each vector to the pattern. Conditions are examined that result in the decline of *Bouteloua Eripoda* and subsequent invasion of *Larrea Tridentata*, such as has been noted in the south western desert systems of North America.