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# Periodic and scale-free patterns of dryland vegetation

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Field observations of vegetation patchiness in drylands reveal periodic patterns having characteristic length scales and patch sizes, along with patterns characterized by broad patch size distributions, often reported to obey power-laws. Despite the numerous theoretical and experimental studies that have been devoted to vegetation patchiness this dichotomy of patterns has remained poorly understood. Using a mathematical modeling approach we elucidate the mechanisms that control patch size distributions in water-limited systems, and identify physical and ecological circumstances that lead to periodic patterns and broad patch size distributions. Vegetation patchiness in water-limited systems is often driven by competitive water-transport processes that promote the growth of vegetation patches and inhibit the growth in the patch neighborhoods. We show that finite-range competition leads to regular patterns with characteristic length scales, while global competition leads to a wide range of patch sizes. We discuss the conditions under which global competition is favored and we discuss extent to which observed patch size distributions may reflect endogenous self-organization processes.