



Landscape patchiness along a rainfall gradient and its effects on hydrological processes.

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Rainfall redistribution by runoff and runon is an important driver of ecosystem functioning in arid and semi-arid ecosystems. Rainfall redistribution is controlled by physical and biological induced landscape patchiness. The importance of physical patchiness decreases and of the biological patchiness increases along a dry to wet gradient. In dry ecosystems, where physical patchiness prevail, rock patches generate runoff that infiltrates into the downslope soil patches and creates water enriched soil patches that support relatively high biotic community. In semi-arid ecosystems, biological patchiness made of shrubs embedded in biological soil crusts are the main drivers of hydrological processes. The crust is a source of runoff that infiltrates into the shrub patches creating islands of high productivity. Along the rainfall gradient these small scale processes control the landscape scale hydrology. We will demonstrate the relationship among rainfall gradients, patchiness types, scale and hydrological and ecological processes using field data from Israel. The data were collected using rainfall simulators and natural rainfall to examine hydrological source-sink relationships in areas with biological and physical induced patches. In addition we examined: 1) the effects of anthropogenic disturbances to patchiness and its effect on landscape hydrological processes and 2) the resilience of the biological modulated landscape to these disturbances.

We will synthesize our results in a general conceptual model that links environmental gradients, small scale landscape structure and anthropogenic disturbances to patchiness and hydrological processes. The model can also help in predicting the effects of climate change and desertification on the hydrological processes and consequently on ecosystem functioning.