

## **Development of the critical zone and ecosystem in dryland: The Israel Negev as a case study**

Shayli Dor Haim (1,2) and Moshe Shachak (2)

(1) Dead Sea & Arava Science Center, Israel (shayli10@gmail.com), (2) Ben-Gurion University of the Negev, Israel

The Negev is a unique critical zone (CZ), the primary source of soil is not rock weathering, but dust deposition. Research revealed that there are five main factors that creates the CZ and ecosystem development: dust deposition, soil formation, rainfall and runoff patterns, and activity of ecosystem engineers (EE).

Soil accumulation is the product of dust deposition and its engineering by cyanobacteria and shrubs. Cyanobacteria engineer the soil through the formation of biological soil crust (BSC) that generates semi-impermeable surfaces and stabilize soil. Soil erosion are driven by porcupine and isopod activity that produce easily erodible soil that are eroded by surface runoff water. The balance between soil accumulation and erosion determine geomorphology dynamics that construct landscape patchiness in terms of rock to soil.

The system is water limited (mean between 100-200mm per year). Rainfall pattern is characterized by high frequency of small rainfall amount and low frequency of high rainfall amount. Part of the rainfall is transfer to surface runoff ether by rocks or BSC.

The development of ecosystem is by soil and water dynamics in conjunction of the activity of EE that create a patchy landscape of two phase mosaic. In the rocky areas the mosaic is of soil patches embedded in a rocky matrix, in loess areas the structure is of shrubs embedded in a matrix of soil crust.

Common to the two types of the landscape mosaic is a source-sink system in which the rock or the crust serve as a source while the soil patches or the shrub function as a sink for water, soil and nutrients. Ecosystem development last state is composed by resources enriched and resource deprived patches. The productivity, diversity and soil properties across the landscape is depend on the distribution and abundance of the two patch types.

In spite of our knowledge on ecosystem development in the Negev, very little is known on how each factor contribute to the trajectory of ecosystem development. Our aim is to experimentally study the effect of frequency of rainfall and runoff on CZ and ecosystem development in terms of patch mosaic, soil quality, productivity and diversity.

We build an experimental system on loess system by removing the upper part of the soil by constructing 12 pits (10x10x0.2m). By removing the upper part, we reached the initial conditions before ecosystem development. The pits are embedded in a matrix of natural vegetation that will provide the pool of organism and will be used as a sink to collect runoff and creating water enriched patches. We will manipulate the runoff by adding the same amount of water to each patch in different frequencies. We test a set of hypothesis in relation to: patchiness development, community functional diversity, productivity and soil quality. We assume that this factors will show different trajectories in relation to the water manipulation. We will present preliminary results.