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Co-Evolution of Surface Properties and Vegetation under Changing Climatic Conditions at a Desert Fringe

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Co-Evolution of Surface Properties and Vegetation under Changing Climatic Conditions in a Dry-Land Area.

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Semi-arid and arid areas are often regarded as highly sensitive to climatic changes. A positive relationship between average annual rainfall and related environmental variables is usually assumed for such areas. This approach disregards the fact that a climatic change in dry-land areas is often accompanied by a parallel change in surface properties; such as sand accumulation during a dry phase and of loess deposition during a wet phase. The new surface properties can be expected to exercise a strong effect on infiltration, runoff, and soil moisture regime and water availability for plants. The work presented will cover two studies conducted in the northern Negev desert; along a rainfall gradient of $\sim$ 90 to $\sim$170 mm. The first study focuses on the negative effect of loess penetration during a wet phase. Loess deposition over rocky surfaces increased raindrop absorption by the fine grained loess material. Due to the limited rain amounts, at most rainstorms, depth of water infiltration is limited and most infiltrated waters are lost by evaporation. A comparative analysis of the vegetation cover, soil properties and human activity in adjoining rocky and loess covered areas clearly show that loess penetration has led to a desertification process. The second study was conducted in a sandy area along the Egyptian-Israeli border. Most of the sandy area is covered by a biological topsoil crust. Data collected show a differential development of the biological crusts along the rainfall gradient. The crust is better developed, richer in fine grained particles and organic matter content than the crust in the drier area. However, the better developed crust is able to absorb and retain all rainwater at most rainstorms; limiting thus the depth of water infiltration and water availability for higher plants. At the same time the crust in the drier area absorbs less water and generates surface runoff. The overall result is deeper water penetration and higher water availability for the perennial vegetation; very well expressed by the extent of the vegetation cover and species diversity.