The role of dry riverbed terraces in the ecology of drylands

Shayli Dor Haim (1,2), Arnon Karnieli (2), Elli Groner (1), Moshe Shachak (2), and Tarin Paz-Kagan (3)

(1) Dead Sea & Arava Science Center, Israel (shayli10@gmail.com), (2) Ben-Gurion University of the Negev, Israel, (3) Agriculture Research Organization – Volcani Center, Israel

In the Negev Desert, southern Israel, ancient terraces cover large areas of the dry riverbeds. Terraces have been built as a mean to accumulate water and soil by resources redistribution, to reduce hydrologic connectivity and erosion, and to increase primary and secondary productivity of agro-ecological systems. In spite of their large extend, most of the researches deal with the terraces structure and function in relation to past cultures. Recently, the scientific community acknowledged the importance of terraces as an integrated hydro-geo-eco system that can provide bundle of ecosystem services to human. Furthermore, their importance increases with the enhancement of desertification processes due to climatic change and land-use management.

The aim of our research is to understand the hydro-geo-eco processes within these terraces using plant productivity, density, and vegetation patchiness as measures for total ecosystem function. Our hypotheses are that the distribution of these measures in the terraces are depended on: (1) the position of terrace location along the watershed; (2) the degree of the physical disturbance of the terraces measured by the degradation of the stone walls; and (3) the temporal dynamics of the measures along the terraces in the riverbed as indicators to the source of water to terraces either from the watershed head or the slopes.

To test our hypotheses, we used remote sensing information from different space systems with 2 and 5 m resolution. In addition, we used light detection and ranging (LiDAR) based on the digital elevation model (DEM) with high resolution (1 m) to study the hydro-ecology of terraces related to the measures. We mapped the productivity of woody vegetation using the several vegetation indices. In addition, we used different classification methods to classify the woody vegetation density and patchiness along the terraces within the watershed. We related the terraces vegetation to environmental factors such as: topography, substrate, land use, and more.

We found that the terraces exhibit a gradient of productivity depends on the degree of disturbance to the terraces structure. Our research suggests that in order to increase the ecosystem function of the terraces system, restoration of disturbance system could increase ecosystem services both for agriculture and for nature reserve.