Geophysical Research Abstracts
Vol. 20, EGU2018-3888, 2018
EGU General Assembly 2018

Modeling of Terraces System in the Negev Highlands

Hezi Yizhaq (1), Moshe Shachak (2), and Ehud Meron (3)

(1) Ben Gurion University. Swiss Institute for Dryland Environmental and Energy Research, BIDR, Israel (yiyeh@bgu.ac.il), (2) Ben Gurion University. Mitrani Department of Desert Ecology, Blaustein Institutes for Desert Research. Israel, (3) Ben gurion University. Swiss Institute for Dryland Environmental and Energy Research, BIDR, Israel

We developed a meta-ecosystem model of dryland vegetation to study three essential variables, functional diversity, community composition and total biomass, under various rainfall regimes. The model is applicable to systems that consist of soil patches (the ecosystems) coupled to one another through water flow (runoff). We applied the model to ancient wadi terraces, which are widespread in Negev Highlands in southern Israel. Each terrace is regarded as an ecosystem consisting of a community of annuals that is coupled to its neighbour terraces through water flow. The top terrace is subjected to runoff from the surrounding environment, once the rainfall there exceeds a threshold value. Assuming no lateral inflow into the terraces, reveal a strong dependence of the essential variables on the rainfall regime - many small rainfall events vs. a few large events - keeping the total annual rainfall constant. The asymptotic biomass pulse-shape distributions for each terrace, contain information about three community-level properties: the total biomass (pulse area), functional diversity (pulse width) and community composition (pulse position)

We studied the effect of the community structure on the biomass and functional diversity. The community structure is described in the model in terms of functional groups that differ from one another in the trade-off they make between above ground and below ground investment in biomass. This trade-off can be nonlinear and it is dictated in the model by a parameter which defines the species' functional pool under consideration in terms of competitive capabilities (defined as ε in the model). Large values of this parameter represent functional-group pools with competitive advantage given to functional groups with intermediate values of investment in below ground and above ground biomass. Small values represent advantage to groups with extreme investment either in above ground biomass or in below ground biomass. Our results show that the total biomass decreases with ε whereas the functional diversity increases with ε and reaches a maximum for ε=2. In addition, for small values of ε there was an advantage for functional group investing in below-ground biomass. The significance of this opposite trend is that higher functional diversity implies less biomass.

Changing the number of rainfall events keeping the mean annual precipitation constant may have strong effects on functional diversity and total biomass. The functional diversity and total biomass calculated for the first, uppermost terrace sharply decline as the number of rain events increases and their intensity decreases, and approach constant values as the rainfall drops to levels for which runoff contributions from the surrounding hillslopes of the terrace become negligible. We also studied the effect of extended drought on the system composed of 9 terraces. While convex pools (ε=0.5) show a mild biomass decline following a drought, concave pools (ε=1.6) show a severe decline.

Integrating model results with the recognition that hydro-geo-eco legacies shapes the long-term structure, composition, and function of terraced systems can increase our scientific based knowledge for effective management of terraced riverbeds to increase ecosystem services.ABSTRACT@