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# BELOW GROUND BIOMASS PATTERNS OF COMPETING SPECIES IN ARID LANDS

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**Summary.** Vegetation patterns have been observed in many arid zones around the world. This particular spontaneous arrangement of the vegetation optimizes the use of the scarce water resources and could be imitated to restore vulnerable ecosystems; at the same time, the patterns of vegetation act as an early warning signal of the fact that fragile ecosystems may suddenly undergo irreversible shifts, thus, they deserve a special attention. The formation of vegetation patterns is the object of many theoretical and experimental studies, nevertheless, in previous works, the interest that is deserved to below ground biomass allocation is minor as compared to the effort that is spent to describe the organization of vegetation above ground.
In general, the distribution, growth, and mortality of vegetation is more sensitive to the hydrological cycle than to any other factor. Modelling root water uptake and the interrelated spatial and temporal variations in soil water content is a particularly challenging area.
A simple model for the study of vegetation patterns in arid lands has been used here to investigate the interrelations between plant ecology and hydrology, and the interplay between above and below ground biomass patterns.
The model is a set of partial differential equations for soil moisture, plant biomass (above and below biomass of one or more species) and surface water balance, and describes the dynamics of vegetation organization in space and time. Competition and vegetation survival strategies are accounted for within the biomass balance according with a classical mathematical biology approach. The preferential allocation of biomass below ground may be a survival strategy that plats adopt when they compete with other species that are superior competitor above ground or under particular stress e.g.: fire or grazing. By numerical simulations several crucial eco-hydrological mechanisms may be investigated: the impact of root distribution on patterns of above ground biomass with different survival strategy, competition among species that under less productive conditions tend to allocate resources to roots, the impact of alteration in root biomass distribution due to fire or grazing in water limited ecosystem.
Recent literature results are revised and presented here together with a new model outcome that advances our comprehension of relevant eco-hydrological feedbacks with special focus on the role of above and below ground biomass partitioning.