Patchiness and Species Interactions in Water-Limited Ecosystems: Pattern Formation Approach

Erez Gilad
Royal Holloway University of London, School of biological Sciences
Egham, Surrey, TW20 0 EX, England
email: erez.gilad@rhul.ac.uk

ABSTRACT: A spatially explicit model for plant communities in water-limited systems will be introduced and studied. The model captures two positive feedbacks between biomass and water that are crucial for understanding patchiness and interspecific interactions: water uptake by plants' roots and increased water infiltration at vegetation patches. Both feedbacks cause intraspecific competition that leads to self-organized patchiness at the landscape level, but differ in the water distributions they induce. The former acts to increase interspecific competition while the latter favours facilitation. The net interspecific interaction is determined by the relative strength of the two feedbacks. The model sheds new light on recent observations of plant interactions along aridity gradients which are apparently in conflict, and predicts the possible emergence of facilitation as a result of patch grouping.

THE MODEL FURTHER HIGHLIGHTS MECHANISMS BY WHICH VEGETATION PATTERN FORMATION AT THE LANDSCAPE LEVEL AFFECTS SPECIES COEXISTENCE AT THE SINGLE PATCH LEVEL.