Geophysical Research Abstracts
Vol. 20, EGU2018-10361, 2018
EGU General Assembly 2018

Connectivity-mediated ecohydrological feedbacks and catastrophic shifts in drylands

Angeles G. Mayor (1), Sonia Kefi (1), Francisco Rodriguez (2), and Susana Bautista (2)

(1) Institut des Sciences de l'Evolution de Montpellier, CNRS, UM, IRD, EPHE, France (angeles.garcia-mayor@umontpellier.fr), (2) Dpt. of Ecology, University of Alicante, Spain

Both positive and negative feedbacks between vegetation pattern, resource redistribution and productivity are increasingly recognised as critical mechanisms underlying dryland function and resilience. The decrease in vegetation cover along a degradation pathway results in an increase of the hydrological connectivity of bare-soil areas. This entails an increase of global losses of water and nutrients but also a local increase in resource inputs to the individual vegetation patches, which decreases and increases vegetation cover, respectively. In this work, we analysed the relative role of global and local connectivity-mediated ecohydrological feedbacks as critical mechanisms driving dryland dynamics and resilience, with special emphasis in the role of the relative strength of both feedbacks determining catastrophic shifts. For this purpose, we incorporated global and local feedbacks between vegetation pattern, redistribution of resources (as driven by hydrological connectivity) and plant performance to a well-known spatially-explicit model of dryland vegetation dynamics and perform simulations along pressure gradients for a number of feedback strengths. A dominance of the global feedbacks dramatically decreased the resistance and resilience to external stress and the recovery potential of the ecosystem, fostering threshold dynamics associated with a non-linear increase in hydrological connectivity with decreasing vegetation cover. However, when strong, the local feedbacks could make the transition to a degraded state more gradual, increasing the range of conditions (external stress, minimum initial cover) that allow the recovery of the system.