Geophysical Research Abstracts
Vol. 17, EGU2015-9009, 2015
EGU General Assembly 2015

The evolution of biocrusts after their removal: gaining insights for restoring degraded areas

Emilio Rodriguez-Caballero (1,2), Sonia Chamizo (2), and Yolanda Cantón (2)

(1) Multiphase Chemistry Department, Max Planck Institute for Chemistry, Mainz, Germany (e.rodriguez-caballer@mpic.de), (2) University of Almeria, Agronomy, Spain

Biocrusts, as the primary colonizers in a diverse range of terrestrial habitats, are key contributors in the sustenance of fertility. They are known to play crucial roles in ecosystems: regulating soil hydrology, preventing erosion, and supplying large amounts of carbon and nitrogen to soils. These arguments can enable one to erect plausible alternatives using these engineers to ecosystem functions restoration based on their important roles on water limited environments. In this work we examine the recovery of soil by biocrusts after disturbance and the concomitant evolution of soil properties as an opportunity to explore the potential of biocrust rehabilitation as a tool to return disturbed ecosystems to a desirable trajectory. This study was performed in the Tabernas Desert (Almería, SE Spain), a badlands catchment with silty loam soils, where we are controlling the changes in different soil properties after biocrust removal in soils previously colonized by cyanobacteria- and lichen- biocrusts. Two sets of plots (8 small plots each) were monitored: one in which the biocrust was removed in Jan 2011, and another where the biocrust was removed in Nov 2007. Every plot was divided into two areas: one half was used for soil sampling and the other half was kept intact to periodically measure roughness and the spectral response. Every six months, samples of the first 0.5 cm of soil were collected and organic carbon (OC), total C, total N and chlorophyll (a and b) content were determined. Surface roughness was measured every year using a high resolution laser scanner, and spectral measurements obtained by a field spectroradiometer were taken to determine absorptions by pigments. Our results show, that just after biocrust removal, the content in total C and N, as well as roughness, decreased as consequence of the loss of loose soil particles by runoff following BSC removal. On the contrary, total chlorophyll content increases immediately after the biocrust rehabilitation starts, and it was together with deeper absorptions around 500 and 680 nm (absorptions by pigments), explained by an early colonization of the soil by cyanobacteria. After this first year, it was detected a significant increase in OC and N content, mainly in the lichen-removed plots. Moreover, surface roughness, chlorophyll content and pigment absorptions increased in all the plots after the 2 year-recovery, and reflectance tended to decrease. These changes were particularly significant in the plots with 5 year-recovery after biocrust removal, in which, also the increase in soil properties was more noticeable in the lichen than in the cyanobacteria-removed soils, highlighting the importance of initial soil conditions for the degree of success of biocrust rehabilitation. Our results provide key insights on the reestablishment of the structure and functions of altered ecosystems by assisted recovery of biocrusts which, later, may facilitate the establishment of later successional species.