Biocrusts influence on C-assimilation and C-losses by respiration and erosion in drylands soils

Y. Cantón[1], S. Chamizo[2], I. Miralles[3], E. Rodríguez-Caballero[4], R. Ortega[5], M. Ladrón[6], R. Lázaro[6]

1: Agronomy Department. University of Almeria, Spain

2: Applied Physics Department. University of Granada, Spain

3: Earth and Life Institute, Université Catholique de Louvain, Louvain-La-Neuve, Belgium

4: Max-Plank-Institute for Chemistry. Mainz, Germany

5: CAESG. University of Almeria, Spain

6: Experimental Station of Arid Zones (CSIC). Almeria,Spain

In this work we refute the long held perception of dryland soils having an insignificant effect on Carbon (C) cycle, based on their low and disperse plant cover and the dominance of bare surfaces. In many cases, the drylands are not bare, but colonized by biocrusts, complex communities of cyanobacteria, bacteria, green algae, microfungi, lichens and mosses. All these organisms are able to fix CO_2, increasing soil fertility. To ascertain the effect of biocrusts on C cycle, we measured CO_2 fixation and emissions, with an infrared gas analyser (IRGA 6400), for a year and organic C (OC) exported by runoff and erosion on plots with biocrusts at different stages of development, and compared them with OC dynamics in soils with no biocrusts. Our results show a pattern in CO_2 fixation and emissions clearly marked by water availability over the year, and by the presence and development of biocrust. Both CO_2-fluxes were close to zero in all biocrusts when soil moisture was low. However, after rainfall or dew events, CO_2-fluxes recorded high values as a result of biocrust photosynthesis activation, driving to high OC fixation, along with high respiration rates. Moreover, both CO_2-fluxes were higher on more developed than less developed biocrusts or soils with no biocrusts, which contribute higher organic carbon to biocrusted soils. At daily scale, for some periods, CO_2 emissions were compensated by CO_2 fixation through biocrust photosynthesis, resulting in a net CO_2 uptake. The fixed C improved soil aggregation, preventing erosion and reducing OC losses, which were substantially lower on biocrusts respect bare soils.