Geophysical Research Abstracts
Vol. 15, EGU2013-10933, 2013
EGU General Assembly 2013

Carbon Dioxide Enrichment Enhances Carbon Sequestration of Dryland Soil Microbial Communities

Richard Lane (1), Manoj Menon (2,3), Jim McQuaid (1), Andy Dougill (2), David Adams (4), Andrew Thomas (5,6), and Steve Hoon (5)

(1) Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, LS2 9JT UK, (2) Sustainability Research Institute, School of Earth and Environment, University of Leeds, Leeds, LS2 9JT UK, (3) Department of Civil and Structural Engineering, University of Sheffield, Sheffield S3 7HQ, UK, (4) Institute of Integrative and Comparative Biology, Faculty of Biological Sciences, University of Leeds, Leeds, LS2 9JT, UK, (5) School of Science & Environment, Manchester Metropolitan University, Manchester, M1 5GD, UK, (6) Institute of Geography and Earth Sciences, Aberystwyth University, Aberystwyth, SY23 3DB, UK

Biological Soil Crusts (BSCs) are found in many terrestrial environments, forming substantial biomass in dryland areas of the Earth; they play a key role in carbon and nitrogen cycling in these drylands where vascular vegetation is sparse and soil nutrient content poor. Metabolic activity of BSC is principally dependent on moisture availability, but also on temperature and light conditions. Less understood is how these communities would respond to elevated levels of CO_2 in the atmosphere.

We will report on the results of elevated levels of atmospheric CO_2 and wetting treatments on carbon fluxes (photosynthesis and respiration) of cyanobacterial BSC from Kalahari Sands, using several newly designed dynamic gas exchange chambers (DGECs), in which the internal atmosphere was controlled. CO_2 flux was monitored during controlled laboratory experiments in two phases under simulated rainfall events (2 & 5 mm plus control with no wetting, with three replicates of each) each lasting 3 days with a dry period in between. In phase 1, crusts were subjected to an atmosphere of 392 ppm CO_2 (representing ambient level) in dry air; in phase 2, the CO_2 concentration was 801 ppm (approximately twice the ambient level).

Results showed that in both phases, there was a significant efflux (respiration) of CO_2 immediately after the wetting treatments, followed by a substantial influx (sequestration) of CO_2. The total carbon sequestrated was significantly higher than the controls in higher wetting and CO_2 levels. There was an order of magnitude increase in C sequestration with 2 mm wetting treatment, and a threefold increase of C sequestration with 5 mm wetting treatment, when comparing results from elevated CO_2 levels with results from ambient CO_2 levels. These results reinforce the importance of BSCs as they are capable of fixing carbon in changing environmental conditions (short, erratic simulated rainfall events and rising CO_2 levels) without any additional nutrient inputs, and would therefore play even greater roles in future global carbon budgets.