Geophysical Research Abstracts
Vol. 20, EGU2018-4267, 2018
EGU General Assembly 2018

Does the legacy of drought control the microbial carbon use efficiency?

Ainara Leizeaga (1), Lettice C. Hicks (1), Christine V. Hawkes (2), and Johannes Rousk (1)
(1) Lund University, Biology, Lund, Sweden , (2) Department of Integrative Biology, University of Texas at Austin, USA

Drying-rewetting events induce enormous dynamics in the microbial control of soil biogeochemistry. Two different responses upon rewetting have been identified; a more efficient way of growing where bacteria begin to recover immediately upon rewetting, coinciding with respiration rates that peak immediately and then decrease exponentially (“Type 1”), or a more ‘wasteful’ response in which bacteria grow exponentially after a lag period, with a sustained period of elevated respiration, sometimes followed by a further increase in sync with bacterial growth (“Type 2”). Previous studies have suggested that the response upon rewetting could be related to the harshness of the disturbance as experienced by the microbes, with more “harsh” (i.e. longer or more severe) drying resulting in a Type 2 response. However, this has yet to be tested at an ecosystem scale.

We predicted that soils with less previous exposure to drying-rewetting events (historically wetter soils) would have a less efficient response to the perturbation (a Type 2 response). Further, given the different legacies of drought we expected to find a systematic shift in the moisture tolerance of the microbes towards more drought tolerant microbial communities in the historically drier soils. To address our hypotheses, we investigated the legacy of drought on microbial responses to drying and rewetting using savanna grassland soils from a natural precipitation gradient in Texas. Mean annual precipitation spanned a 500 mm range with constant mean annual temperature. Soil properties (pH, SOM) did not vary systematically across the gradient. Air dried soils from 18 sites were rewetted, with bacterial growth, fungal growth and respiration measured at high temporal resolution over 7 days. The moisture dependence of microbes was also measured for all soils. Finally, all these functional responses will be linked to the community structure using amplicon sequencing.

All soils exhibited a Type 1 response, with respiration, bacterial and fungal growth increasing immediately upon rewetting, and typically stabilizing after c. 20 hours. This suggested that microbial communities across the whole precipitation gradient did not perceive exposure to drying-rewetting as “harsh”, growing efficiently during perturbation. However, the amount of carbon used for growth compared to respiration during a drying-rewetting event increased in historically drier soils, suggesting that an enhanced carbon use efficiency had been selected for there. Contrary to expectations, the moisture tolerance of microbes did not change across the gradient. On the other hand, we observed that across the gradient, microbes generally used carbon more efficiently at lower moisture levels (drier conditions).

Our results show that the legacy of drought has exerted two distinct selection pressures in this particular system. First, microbes in more arid systems have been selected to be more efficient during a drying-rewetting perturbation. Second, microbes have been selected to be more efficient at low moisture levels across the gradient due to exposure to dry conditions.