Impact of enhanced CO_2 on soil respiration and nutrient dynamics at BIFoR FACE

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Introduction

Soil respiration: the second largest flux in the global carbon cycle. Climate change may have a significant impact on soil respiration and affect the global carbon cycle. This impact may be largely mediated by nutrient dynamics in the soil.

The free-air CO_2 enrichment (FACE) experiments at BIFoR will enable us to robustly disentangle the interaction of nutrient dynamics and soil respiration.

Figure 1: Long-term chambers deployed on top of collars installed in the soil measuring soil respiration. Each array has three plots and each plot has a surface collar, a collar with 41µm window and with 1 µm window

Methodology

1) Soil respiration rate: measured fortnightly at paired rings using a LI-8100 analyser connected to 9 automatic chambers on three blocks of collars (Fig. 1) incorporating different exclusion meshes allowing the activity of roots, mycorrhizal fungi and free-living microbes to be determined.

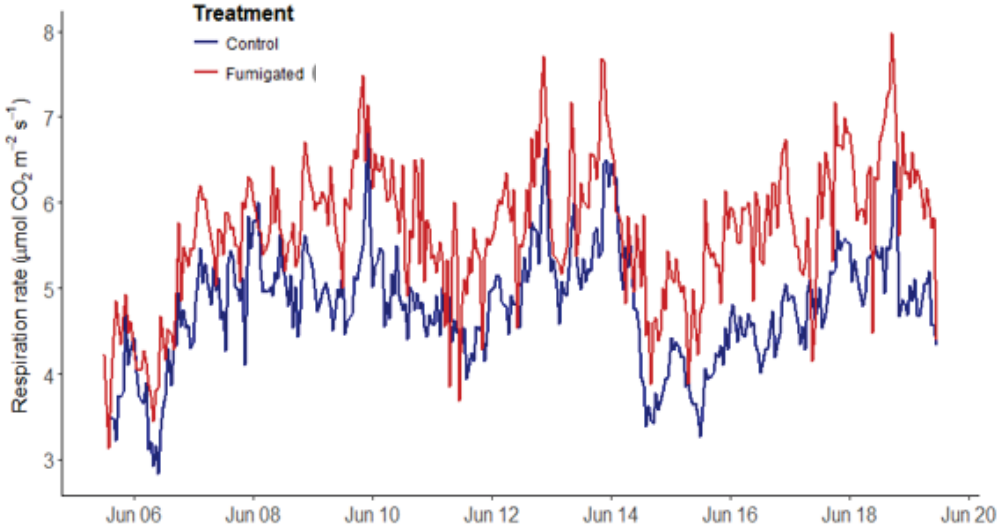
2) N_2O flux: the flux of N_2O will be measured using a Picarro G2508 analyser connected to automatic chambers.

3) "Bioavailable" nutrients: Soil membranes are deployed at each array (Fig. 2) to meausre the NH_4^+, NO_3^-, PO_4^{3-} on a monthly basis.

Figure 2: Soil membranes deployed in the soil adsorbing nutrients.

Preliminary results – soil respiration

Figure 3 Snapshot of a fortnightly measurement of soil respiration at a control (array 5) and a fumigated array (6). Soil respiration rate in the fumigated array seems higher than that in the control array, consistent with what we would expect.



Preliminary results - nutrients

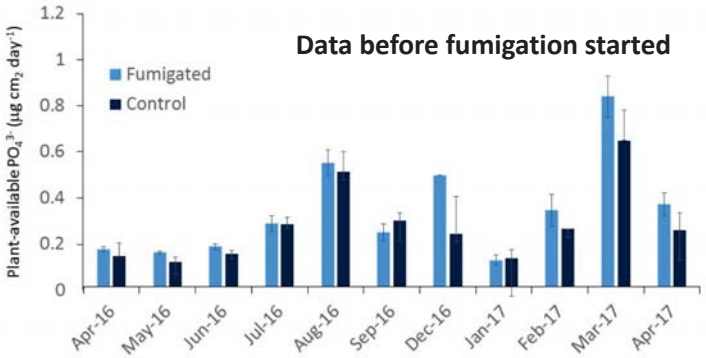


Figure 4. Monthly average in-situ "available" soil PO_4^{3-} in the control vs. to-be-fumigated rings, April 2016 to April 2017. There does not seem to have a statistical difference in available P between the control vs. to-be-fumigated rings.

Ongoing/Future work

- We will continue to measure the soil respiration rates, in particular those at soil collars with different exclusion meshes allowing the activity of roots, mycorrhizal fungi and free-living microbes.
- We will continue to measure the "bioavailable" nutrients.
- We will install the new G2508 analyser so that we can measured CO_2 and N_2O analyser at the same time.

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