Changes in carbon dioxide and methane fluxes in Sphagnum peat mesocosms invaded by vascular plants (Molinia caerulea)

Fabien Leroy*[1], Sébastien Gogo[1], Christophe Guimbaud[2], Xiaole Yin[1,3], Guillaume Belot[2], Zhen Hu[3], and Fatima Laggoun-Défarge[1]

[1]Institut des Sciences de la Terre d'Orléans (ISTO) – Université d'Orléans, CNRS : UMR7327, INSU, Bureau de Recherches Géologiques et Minières (BRGM) – Campus Géosciences 1A, rue de la Férollerie 45071 Orléans cedex 2, France

[2]Laboratoire de Physique et Chimie de l'Environnement et de l'Espace (LPC2E) – CNRS : UMR7328 – 3A, Avenue de la Recherche Scientifique 45071 Orléans cedex 2, France

[3]School of Environmental Science and Engineering, University of Shandong – 27 Shanda Nan Road,Jinan, Shandong 250100, China

Abstract

Peatlands have stored a third of the soil organic Carbon (C) in only 3% of the land area. However, with global changes, vascular plants invade peatlands to the detriment of *Sphagnum* mosses that contribute to C storing. Our study aims to assess the effect of vascular plant (*Molinia caerulea*) occurrence on C storage in *Sphagnum*-dominated peatlands by monitoring CO2 and CH4 emissions and Dissolved Organic C (DOC) dynamics and to relate C flux changes to environmental variables.
Peat mesocoms were collected in La Guette peatland (France) in March 2015. Twelve mesocosms received randomly two treatments: 6 with only *Sphagnum rubellum* and 6 containing both *Sphagnum rubellum* and *Molinia caerulea*. From April 2015 to June 2016, mesocosms were environmentally monitored and DOC contents; CO2 and CH4 emissions weekly measured.

CO2 uptake was significantly higher with *Molinia caerulea* during the growing season and positively correlated with *Molinia* leaves number (r2:0.84). After senescence, the leaves decomposed, which generated a higher CO2 flux than in *Sphagnum* ones. CH4 emissions significantly increased during summer with a higher sensitivity and relationship to the soil temperature (r2:0.78) with *Molinia*. DOC contents were significantly lower with *Molinia* and was related to an increase of respiration (r2:0.41) suggesting an increase of DOC consumption by microorganisms to form CO2.
Molinia caerulea occurrence affects C cycle in peatlands by increasing CO2 and CH4 fluxes which are mainly explained by vegetation and environmental parameters. Specific mechanisms of these findings will be further investigated through the study of the belowground compartment.

Keywords: Dissolved Organic Carbon, Greenhouse gases fluxes, Peatlands invading species

*Speaker