Geophysical Research Abstracts
Vol. 20, EGU2018-11608, 2018
EGU General Assembly 2018

Effects of biochar management on litter-soil-atmosphere greenhouse gas (GHG) exchange in a warming environment

Jane Jinglan Cui (1), Derrick Yuk Fo Lai (1), Stephan Glatzel (2), Viktor J. Bruckman (3), and Baozhan Wang (4)

(1) The Chinese University of Hong Kong, Hong Kong, China (janecui@link.cuhk.edu.hk), (2) University of Vienna, Vienna, Austria(stephan.glatzel@univie.ac.at), (3) Austrian Academy of Sciences (ÖAW), Vienna, Austria(viktor.bruckman@oeaw.ac.at), (4) Chinese Academy of Sciences, Nanjing, China (bzwang@issas.ac.cn)

Forest has an enormous potential in affecting climate change through soil-atmosphere exchange of greenhouse gases (GHGs). Biochar management is considered to be a promising approach to combat anthropogenic climate change and improve soil fertility, but its impacts on forest soils remain largely unclear. Two laboratory incubation experiments were conducted in China and Austria using subtropical and temperate forest soils, respectively, to investigate the effects of short-term (one month, China) and long-term (∼four years, Austria) biochar management on litter-soil-atmosphere GHG fluxes under a warming environment.

Warming significantly stimulated soil CO_2 and N_2O emission, but significantly suppressed CH_4 uptake. The priming effects of leaf litter on soil CO_2 emissions were greater with the deciduous litter in China than the coniferous litter in Austria. Although biochar did not have any significant effect on soil CO_2 fluxes, its application significantly decreased CH_4 uptakes up to101 %. Moreover, N_2O emissions from temperate forest soils were significantly reduced by 84-95 % after biochar addition, but N_2O emissions from subtropical soil showed insignificant response to biochar addition. In the short-term biochar application in China, soil available P and NH_4^+ were enhanced, while soil NO_3^- , microbial biomass carbon and microbial biomass nitrogen were reduced. In contrast, the long-term biochar application in Austria only enhanced soil available P.

Our results suggest that warming would trigger positive responses of soil GHG emissions, and thereby contributing to global warming. Biochar management could serve as an effective approach to sequester stable carbon and improve soil nutriention, but cautions should be taken when utilizing biochar to mitigate climate change as its impacts on soil GHG exchange could vary under different environmental conditions.