Geophysical Research Abstracts
Vol. 15, EGU2013-2788, 2013
EGU General Assembly 2013

Effects of losing keystone oak species on soil microbial community composition in temperate forests in the USA

Ika Djukic (1), Krista McGuire (2), Wiliam Schuster (3), and Kevin Griffin (4)

(1) BOKU Vienna, Institute of Soil Sciences, Vienna, Austria (ika.djukic@boku.ac.at), (2) Department of Biological Sciences, Barnard College - Columbia University, 3009 Broadway, New York City, NY 10027, USA, (3) Black Rock Forest Consortium, 129 Continental Road, Cornwall, NY 12518, USA, (4) Lemont Doherty Earth Observatory, Columbia University, 61 Route 9W, 6 Biology, Palisades, NY 10964, USA

Plant communities are closely associated with distinct soil microbial communities by controlling available soil carbon, temperature and water content. In the Eastern North America forests, genus Quercus (Oak) represents one of the foundation tree taxa. However, the future of oak forests is uncertain as forests are impacted by events such as insect herbivory, pathogen introduction and human disturbance; hence, the feedback to nutrients cycling will in part be dependent on changes in the associated microbial communities which in turn may have dramatically impact on the ecosystem services.

The main objective of this study was to mimic pathogen-induced cascade mortality of the key taxa and subsequently to evaluate its specific impact on the soil microbial community composition. To this end, a tree-girdling experiment was performed (summer 2008) by excluding oak trees (50% (O50) and all (O)) and non-oak trees (N), respectively.

Already one year after the tree-girdling, all soil chemical properties have been affected by the treatment. Soil pH increased from 0.2 to 0.7 units and was coupled with the increase of base cations probably as a result of disturbed absorption. However, a reversed trend was noted for the C:N ratios indicating a limited carbon supply for the soil microorganisms.

Principal component analysis (PCA) of phospholipids fatty acids (PLFA) patterns revealed that the microbial communities were compositionally distinct among different treatments and their position along the slope, which in turn indicates an important indirect effect of soil chemistry on the microbial composition.

The simulated decrease in carbon supply resulted in a considerable reduction of the relative fungal abundance in particular at the all oak girdled plots (by 6% at O50 and 27% at all oak girdled plots). The relative bacterial abundance remains unchanged; however, an increase in cyclopropy fatty acids, an indicator of the stress conditions, could be noted for all treated plots.

The recent tree-girdling experiment demonstrated that the changes in plant community composition will implicate changes in soil chemistry which in turn will exert influence on the soil microbial community composition. Especially, the strong decreases and shifts in fungal community due to the loss of the oak species might have notable ecosystems consequences.