Geophysical Research Abstracts
Vol. 16, EGU2014-4929, 2014
EGU General Assembly 2014


# Linking N2O emissions from biochar-amended soil to the structure and function of the N-cycling microbial community

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Nitrous oxide (N2O) contributes 8% to global greenhouse gas emissions. Agricultural sources represent about 60% of anthropogenic N2O emissions. Most agricultural N2O emissions are due to increased fertilizer application. A considerable fraction of nitrogen fertilizers are converted to N2O by microbially-mediated processes. Soil amended with biochar has been demonstrated to reduce N2O emissions in the field and in laboratory experiments. Although N2O emission mitigation following soil biochar amendment has been reported frequently the underlying processes and specific role of the nitrogen cycling microbial community in decreasing soil N2O emissions has not been subject of systematic investigation.

To investigate the impact of biochar on the microbial community of nitrogen-transforming microorganisms we performed a microcosm study with arable soil amended with different amounts (0%, 2% and 10% (w/w)) of high-temperature wood derived biochar. By quantifying the abundance and activity of functional marker genes of microbial nitrogen fixation (nifH), nitrification (amoA) and denitrification (nirK, nirS and nosZ) using quantitative real-time PCR we found that biochar addition enhanced microbial nitrous oxide reduction and increased the abundance of microorganisms capable of N2-fixation. Soil biochar amendment increased the relative gene and transcript copy numbers of the nosZ-encoded bacterial N2O reductase, suggesting a mechanistic link to the observed reduction in N2O emissions.

Our findings contribute to a better understanding of the impact of biochar on the nitrogen cycling microbial community and the consequences of soil biochar amendment for microbial nitrogen transformation processes and N2O emissions from soil.