Cumulative Effects of Decadal CO_2 Enrichment on Forest Soil Microbial Processes and Communities

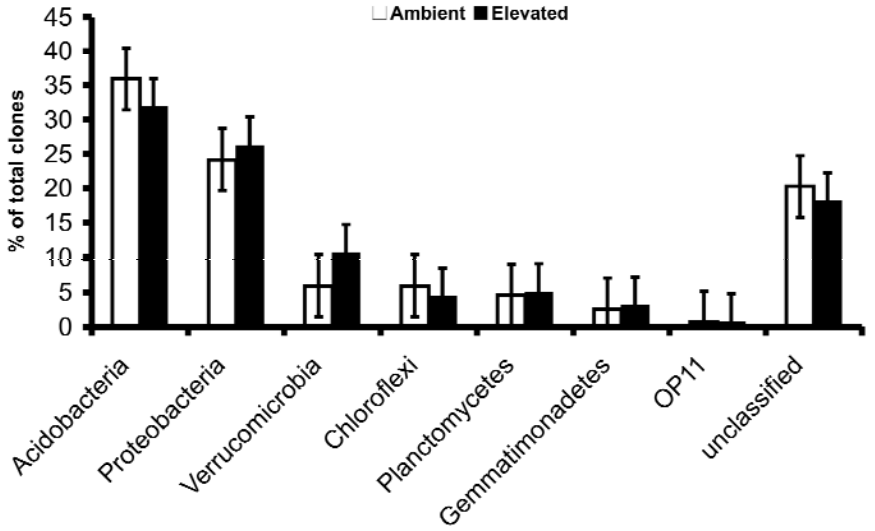
Contact: Chris Schadt, 865-576-3982, schadtcw@ornl.gov
Funding: DOE Office of Science, Biological and Environmental Research

•Counter to expectations, phylum-level soil microbial community structure showed insignificant CO_2 effects despite 10yrs of CO_2 fumigation at the ORNL Free Air CO_2 Enrichment (FACE) experiment.

•Differences in hypothesized N mineralization and soil enzyme activity were also not detected in the surface soils.

•Previously reported increased fine root production and turnover apparently did not affect microbial processes and communities in the uppermost surface soil layer.

•Final evaluation of seasonal, depth-specific, and fine scale community effects of the long-term treatments await ongoing comprehensive sequencing and additional metagenomic studies through collaborations with the Joint Genome Institute (JGI) and Los Alamos Nat. Lab (LANL).



U.S. DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Cumulative Effects of Decadal CO_2 Enrichment on Forest Soil Microbial Processes and Communities

Contact: Chris Schadt, 865-576-3982, schadtcw@ornl.gov
Funding: DOE Office of Science, Biological and Environmental Research

Abstract:

Increased vegetative growth and soil carbon (C) storage under elevated carbon dioxide concentration ([CO2]) has been demonstrated in a number of experiments. However, the ability of ecosystems, either above- or belowground, to maintain increased C storage relies on the response of soil processes, such as those that control nitrogen (N) mineralization, to climatic change. These soil processes are mediated by microbial communities whose activity and structure may also respond to increasing atmospheric [CO_2]. We took advantage of a long-term (ca 10 y) CO_2 enrichment experiment in a sweetgum plantation located in the southeastern United States to test the hypothesis that observed increases in root production in elevated relative to ambient CO_2 plots would alter microbial community structure, increase microbial activity, and increase soil nutrient cycling. We found that elevated [CO_2] had no detectable effect on microbial community structure using 16S rRNA gene clone libraries, on microbial activity measured with extracellular enzyme activity, or on potential soil N mineralization and nitrification rates. These results support findings at other forested Free air CO_2 enrichment (FACE) sites.

Citation:

Austin, E.E., H.F. Castro-Gonzalez, K.E. Sides, C.W. Schadt and A.T. Classen. Assessment of 10 years of CO_2 fumigation on soil microbial communities and function in a sweetgum plantation. Soil Biology & Biochemistry (2009), doi:10.1016/j.soilbio.2008.12.010

This specific work was conducted a part of a larger study sponsored by the Laboratory Directed Research and Development Program of Oak Ridge National Laboratory (ORNL), managed by UT-Battelle, LLC for the U. S. Department of Energy under Contract No. DE-AC05-00OR22725. The FACE site is supported by the Office of Biological and Environmental Research in the DOE Office of Science.