Elevated atmospheric CO_2 concentrations do not alter net nitrogen mineralization rates in a CO_2 enriched sweetgum forest

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Hypothesis

Increased production and N uptake in a sweetgum forest under elevated atmospheric [CO_2] will decrease net N mineralization.

Key Results

There was no difference in net N mineralization rates, net N nitrification rates, or N leaching between elevated and ambient treatments.

Take-home Message

These results indicate that increased forest production and N uptake under elevated [CO_2] have not altered the net amount of N available for forest uptake at ORNL FACE.

The FACE site consists of five 25 m-diameter rings. FACE apparatus was built around four of the five rings - for a total of 2 elevated (544 ppm) & 3 ambient (391 ppm) rings.

Caitlin and Colleen taking soil cores at the ORNL FACE experiment.

Background & Methods

- Previous research has demonstrated that elevated levels of atmospheric [CO_2] increase forest production and N demand in temperate ecosystems. Therefore, soil N availability may constrain the response of forests to elevated [CO_2].
- Understanding how soil N cycling responds to elevated [CO_2] in forests will enable scientists to make better predictions of how forests will respond to future atmospheric change.
- We took advantage of a long-term Free-Air CO_2 Enrichment (FACE) experiment at Oak Ridge National Laboratory (ORNL) to test our hypothesis that net N mineralization would decrease under elevated [CO_2].
- We incubated soil cores during the growing season of 2007 in one-month intervals, and measured the difference in inorganic N concentrations and leaching from the beginning to the end of the incubation.

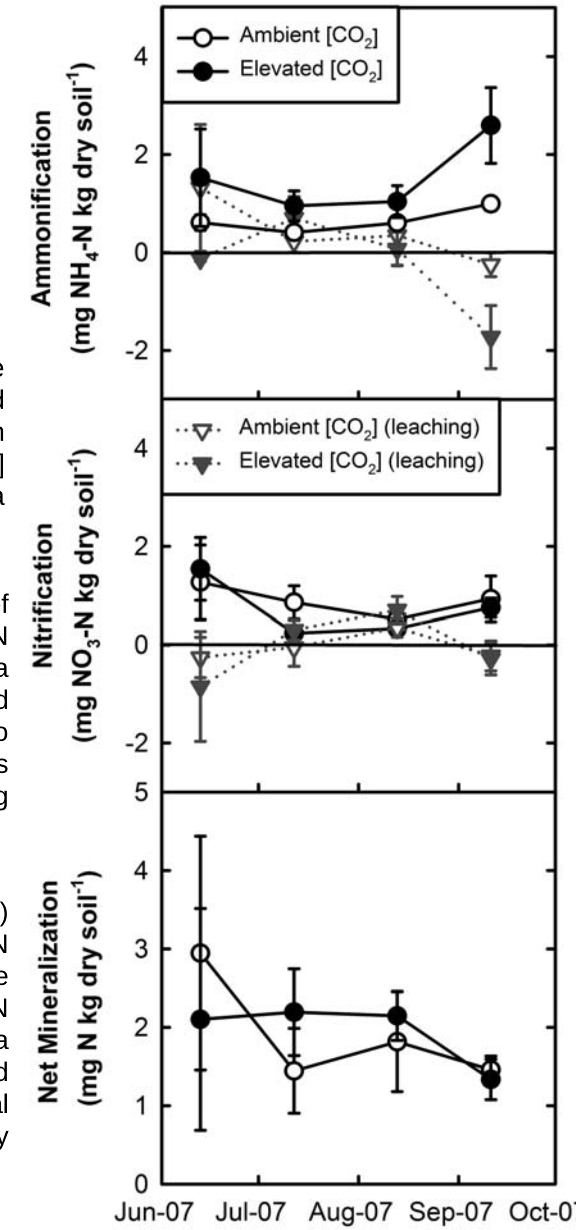
Results

Net ammonification rates (i.e., the transformation of organic N to NH_4^+) and NH_4^+ leaching levels were not significantly different between the ambient and elevated [CO_2] treatments. However, there was a substantial increase in N leaching in September in both treatments.

Net nitrification rates (i.e., the transformation of NH_4^+ to NO_3^-) and NO_3^- leaching did not differ between the elevated and ambient [CO_2] treatments, nor was there a significant difference over time.

There was no significant effect of elevated [CO_2] on net N mineralization rates (i.e., a combination of ammonification and nitrification plus the N lost to leaching). Net N mineralization rates also did not change over the growing season period.

These results indicate that: (1) increased forest production and N demand under elevated [CO_2] have not altered the net amount of N available for plant uptake in a measurable way, and (2) increased litter input has not altered microbial N demand and therefore the supply to plants.



Research was sponsored by the U.S. Department of Energy, Office of Science, Biological and Environmental Research.