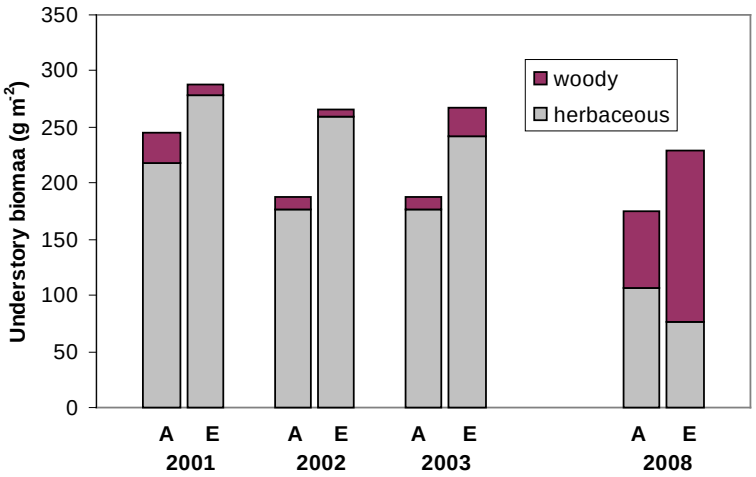
CO_2 enrichment accelerates successional development of an understory plant community

Contact: Richard Norby, 865-576-5261, rjn@ornl.gov
Funding: DOE Office of Science, Biological and Environmental Research

- Over 11 years of CO_2 enrichment in the ORNL FACE experiment, the understory community changed dramatically.
- Aboveground biomass was on average 25% greater in elevated [CO_2] than in ambient [CO_2] plots across years.
- Early in the study (2001-2003), herbaceous species made up 94% of the total understory biomass.
- After multiple years of treatments (2008), woody shrubs and saplings comprised 39% of total understory biomass in ambient [CO_2] and 67% in elevated [CO_2].
- Understory communities in elevated [CO_2] showed more rapid transition from herbaceous to woody-dominated communities, indicating faster succession.
- Our results suggest that rising atmospheric [CO_2] could accelerate ecosystem succession and have long-term impacts on forest dynamics.



U.S. DEPARTMENT OF ENERGY
OAK RIDGE NATIONAL LABORATORY
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Abstract:

Rising concentrations of atmospheric carbon dioxide ([CO_2]) are likely to affect forest ecosystems via both direct and indirect effects on understory plant communities. We investigated the effects of elevated [CO_2] on aboveground biomass of the understory community of a temperate deciduous forest at the Oak Ridge National Laboratory free-air carbon dioxide enrichment (FACE) facility. We asked if: (1) CO_2 enrichment affected total understory biomass; and (2) whether total biomass responses could be explained by changes in understory species composition or changes in relative abundance of functional groups through time. After 11 years of CO_2 enrichment, understory community aboveground biomass was on average 25% greater in elevated [CO_2] than in ambient [CO_2] plots across years. Elevated [CO_2] caused a shift in the relative abundance of plant functional groups, which reflect important structural changes in the understory community. In 2001-2003, little of the understory biomass was in woody species; herbaceous species made up 94% of the total understory biomass. In 2008 the contribution of herbaceous species to total understory biomass was 61% in ambient [CO_2] and only 33% in elevated [CO_2] treatments. Our results suggest that rising atmospheric [CO_2] could accelerate successional development and have longer-term impact on forest dynamics.

Citation:

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