

## Abstract

Effects of forest age, soil drainage and interannual climate variation on deciduous forest carbon exchange: A comparison to long-term Harvard Forest measurements, in a contrasting forest type

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This project is designed to expand knowledge of the rate of carbon storage by deciduous forests in the northeastern United States to a broader range of forest age and soil drainage conditions than were previously measured.

All research will be conducted at the Harvard Forest in central Massachusetts. We will compare carbon exchange in two contrasting primarily deciduous forests. Red oak (*Quercus rubra*) and red maple (*Acer rubrum*) are the most common tree species in both forests. However, one forest has trees less than 50 years old covering a large part of the C exchange measurement footprint, and has very well drained soil. The other site has trees mostly 65-100 years old, has moderately well drained to well-drained soil in most of the footprint, but also includes a swamp. This site has had continuous C exchange measurements since 1992, with several publications, and is the most-studied deciduous forest site in the northeastern U.S. with respect to carbon exchange.

Hypotheses to be tested include:

- a younger forest with very well-drained soil will have lower ecosystem respiration than an older forest with moister soil
- a younger forest with very well-drained soil will have lower gross ecosystem carbon production (GEP) than an older forest with moister soil
- a younger forest with very well-drained soil will tend to have lower net ecosystem carbon production (NEP) than an older forest with moister soil, but it may also be more affected by interannual climate variation
- growing-season drought will have a greater effect on both ecosystem respiration and GEP in a younger forest with very well-drained soil than in an older forest with moister soil

We will measure total ecosystem carbon exchange by the eddy covariance technique. Aboveground carbon storage will be estimated from tree growth data gathered from dendrometer band measurements and radial growth increment cores. We will measure soil respiration using closed chambers with a portable infrared gas analyzer. A net radiometer, quantum sensors, temperature/relative humidity probes, and thermocouples will measure microclimate above the forest canopy, in the forest understory and in the soil.

The research is intended to provide data resulting in improved estimates of current carbon storage in forests of the northeastern U.S., as well as projections of future carbon storage. We expect that at least two peer-reviewed publications will be produced by the end of the project.