

Measurements of the O₂-CO₂ Stoichiometry of Terrestrial Ecosystems

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The goal of this project is to measure the covariation of atmospheric oxygen and carbon dioxide in and above the canopy at a mid-latitude mixed forest. These measurements will inform us of the mechanisms of photosynthesis and respiration and overall ecosystem physiology. They will also be useful for improving global-scale measurements of carbon fluxes between the oceans, land and atmosphere.

The measurements will be carried out at the Environmental Monitoring Station located at Harvard Forest in Petersham, Massachusetts.

With the proposed dataset in hand, we expect to reduce the uncertainties in global carbon fluxes already derived from concurrent measurements of oxygen and carbon dioxide. We will also be testing the hypothesis that the molar ratio of O₂ and CO₂ variations should change with temperature, water availability and light level as photorespiration becomes more or less important.

Measurements will be made using a differential fuel-cell based oxygen analyzer connected to an NDIR CO₂ analyzer, both with active pressure and flow control. The air will be drawn from a pair of inlets on an instrument tower, at heights within and above the forest canopy.

At the end of the funding period, we will deliver a precise dataset of concurrent O₂ and CO₂ mixing ratios tied to internationally recognized scales. We will also prepare publications presenting these data, analyzing their impact on global-scale fluxes, and testing our hypothesis on controls on the covariation of these species.