Quantifying stem respiration in stands of red oak (Quercus rubra) at Black Rock Forest

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Measurements of CO_2 efflux from woody stems were collected from *Quercus rubra* in three stands (30, 70, +90 years) in Black Rock Forest. An automated, multi-chambered system was utilized to make continuous measurements on the stems of nine trees per stand for up to 96 hours at various times during the growing seasons of 2001 and 2002. Temperature-normalized CO_2 efflux rates from stems ranged from 1.05 µmol s^{-1} to 3.26 µmol s^{-1} (per m^2 of stem surface area) and from 47 µmol s^{-1} to 303 µmol s^{-1} (per m^3 of sapwood volume). CO_2 efflux rates were largely predictable from sapwood temperature. CO2 efflux, when expressed per unit sapwood volume, was found to be positively correlated with the reciprocal of stem diameter indicating that the source of this CO2 is located close to the stem surface, such as the cambium and the thin-layer of living sapwood. In addition, area- and volume-based respiration rates decreased with increasing tree size. This is most likely due to decreased growth respiration in larger trees and, possibly, a decrease in maintenance respiration (per unit sapwood) in the large trees. Also, temperature-normalized respiration rates were found to decline later in the growing season, particularly in younger trees, due to decreased respiration related to tree growth.