Title: How does the definition of plant functional types affect the modeling of carbon and water fluxes on a mixed pine/oak forest?

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Abstract:

Land surface models reduce computations by resolving energy, water, and nutrient balances of representative vegetation groups instead of operating on individual trees. Such groups are often based on plant functional type (PFT) and tree size or age. The group's plant functional type dictates which parameters control plant physiology while, in some demographic models, age or size of each cohort defines their access to different resources. Our work examines the sensitivity of ecosystem fluxes to the resolution and definition of PFTs in an Atlantic Coastal Plain upland forest. Our study site is located in the Northeastern USA, at the Rutgers Pinelands Research Station (USFS Silas Little Experimental Forest), in New Jersey, USA. Species in the site include chestnut oak (*Quercus prinus*), black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea* Muenchh.), white oak (*Quercus alba* L.), post oak (*Quercus stellate* Wangenh.), pitch pine (*Pinus rigida* Mill.) and shortleaf pine (*Pinus echinata* Mill.). Previous experimental works conducted at this site identified two distinct water-use strategies among the local oak species. While one group has higher Rubisco-limited carboxylation rate (V_{cmax}), it requires more water than the second group, which has a more conservative nutrient and water use strategy. We employ the Ecosystem Demography model version 2 (ED2) to test two different scenarios. In the first, we utilize ED2's standard definition of plant functional types, classifying all oaks as temperate, mid-successional deciduous trees and the pines as northern pines. In the second scenario, we create two distinct plant functional types to describe the oak species. The first oak PFT has higher Rubisco-limited carboxylation rate (V_{cmax}), higher dark respiration rate, and lower water availability parameter (K_w). The second PFT has higher K_w, lower V_{cmax}, and lower dark respiration rate. We evaluate our estimates of carbon and water fluxes against eddy covariance data collected at the Silas Little Experimental Forest. As a result of our work, we expect to determine if grouping of oak species with different water usage strategies into one plant functional type is detrimental to our ability to predict plot level water and carbon fluxes.