Generalized PnET-CN model

The PnET family of models have been forest ecosystem models since they were first developed in 1992. The PnET family of models, originally developed to simulate temperate and boreal forests (Aber and Federer 1992), provide a unique simplified approach to modeling carbon, water, and nitrogen dynamics of forest ecosystems. Among terrestrial ecosystem models, PnET-CN offers some unique benefits, including simplicity in model structure, the linkage of photosynthesis rates to leaf nitrogen, and yearly assessment of the canopy biomass that produces maximum photosynthesis while accounting for shading. Processes in PnET models are modeled based on observed relationships with a small number of drivers, with less emphasis on the details of tissue-level physics and other fine-scale mechanisms. Despite clear sacrifices in physiological detail, these models have demonstrated a high reliability in a wide range of forest ecosystems (Aber et al. 1995, Aber et al. 1996, Aber et al. 1997, Ollinger et al. 2002a), raising the question of whether the same simplistic approach is also suitable for non-forest biomes.

We applied PnET-CN to non-forest biomes: grasslands, shrublands, and savannas. We determined parameter values for grasslands and shrublands using the literature and ecophysiological databases. To validate the usefulness of PnET-CN in these systems, we simulated carbon and water fluxes for six AmeriFlux sites: two grassland sites (Konza Prairie and Fermi Prairie), two open shrubland sites (Heritage Land Conservancy Pinyon Juniper Woodland and Sevilleta Desert Shrubland), and two woody savanna sites (Freeman Ranch and Tonzi Ranch). PnET-CN generally captured the magnitude, seasonality, and interannual variability of carbon and water fluxes as well as WUE for grasslands, shrublands, and savannas. Overall, our results show that PnET-CN is a promising tool for modeling ecosystem carbon and water fluxes for non-forest biomes (grasslands, shrublands, and savannas).

The generalized version of PnET-CN is implemented in R. If you use this version in your research, please cite the following paper:

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