Linking species-level physiology with vegetation fluxes

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Short outline:

We have begun a multi-site synthesis of available leaf-level physiology data (from independent databases and from Wright et al. 2004, *Nature*) and metrics derived from fluxnet tower site measurements, to ask questions about the role of leaf-scale physiological traits of plant species in driving ecosystem fluxes of CO_2 and H_2O. The original effort was funded by the Australian Research Council through the Macquarie University Vegetation Function Network. We seek to extend the original analysis on the relations between species-level processes and ecosystem-level processes. We wish to ask the following questions: 1) Does variation in canopy CO_2 fixation or CO_2 flux capacity scale according to leaf characteristics of the component dominant species (such as photosynthetic or carboxylation capacity, leaf N, and so forth scaled according to sunlit leaf area index) in an ecosystem? 2) Is regional, biome and/or latitudinal variation in leaf characteristics associated with regional and biome-scale variation in canopy CO_2 and H_2O flux capacity? 3) Is there a consistent association between high-CO_2-flux ecosystems and certain leaf and/or canopy traits of species such as: high SLA, high canopy N_{mass}, low LAI reflecting trade-offs between high investment into photosynthetic activity versus a long-lived or durable canopy, or is this relationship associated with certain biomes and/or latitudinal domains? We intend the address these and related questions via a synthesis of available leaf physiological, chemical and structural traits with respect to CO_2 and H_2O flux behaviour. For this purpose, we require relatively simple flux data from as many Fluxnet sites as are available, particularly since the availability of leaf physiological data from such sites is expected to be most limiting.

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Proposing group:

David Ellsworth, and Ian Wright, Macquarie University; Ross McMurtrie, University of New South Wales; Alexander Knohl, ETH-Zürich; Peter Reich, University of Minnesota.

We will be soliciting other major figures in the Fluxnet group for participation in our synthesis activity as they are available. There is capacity to fund travel to Australia to participate in a short-focussed synthesis workshop under the framework of the various Sydney Universities (MQ, UNSW, and UWS) and/or the ARC/NZ Vegetation Function network.

CVs of coordinating group:

See attached documentation. Proposing group members Ellsworth (Duke Forest), Knohl (Hainich), and Reich (Park Falls) are or have been co-Investigators at AmeriFlux or EuroFlux sites that have already contributed data to Fluxnet.

Sites initially involved:

We aim for as large a suite of sites, and hence leaf and canopy characteristics, as possible. Initial analysis is to focus on the following sites: Collelongo, Castel Porziano, Sarrebourg, Bordeaux, Lille Boegeskov, Flakaliden, Norunda, Bayreuth, Tharandt, Loobos, Aberfeldy, Vielsalm, Brasschaat, Gunnarsholt, Hyytiälä, Renon, Solling F1, Bílý Kriz, WeidenBrunnen, Fichtelgebirge, Hesse, Soroe, Risoe, Hainich, Skukuza, SAFARI 2000 sites, Walker Branch, Howland, Harvard, Metolius, Duke Forest-Pine, Duke Forest-Hardwood, Boreas-North site, Niwot Ridge, Wind River, Blodgett Forest, Sky Oaks, Manaus, Tapajos, Cerrado, Park

Falls/WLEF, Willow Creek, Happy Valley, Atqasuk, Barrow, Little Washita, Shidler, Tumbarumba, Howard Springs NT, and any additional low-latitude sites where physiological data are also available. Given that low-dimensional data are required of these sites (e.g., 3-4 diurnal cycles of CO_2 and H_2O fluxes measured under favourable conditions in the middle of the growing season for a given year). Leaf-scale characteristics have been compiled separately but additional contributions of such data are welcome.

Rules for Co-authorship:

We will comply with the broad guidelines for authorship associated with the Fluxnet Synthesis activity and with those established for the ARC/NZ Vegetation Function Network (www.vegfunction.net). We will make efforts to extend authorship to colleagues contributing one or more of the following: >3% of the dataset, data from multiple sites, and those attending the ARC/NZ Vegetation Function Network meeting to be held at a future date in 2008 in Sydney, NSW, Australia. Primary Fluxnet data will NOT be made available to collaborators who have not contributed data to Fluxnet, as specified by Fluxnet. Some of the analyses can be done by packaged programs provided to Fluxnet collaborators, or the regional Fluxnet groups, thus minimising the amount of primary Fluxnet data that needs to be distributed.