Proposal for FLUXNET Synthesis Research

Title: A mycocentric perspective on environmental factors controlling CO_2 fluxes from terrestrial ecosystems

Leading author: Rodrigo Vargas (UC Berkeley)

Collaborators: Denis Baldocchi (UC Berkeley), Michael F. Allen (UC Riverside), Niles Hasselquist (UC Riverside)

Background:
Mycorrhizal fungi play a crucial role in regulation of terrestrial carbon dioxide (CO_2) fluxes (Zhu & Miller 2003; Fitter *et al.* 2004). These fungi are obligate symbionts that form a mutual relationship with plant roots known as mycorrhizae. The fungi can receive between 3 and 22% of gross primary production (GPP) from their host plants (Johnson *et al.* 2002; Hobbie 2006) in exchange for nutrient transfer to roots that benefit plant growth. Furthermore, previous studies have shown the role of mycorrhizae in regulating water uptake (Querejeta *et al.* 2003), litter decomposition (Cornelissen *et al.* 2001; Langley & Hungate 2003), root respiration (Burton *et al.* 2002), and the stabilization of soil aggregates (Rillig *et al.* 2002), all of which may influence above- and belowground carbon dynamics.

Outline:
Although there are many mycorrhizal types, we will focus on arbuscular mycorrhizae (AM) and ectomycorrhizae (EM) as the most common types in terrestrial ecosystems. We have identified FLUXNET sites by the dominant plant species and classified them as EM- or AM-strategy dominated sites. This value-added product will be shared to the FLUXNET community and included in the ancillary information for each site.

To date it is unclear how environmental factors influence carbon fluxes among mycorrhizal strategy plants across large geographical distances. Furthermore, areas with a same plant functional type (e.g. evergreen broadleaf forests) could have different mycorrhizal associations where one area may be dominated by AM and another by EM plants (Allen *et al.* 1995). When this is the case, the CO_2 fluxes of the first area may be regulated by environmental factors influencing AM plants whereas the second by environmental factors influencing EM plants. Thus, assuming that areas with similar plant functional types respond similarly to environmental factors may have implications on calculation of terrestrial carbon fluxes. Considering the importance of mycorrhizae in regulating plant physiological processes and CO_2 fluxes we propose to investigate how light, temperature, and water influence GPP and Re between AM and EM dominated

FLUXNET study sites. We expect that classifying sites according to their mycorrhizal association instead of vegetation type will provide new insights to incorporate other belowground factors in global climate research.

The main questions for this research are:
1) Are there differences in the environmental factors regulating GPP and Re between AM and EM dominated forests?
2) How does inter-annual variability in GPP and Re differ among AM and EM forests?

Sites Involved:
FLUXNET towers that provide at least 3 years of data and information about dominant plant species will be considered for a preliminarily analysis. QA/QC of the annual sums or annual mean of GPP, Re, air temperature, precipitation, PPFD will be perform to screen which sites to include in the final analysis. We expect to include nearly 50 FLUXNET sites with about 200 site years.

Co-authorship policy:
Substantial and timely contribution from individual PIs involving data sharing data analysis and intellectual input will result in co-authorship.

Co-authorship policy in detail:

a) If a PI contribute with >10% of the final data set will be included in the list of authors.
b) As soon as this proposal is approved an email to all the site PIs will be sent with three options:
    1. Authorize to use the data without further involvement in the research. In this case citations relevant to the PIs site will be included in the manuscript.
    2. Do not authorize to use the data.
    3. Authorize to use the data with further involvement in the research.
c) If the PI authorizes to use the data, timely contributions on data analysis and intellectual input will result in co-authorship. We expect to engage in active communication for data analysis, interpretation of the results and writing of the manuscript. Depending on the number of PIs interested in this proposal and the input received, a group co-authorship (e.g. FLUXNET PIs) may be included.

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