

PROPOSAL FOR FLUXNET DATASET USE, SYNTHESIS AND PUBLICATION

Title: Can plant traits be used to scale ecosystem carbon and water fluxes?

Initial Coordinators and Proposing Group

Martine Janet van de Weg, Han Dolman, Peter van Bodegom

Faculty of Earth and Life Sciences, Vrije Universiteit Amsterdam, De Boelenlaan 1085, 1081 HV, Amsterdam, The Netherlands

Short Outline

Over the past decade, our understanding of the global relationships between plant traits such as foliar nutrients, leaf mass per area and leaf level gas exchange parameters has increased a lot. Especially regarding CO₂ exchange parameters (dark respiration, photosynthetic capacity), the amount of available data has increased considerably (e.g. Wright *et al.* 2004, Kattge *et al.* 2011). The available ecosystem level data for CO₂ fluxes and evapo-transpiration (*i.e.* the FLUXNET datasets) has increased in a similar way.

When analysing the ecosystem level fluxes in synthesis studies, usually distinct plant functional types (PTFs) are assigned to the different ecosystems that are included in the analysis. This way, the photosynthetic and water use efficiency parameters that are derived from the flux data, and which can be used to model global carbon and water fluxes, also differ distinctly per ecosystem. However, from the available plant trait studies and data assemblies, we know that PTFs not always represent the full range traits from the vegetation accurately (*i.e.* different average values) or realistically (*i.e.* a wider range of values per parameter is known *in situ*) (Kattge *et al.* 2011, van Bodegom *et al.* 2012).

To date, no attempts on a global level have been made to link measured plant level traits to ecosystem fluxes. In this study we will investigate the global relationships between plant level traits and ecosystem level carbon and water fluxes. Ultimately, the found plant trait- ecosystem flux relationships are to be used to improve the way vegetation is represented in next-generation DGVMs, by creating a possibility to include plant level dynamic traits to represent the vegetation, rather than PTFs.

Methods

FLUXNET data (NEE, GPP, ER and LE) will be related to plant traits using statistical methods that are to be determined. The plant trait data (e.g. foliar N, ΔC^{13} , LMA etc.) will be solicited from the investigators that are responsible for the concerned FLUXNET sites. If not available (published or unpublished) from those investigators, we will ask them to send us samples that will be analysed by us in order to obtain the desired traits.

Proposed Sites to Be Involved

All sites in the LaThuile, fair use and opened dataset, for which plant trait data can be acquired either through published data or by sampling at the sites, will be considered for this project. Sites will need to represent different vegetation types, environmental conditions and climate regions.

Rules Applied For Use of Site Data and Co-authorship Strategy

La Thuile FLUXNET data policy will be applied

References

Kattge, J., W. Knorr, et al. (2009). Quantifying photosynthetic capacity and its relationship to leaf nitrogen content for global-scale terrestrial biosphere models. Global Change Biology **15**(4): 976-991.

Van Bodegom, P., J.C. Douma, et al. (2012). Going beyond limitations of plant functional types when predicting global ecosystem–atmosphere fluxes: exploring the merits of traits-based approaches. Global Ecology and Biogeography (Online only for now).

Wright, I. J., P. B. Reich, et al. (2004). The worldwide leaf economics spectrum. Nature **428**(6985): 821-827.