

Comments from M. G. De Kauwe (mdekauwe@gmail.com)

I found this paper very interesting, but did have two quick suggestions:

"For example, any modelling approach that predicts photosynthetic capacity from N_{area} , and N_{area} in turn from soil inorganic N supply (Luo et al. 2004), is incompatible with the hypothesis that photosynthetic capacity is optimized at the leaf level as a function of irradiance, leaf internal CO₂ concentration (c_i) and temperature (Haxeltine and Prentice 1996, Dewar 1996) – as assumed in the widely used LPJ DGVM (Sitch et al. 2003) and other models derived from it, including LPJ GUESS (Smith et al. 2001) and LPX (Prentice et al. 2011a; Stocker et al. 2013)." I wonder if this could be explained a little further? I think it is an important point, but don't feel that it is immediately self evident why these hypotheses cannot co-exist, i.e. that a canopy can optimise for leaf N, but be constrained by supply from the soil inorganic N, e.g. McMurtrie et al. 2008, Functional Plant Biology, 2008, 35, 521-534...

Response: At the leaf level, the co-ordination hypothesis predicts that photosynthetic capacity is optimized as a function of irradiance, leaf internal CO₂ concentration (c_i) and temperature. At the whole plant level, we expect limited N supply to be manifested in a limitation on canopy size (i.e. number of leaves) rather than on the photosynthetic capacity of the individual leaves. We propose to state this more explicitly in a revised version

*"For example, one modelling approach predicts photosynthetic capacity from N_{area} , and N_{area} in turn from soil inorganic N supply (e.g. Luo et al. 2004). But this is incompatible with the hypothesis that photosynthetic capacity is optimized at the leaf level as a function of irradiance, leaf-internal CO₂ concentration (c_i) and temperature (Haxeltine and Prentice 1996, Dewar 1996) – as assumed in the widely used LPJ DGVM (Sitch et al. 2003) and other models derived from it, including LPJ-GUESS (Smith et al. 2001) and LPX (Prentice et al. 2011a; Stocker et al. 2013). **This 'plant-centred' hypothesis is based on the idea that plant allocation processes***

determine leaf-level traits. Limited N supply, by this reasoning, should lead to the production of fewer leaves, rather than leaves with suboptimal capacity.”

2. Fig 1:

Remove the labels from the points and increase their size. Currently you cannot see the colour variation very easily.

Response: We have made an improved version of Fig 1, following this suggestion.

The revised Fig 1 is as follows:

Fig 1 Site locations, climate and leaf trait distributions: Mean annual precipitation (MAP, mm), mean annual temperature (MAT, °C), mean incident daytime photosynthetically active radiation (PAR, $\mu\text{mol m}^{-2} \text{s}^{-1}$), moisture index (MI). Site mean N_{area} (g m^{-2}) and LMA (g m^{-2}) are also shown.

