1) Title

Quantifying the constraints imposed by sun-angle, light, water and temperature on ecosystem gross productivity

2) Short outline

This paper will quantify the constraints imposed by environmental factots on ecosystem gross primary productivity. The primary dataset used will be the GPP data derived for the FLUXNET database, using the approach of Reichstein et al 2005

1. The maximum light use efficiency for each site at the optimal time of year will be derived from the light response curves for each site
2. These maximum LUE values will be driven by calculated clear sky radiation values and actual observed solar radiation values: the difference between these will be an estimate the **degree of light limitation imposed by cloudiness on the site**
3. An envelope of seasonal variation of LUE on non light-limited days will be calculated. This envelope will be separated into a temperature-limited region and a water-limited region (for most sites it is anticipated that this distinction will be clear, though some sites will involve a more subjective judgement, the effects of which would be explored and discussed in the paper
4. The light response model will be driven by clear-sky radiation values and the temperature constrained LUE envelope to quantify the degree of **direct temperature constraint on annual GPP**
5. The light response model will be driven by clear-sky radiation values and the water constrained LUE envelope to quantify the degree of **direct water constraint on annual GPP**
6. The peak LUE for each site will be compared with global peak LUE values for forest ecosystems to quantify the degree of **indirect environmental/nutrient constraints on ecosystem GPP**
7. The various quantified constraints will be plotted on a multidimensional axes to identify trends and axes of covariance, and potential mapped and compared with them model output of Churkina and Running
8. The metabolic theory of ecology will be evaluated in the light of these results. Previously, Enquist et al (200x) have suggested that seasonal ecosystem respiration follows Boltzmann logarithmic scaling with respect to temperature, and Kerkhof et al (2006) have suggested that photosynthesis follows similar scaling, but with a lower coefficient. This suggestion will be more directly tested on gross primary production data, both on annual totals and means, but also on seasonal peaks to evaluate the degree to which light and water constraints can explain deviations from this idea Boltzmann scaling.

3) Initial coordinator and proposing group

Yadvinder Malhi,

4) CVs of initial coordinator and proposing group

CVs attached

5) Sites that initially would be involved

Potentially all FLUXNET forest or savanna sites that provide relatively uncomplicated access to their data. The emphasis will be on covering the global range of ecosystems, so more effort will be put into data-poor ecoystems (e.g. tropical ecosystems) than into data-rich systems (e.g. temperate Europe and N America)

6) Rules applied for co-authorship

All data providers will be invited to contribute intellectually to the paper, or comment on the paper, and will be co-authors if they do so.