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Hydrology and Earth System Sciences Discussions

Interactive comment on "Can we predict groundwater discharge from terrestrial ecosystems using eco-hydrological principals?" *by* A. P. O'Grady et al.

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We thank Dr Zeppel for her positive review of our manuscript: 'Can we predict groundwater discharge from terrestrial ecosystems using ecohydrological principals?' Dr Zeppel raises a number of points for response and here we attempt to address each of the questions raised during her review:

âĂć It would be useful to define what you mean by 'convergence' here. It is clear to me that you mean convergence as described by Meinzer (2003) however, people from different fields (evolutionary biology, ecology, ecohydrology) have different meanings

for the word.

Response: It is true that the term “convergence” can be applied to a range of fields and in subtly different contexts. In the example raised by Dr Zeppel she refers to the work of Federick Meinzer 2003 and others who have demonstrated significant “functional convergence” among disparate species. For example, Bucci et al. 2004 demonstrated that although traits related to the hydraulic architecture of plants (eg leaf specific hydraulic conductance) may differ between individual species, the variation in hydraulic traits among species could be described by common anatomical traits such as wood density, and that rather than being intrinsically different, these species operate along a “common physiological continuum” Meinzer thus proposes that rather than focussing on differences between species, ecophysiologists could learn much about the drivers of this variation by identifying the appropriate scaling factors and examining trait variation within this systems context. In this paper, we use the term convergence in a similar context, albeit at a different scale. Here we show that the evapotranspiration and leaf area index of disparate water limited ecosystems “converge” along a common gradient of variation in relation to climate wetness, ie although the absolute values of ET and LAI varied among ecosystems the variation among these ecosystems was strongly related to the climatic wetness of the environment. Similarly, we also demonstrate that although the leaf area index of ecosystem with access to groundwater is higher than those without, when the extra water availability is taken into account the differences between the two types of systems with respect to climatic water availability diminish considerably.

Bucci, S.J., G. Goldstein, F.C. Meinzer, F.G. Scholz, A.C. Franco and M. Bustamante 2004. Functional convergence in hydraulic architecture and water relations of tropical savanna trees: from leaf to whole plant. Tree Physiology. 24:891-899. Meinzer, F.C. 2003. Functional convergence in plant responses to the environment. Oecologia. 134:1-11.

âĂć L9 – using the Huxman paper (Huxman et al., 2004) would put this work in a global

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context.

Response: yes it would

âĂć P8234 - L19 – You say here that vegetation alters soil properties. While this is true, over evolutionary periods, other factors will also alter soil properties, such as weathering.

Response: It is true many factors affect the development of soil properties, and it would be beyond this paper to cover all of these. Here we are referring explicitly to one of th assumptions of Eagleson's Ecological Optimality Hypothesis.

âĂć P8236 L 20 – do you mean potential evaporation instead of evaporation?

Response: Yes we do mean potential Evaporation and will fix this if we are invited to submit a revised manuscript?

âĂć P8240L 11 – I think you mean 'particularly given the underlying: : :'

Response: No we are actually focussing on the assumption of long term water balance studies that changes in soil moisture are zero

âĂć P8240 L 13-15. The paper says 'we expected ratios to converge along the ..'. If you labelled the energy-limit line and the water-limit line in Fig 2b this would further clarify what you mean.

Response: Yes we agree and will do this if we are invited to submit a revision.

âĂć Fig. 2a. It is interesting that the relationship is so strong, with two outliers. Would you like to comment on any biological reason for what caused these two points to fall away from the others?

Response: These two points are from tree belts and we're unsure of the reasons for the departure of these sites. I suspect that it may have something do with the area over which these points are calculated rather than there being an inherent biological

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reason.

P8420 – L17 – ‘thermodynamically’ – do you mean differences in osmotic pressure due to salinity? Thermodynamically is a broader term with meaning different meanings. Do you mean differences in osmotic pressure due to saline soil? It would be simpler and more speciïňĄc if you said ‘groundwater may be less available due to differences in osmotic pressure’.

Response: Yes salinity is one of the factors that affects the availability of water in the soil, here we specifically chose the term thermodynamically to encompass other factors that affects soil water availability, eg soil texture etc.

P8421 – L2 – this is similar with Ellis and Hatton (2008) who also ïňĄnd a plateau when water becomes abundant, and when LAI reaches 4.

Response: We agree

P8242 L1 – Do you meanelevation or do you mean intercept?

Response: Intercept

Table 1 – Are latitude and longitude available for O’Grady et al, Crosbie et al, and Benyon et al?

Response: They were not in the published literature

Fig. 4a – ‘wettness’ replace with ‘wetness’. It would be useful (but not necessary) to expand the acronyms in the caption in all ïňĄgures.

Response: agreed

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 8231, 2011.