

PROJECT INFORMATION

Project title: Generic parameterization of a tree-growth model

Project ID: 106

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PROJECT DESCRIPTION

We have developed a simple model of individual tree growth generic by coupling a light-use efficiency model (the P model: Wang et al., 2014) to a species-based carbon allocation and geometric growth model (the T model: Li et al., 2014). The T model accounts for effects of ontogeny and climate, and predicts annual stem growth and allocation to leaves and roots. The model has been shown to successfully reproduce tree radial growth in the historic past (Li et al., 2014; Li et al., 2016) and to be a useful tool to explore climate and CO₂ impacts on growth (Li et al., 2016; Li et al., subm.)

In applications to date, the T model has been parameterized based on site measurements of the tree-growth shape parameters (i.e. the relationships between height, stem diameter and crown area). We wish to explore whether it is possible to derive generic species-specific values of tree-growth shape parameters in order to distinguish between ontogenetic and climatic effects on tree growth, and whether these values differ significantly across climate gradients. The goal is to be able to subsequently use these “generic” relationships to provide a more robust method of removing ontogenetic trends from tree-ring sequences and thus to determine past climate impacts on tree growth.

To achieve these goals, we plan to analyse the Level II data on tree height, diameter, crown base height, and crown width, leaf area and phenology for individual trees within sites through time using statistical techniques (regression, generalized linear

modeling, mixed-layer models); we will use the same data across sites to explore geographic variation.

References

Li, G., **Harrison, S.P.**, Prentice, I.C., Falster, D., 2014. Interpretation of tree-ring data with a model for primary production, carbon allocation and growth. *Biogeosciences* 11: 6711-6724.

Li, G., **Harrison, S.P.** and Prentice, I.C., 2016. A model analysis of climate and CO₂ controls on tree growth in a semi-arid woodland. *Ecological Modelling* 342: 175-185.

Li, G., Gerhart, L.M., Harrison, S.P., Ward, J., Harris, J., and Prentice, I.C. Changes in biomass allocation buffer low CO₂ effects on tree growth during the last glaciation. (Submitted to *Nature Communications*)

Wang H et al. (2016) A universal model for carbon dioxide uptake by plants. *bioRxiv*
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