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Influence of Morphological Traits on Wood Litter Production

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Highlights: We study the effect of variation of morphological traits on the wood litter production using an L-systems based model.

Keywords: L-systems, wood litter production, architectural traits, morphological traits, physiological traits.

Wood-litterfall is among the principal factors determining carbon accumulation in soil. Understanding the mechanisms that give rise to this process is therefore an important task for the estimation of carbon balances of forests and to develop management practices which balance timber production with carbon sequestration (Franklin et al., 2012). In fire-prone areas, wood litterfall is an important facilitator of forest fires, but a predictive theory of fire risk based on the rate of wood litterfall, branch diameter distributions have yet to be developed.

In this study, we investigate how morphological traits (e.g. branching angle, metamer length and branching frequency) affect the wood litter production. Similar questions have been studied theoretically using continuous population dynamics models, e.g., Falster et al. (2011) and the dependence of ecosystem processes on traits has long been investigated (Eviner, 2004). We use an L-systems (Lindenmayer and Prusinkiewicz, 1990) based model introduced by Sterck and Schieving (2007). The model respects fundamental physiological principles of plant growth, accounts for the age and weight of a plant's constituent parts. The model provided promising results when investigating the effects of size, shading, carbon economy, meristem population and reproductive allocation on the ontogenetic patterns in 3-D growth and structure.

The project, currently in its initial phase, aims to elucidate how differences in architectural and physiological traits between species affect the rate of biomass loss due to branch turnover. In addition, as various architectural strategies show different patterns in the size-dependence of biomass loss, we hypothesize that growth efficiency (fraction of biomass lost due to branch turnover) is inversely proportional to crown width.

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