The influence of branching pattern on the performance of tree species

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Abstract

The dynamic development and the formation of a tree crown is based on species specific branching patterns. At the same time the architectural structure of a tree is directly linked to and interacts with its physiological processes. In order to understand a species' performance within a community it is essential to understand how structural and physiological processes interact. The shape of a tree is the result from of the genetic constitution and environmental influences. Light is probably the prime environmental factor influencing the crown shape of a tree. Each tree has to find the balance between optimal light interception and transpiration, carbon allocation for structural support, assimilation organs and nutrient supplying organs (Cannel and Dewar 1994).

To investigate which crown traits are beneficial under given light conditions, eight tree species with different ecological traits (e.g. *Populus tremula, Fagus sylvatica, Picea abies*) were subjected to varying light conditions in a field experiment. Trees were planted on two sites which have a size of 23ha and 11ha between 2003 and 2004. The two experimental sites are part of the BIOTREE-Project and located in Thuringia/ Germany.

During the summer 2007, the eight tree species were shaded in five different treatments: 1. No shading, 2. 70% reduced light over the whole tree crown, 3. 50% reduced light over the whole tree crown, 4. 70% reduced light over half the crown, 5. Shading of buds only. Each treatment is repeated ten times. In the course of the study the effect of shading on branching pattern, carbon allocation and storage will be measured. Using the modeling platform GroIMP (Growth Grammar-related Interactive Modeling Platform) I want to analyze the interaction between architecture and physiological processes like carbon gain and resource allocation. Integrated within GroIMP is the modeling language XL (eXtended L-System language), "which combines the rule based-programming paradigm of graph grammars and L-systems with the imperative and object orientated programming paradigm of Java" (Kniemeyer 2004).

In this presentation I will demonstrate the experimental setup. Furthermore I will show preliminary results on the generic architectural traits that species from similar functional groups (e.g. all light demanding species) have in common. These are based on my own field observations and an intensive literature survey. Finally I will give examples on how the architecture of a tree can be displayed in GroIMP.

References

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