Project Database of ICP Forests

PROJECT DESCRIPTION

PROJECT INFORMATION

Project title:	**Leaf area constrained by soil nutrient status with Eco-evolutionary optimality principles**
Project ID:	264
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PROJECT DESCRIPTION

Leaf area index (LAI) is an important biophysical property of terrestrial vegetation. As the primary border for mass and energy exchange, leaf area is directly linked with carbon balance of terrestrial ecosystems. Predicting the response of terrestrial vegetation under climate change requires accurate characterization of plant biophysical and biochemical processes in which leaf area is a key determinant.

Available carbon to be allocated to foliage is often constrained by resource (energy, water, nutrient) availability. The trade-off between energy and water availability is relatively well-studied, with models developed and tested on the principles of ecohydrological equilibrium. However, the effect of nutrient limitation on leaf area is poorly understood, and current terrestrial biosphere models (TBMs) are far from capturing the dynamics of nutrient control against field experiments such as Free-Air CO_2 Enrichment (FACE) experiments. In this project, I therefore aim to explore the mechanistic links between vegetation fine root and leaf growth under nutrient limitation, thereby making a step forward towards understanding trade-offs between energy and nutrient availability. Furthermore, by applying a newly-developed soil nutrient status metric, the relationship between fine root mass and leaf area can be extended quantitatively to predict leaf area index. The hypothesis is that the ratio of fine root mass to leaf area will be proportional to soil nutrient status metric.

Specifically, data from ICP Forests will be used to address following research questions/steps:

To account for soil nutrient status, we applied a newly-developed soil nutrient metric using soil SOC content, C:N ratio and soil pH, other related soil chemistry and physical properties might be necessary to adjust the metric under different conditions. Continuous measurements on forest fine root biomass (from growth and biomass data) and leaf area index will be used to explore the relationship between carbon allocation to root and leaf. Forest species distribution is useful for further intra- and interspecies analysis. Soil water condition will affect nutrient availability so it should also be considered as a factor in regression. Initial analysis will focus on annual basis, but further investigation on seasonal pattern of carbon allocation changes will required detailed phenological observations.