CHALLENGES FOR PROCESS-BASED MODELLING OF MIXED FORESTS

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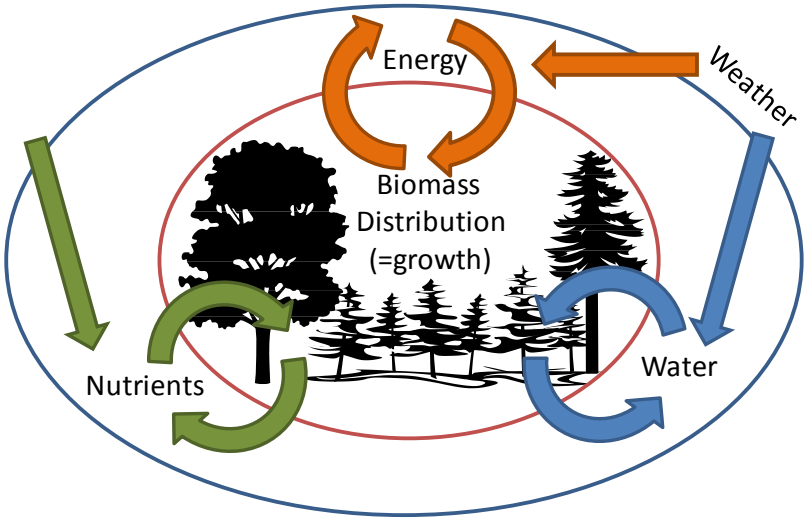
Abstract

In order to investigate the impacts of potential environmental changes on forest systems, process-based (or physiological) models are developed and employed. These models represent the responses of various physiological processes to each single impact and are therefore at least in principle suitable for indicating the response to new environmental combinations – as they are expected under climate change.
This feature makes physiological models ideal for simulating the development of mixed forests since they represent processes on a leaf or canopy scale and are species-specifically parameterized. However, due to the multitude of feedbacks and the spatial heterogeneity in a forest, models to date either represent physiology only roughly or refrain from addressing mixed forest conditions at all. In the latter case, mixed forests are parameterized either according to their dominant species or in a lumped way using weighted averages or large scale measurements.
The challenge is thus to represent long-term stand scale developments based on small-scale physiological processes that can be parameterized with direct small-scale measurements. This requires the simulation of energy and resource distribution within a forest in dependence on a crown and root system that is dynamically developing according to the micro-climatic conditions (Fig.1).



A detailed biosphere model will be presented that considers these feedbacks without the need for a 3-D simulation approach. It is suitable for application in pure forests, where it can be used to determine the direct and indirect impacts of thinning that does not only decrease biomass but also alters micro-climatic and nutritional conditions. By considering several ‘vegetation groups’ (e.g. grass, understorey with species A, overstorey with species A or/and B) at the same time, it is also applicable to mixed forest providing means for a differentiated analysis of whole forest responses to environmental changes, incl. management. It will be demonstrated that Level III measuring sites provide an excellent means for evaluating the approach.