# A Single Plant Growth Model to Simulate Competition and Stress Defence

C2

SFB 607

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## Conclusions

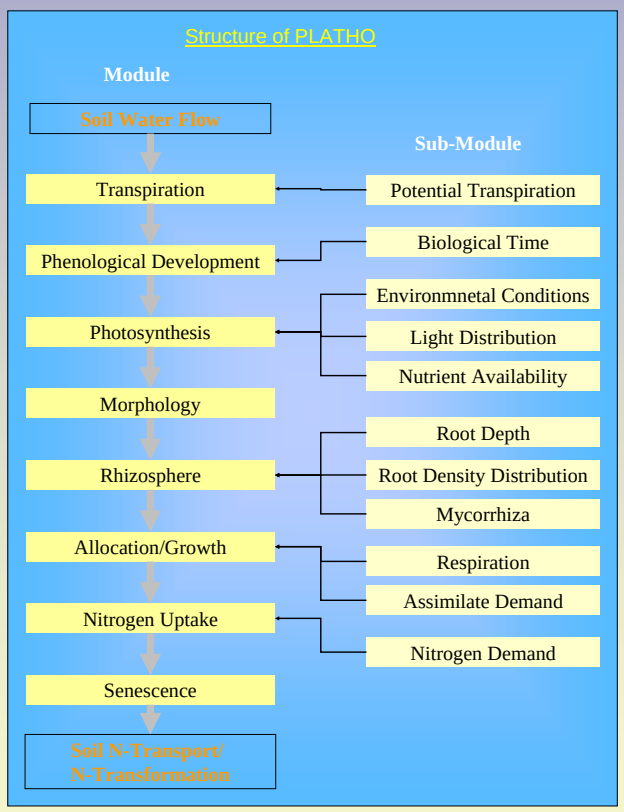
- The main processes investigated by SFB 607 could be successfully integrated to a single plant model
- Growth of woody and herbaceous plants can be simulated by a single generic plant model
- To further investigate the main hypothesises of the SFB a more mechanistic description for the regulation of resource allocation is needed
- Model parameterisation by laboratory experiments (growth rates) may not be useful for field situations (e.g. sunflower)

PLATHO (**PLA**nts as **T**ree and **H**erb **O**bjects), was developed to simulate plant internal regulation of resource allocation

- between plant organs and rhizosphere
- between primary and secondary metabolism

Recognizing the general processes common to all SFB 607 plants, plant species are considered as variations of a class of functionally and structurally equivalent systems (plants), rather than as separate entities.

PLATHO works on the level of physiological processes. Depending on biotic and abiotic external factors, dynamic physiological properties of plant organs are integrated up to the level of a single plant.




## Technical realization

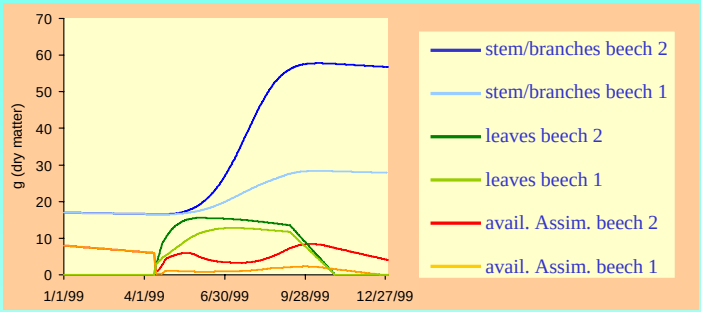
- PLATHO is embedded into the highly modular modeling system Expert-N (http://www.gsf.de/IBOE/expertn)
- Eight main modules (representing the most important physiological processes) and numerous submodules can be substituted by model users directly in the modeling system without a new compilation of the simulation program. This facilitates the comparison of different model assumptions
- Different modules relating to soil processes (transport, turnover) are available in Expert-N and can be linked to PLATHO
- The programming language is C/C++.

## Aspects of PLATHO

- Temporal scale from days to a few years
- Spatial scales: container, phytotrons, lysimeter, fields
- Simulation objects: barley, potato, sunflower, young beech and spruce
- Calculations in units of glucose:
  - -gain of resources due to photosynthesis and retranslocation
  - - consumption of resources due to respiration, growth and stress reactions
- Simulation of:
  - -feedback mechanisms to photosynthesis, water uptake und nutrient demand
  - - interactions between plant individuals within the canopy (competition for external resources).
- Several plant individuals with different genetic and ecological properties can be simulated simultaneously.

## Model application

### a) Scenario simulations:




Simulated dry matter development of different plant organs and assimilates available for growth processes and defense in the course of one year of two young beech individuals in a high ozone simulation scenario. Beech 1 is more sensitive against atmospheric ozone as beech 2.

b) Testing hypothesis by comparison with experimental data: