

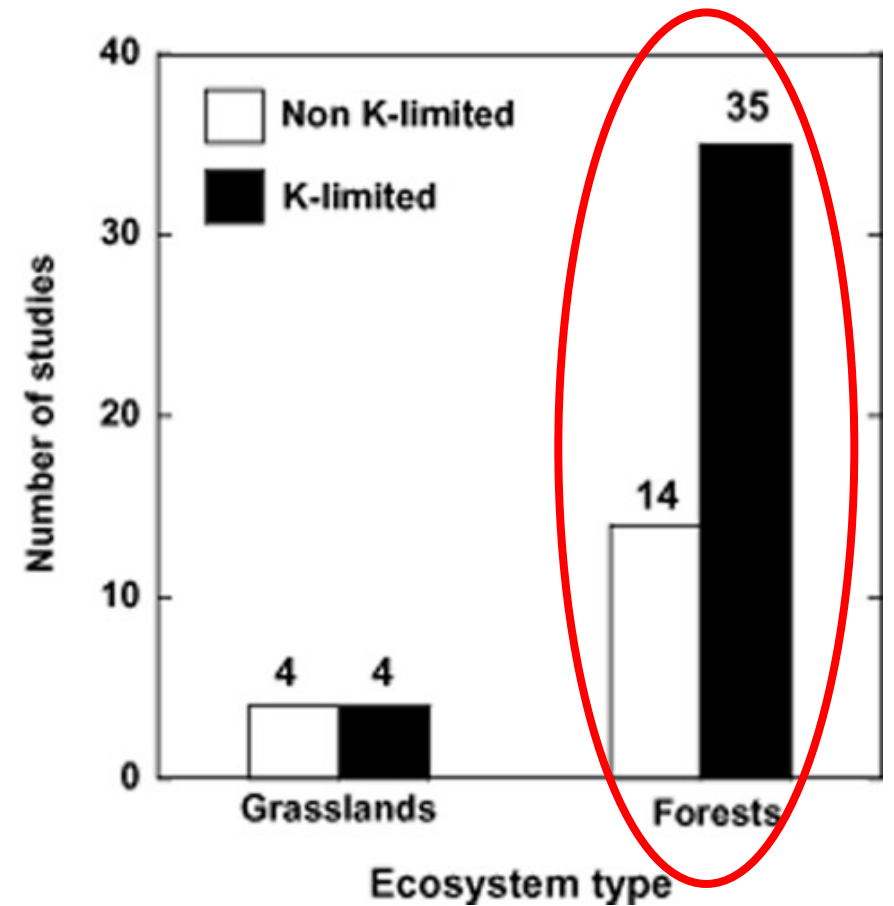
Use of eco-physiological modelling to investigate Potassium limitation of wood productivity in tropical eucalypt plantations

Ivan Cornut, Nicolas Delpierre, Gueric Le Maire, Joannès Guillemot, Yann Nouvellon, Otavio Campoe, and Jean-Paul Laclau



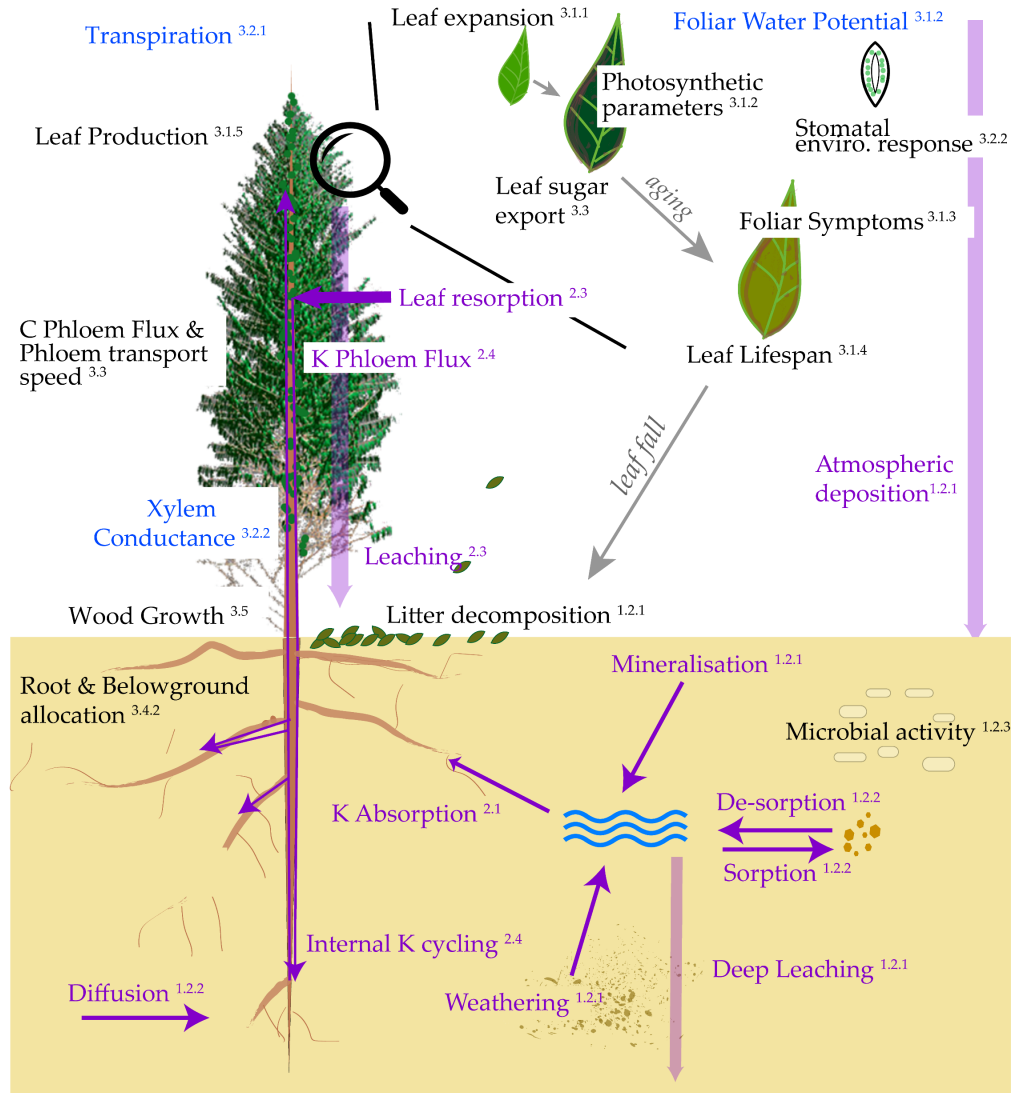
K is a limiting nutrient at the global scale

Thanks to previous meta-studies it is now well known that K is a limiting or co-limiting element in many forest ecosystems.



Sardans, J., & Peñuelas, J. (2015). Potassium: a neglected nutrient in global change. *Global Ecology and Biogeography*, 24(3), 261-275.

Reviewing the impact of K on processes



A review of the different processes impacted by K availability as well as a compilation of results observed in fertilization experiments conducted in tropical eucalypt plantations. This was necessary to be able to build hypotheses on the limitation of wood productivity by K since K is quite different from N and P.



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

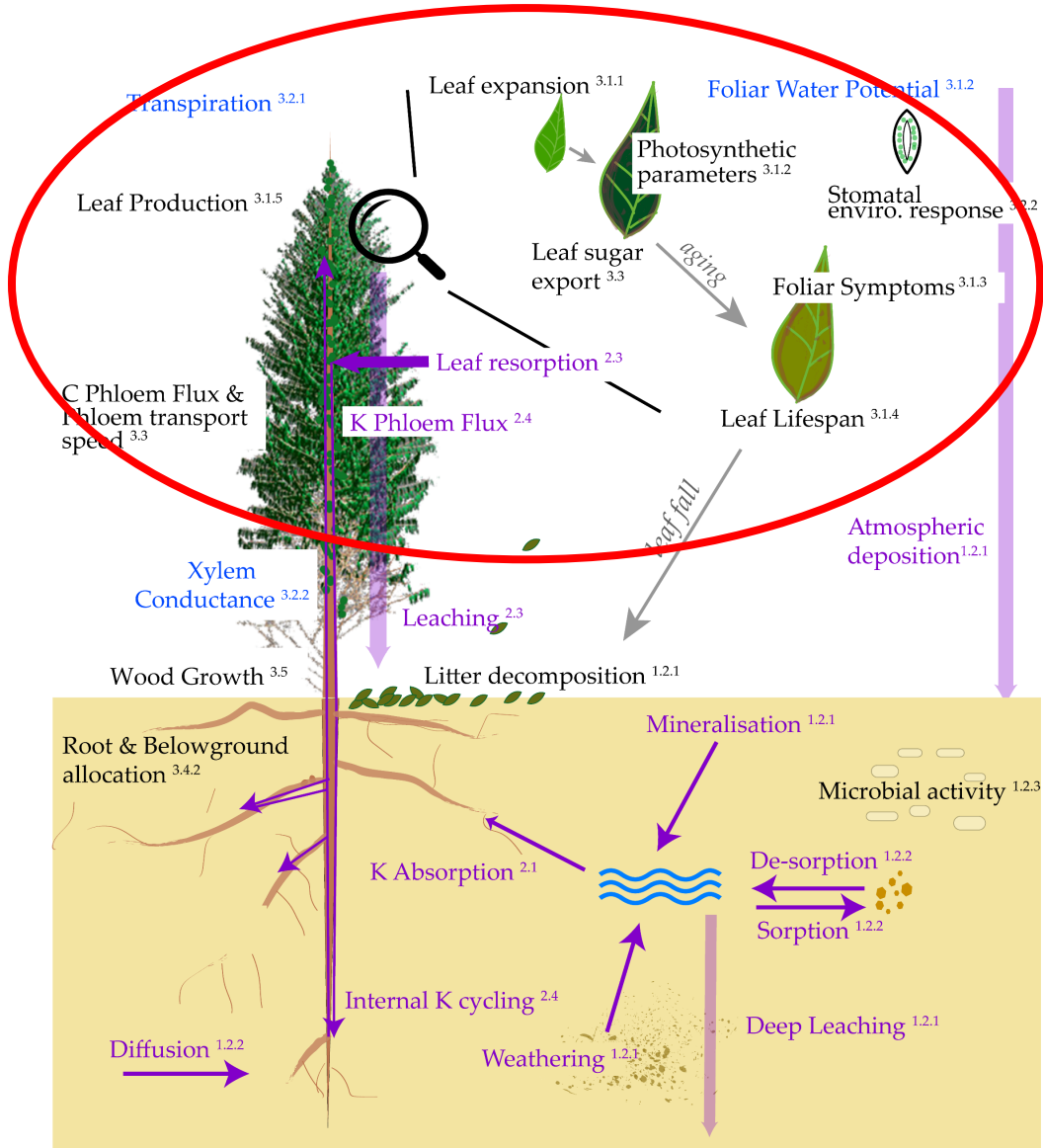
Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Potassium limitation of wood productivity: A review of elementary processes and ways forward to modelling illustrated by *Eucalyptus* plantations

Ivan Cornut^{a, b, *}, Gueric Le Maire^{b, c}, Jean-Paul Laclau^{b, c}, Joannès Guillemot^{b, c, d}, Louis Mareschal^b, Yann Nouvellon^{b, c}, Nicolas Delpierre^{a, f}

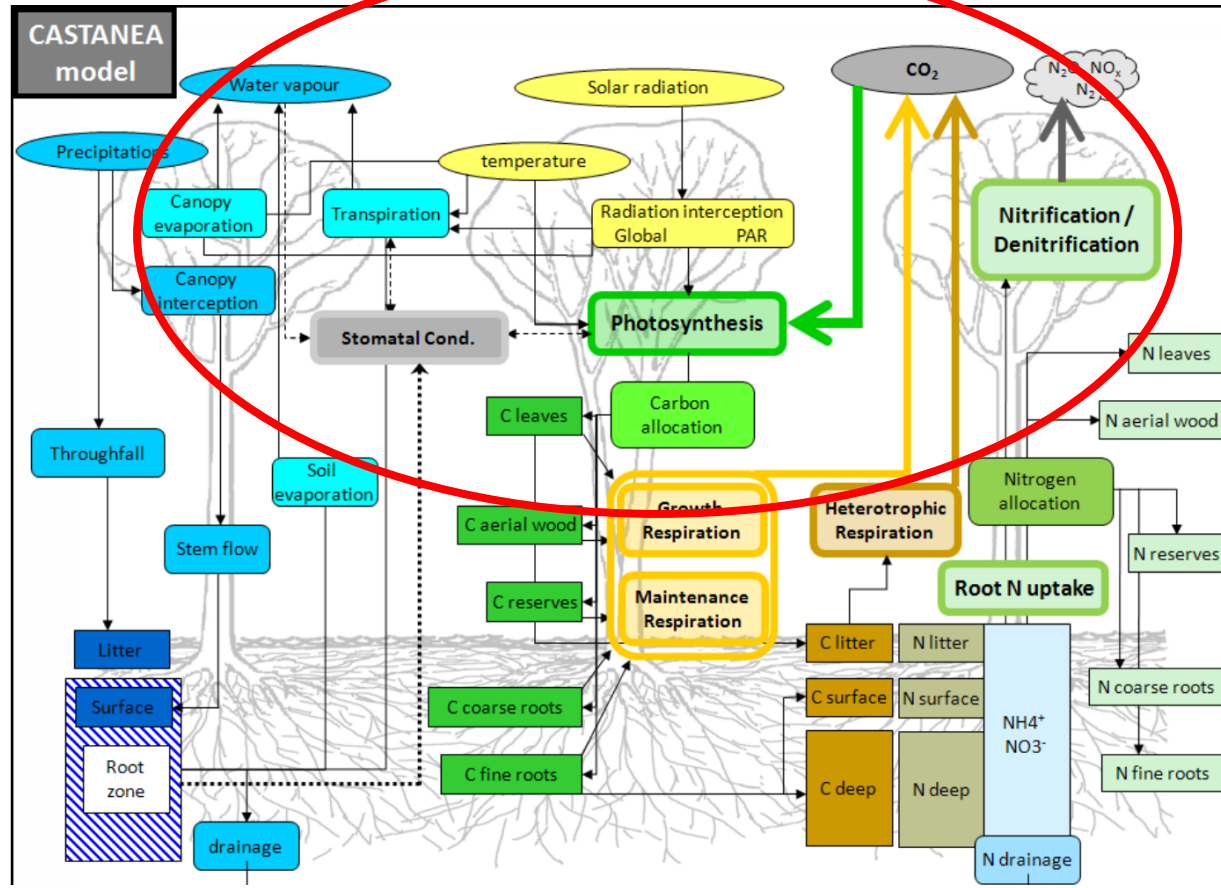
Focusing on the canopy and C assimilation



K has a strong impact on canopy functioning as it impacts leaf ontogeny and functioning.

This has an impact both on carbon assimilation and on the water cycle.

Modelling: a necessary tool to investigate K limitation

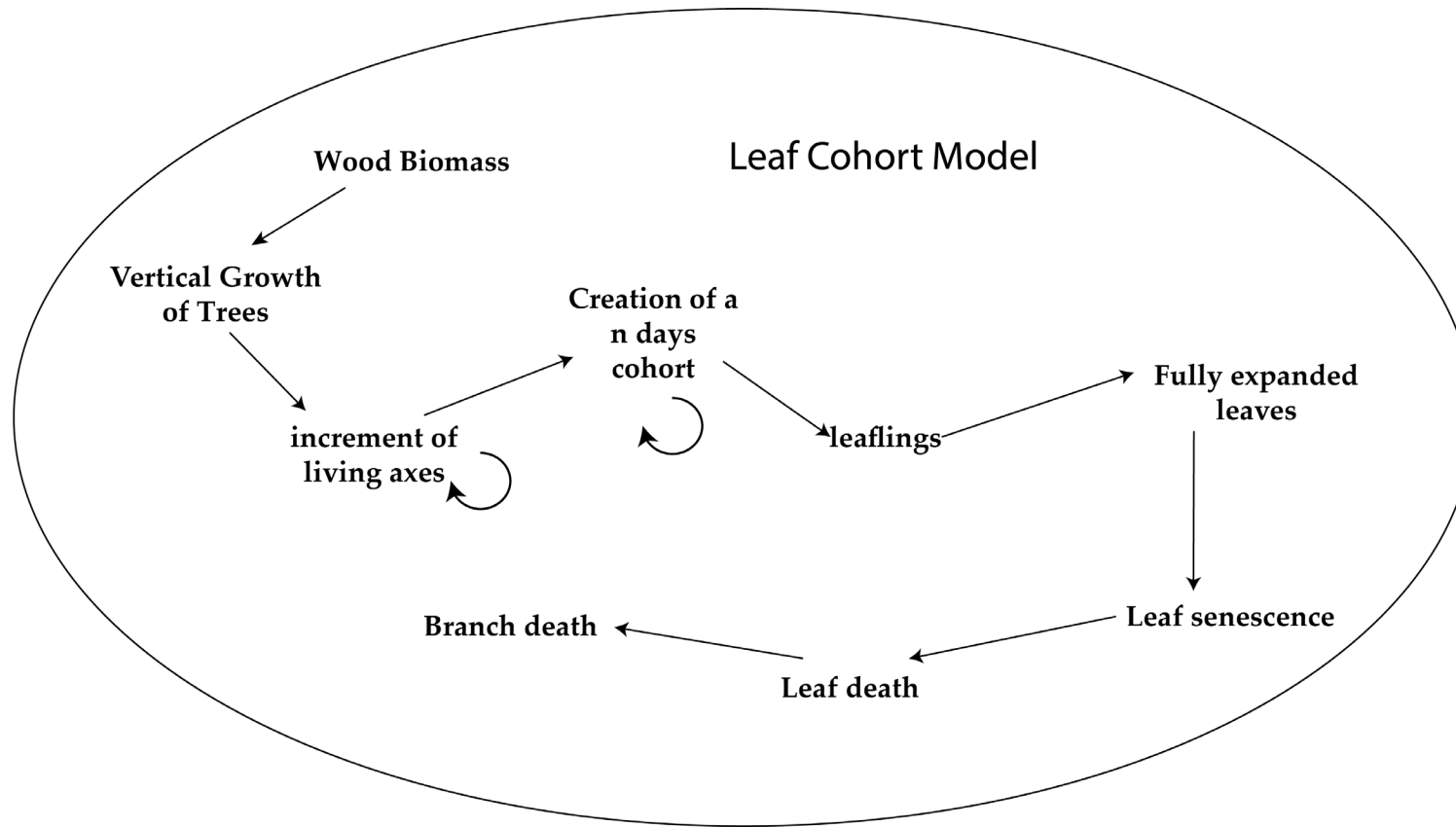


To evaluate the impact the processes affected by K have on GPP, we use an eco-physiological model.

This model represents both the carbon, water and some nutrient cycles through compartments and fluxes.

We will be able to test if K's impact on GPP is enough to explain the variation in wood productivity under K deficient conditions.

A new leaf cohort model



Since our model organism (Eucalyptus) is broadleaved evergreen, a canopy generation is necessary.

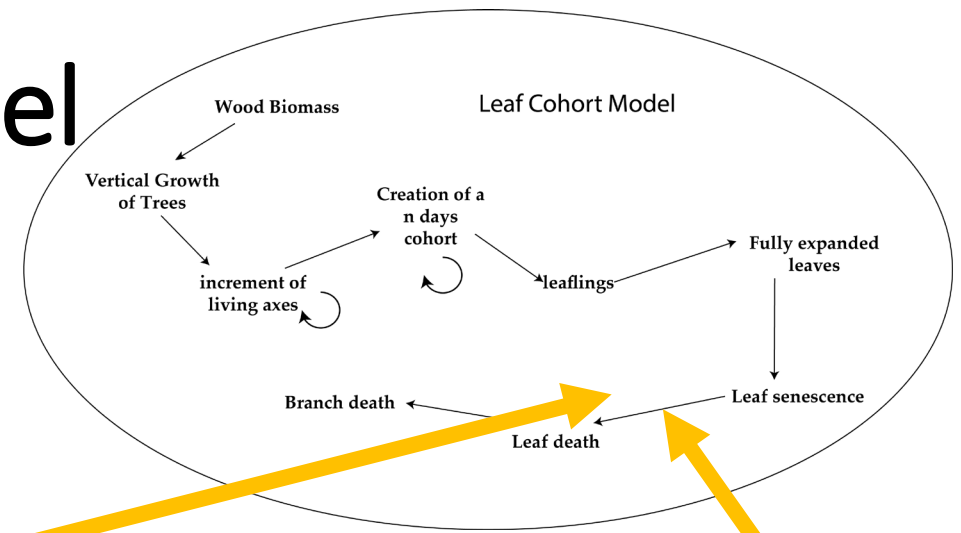
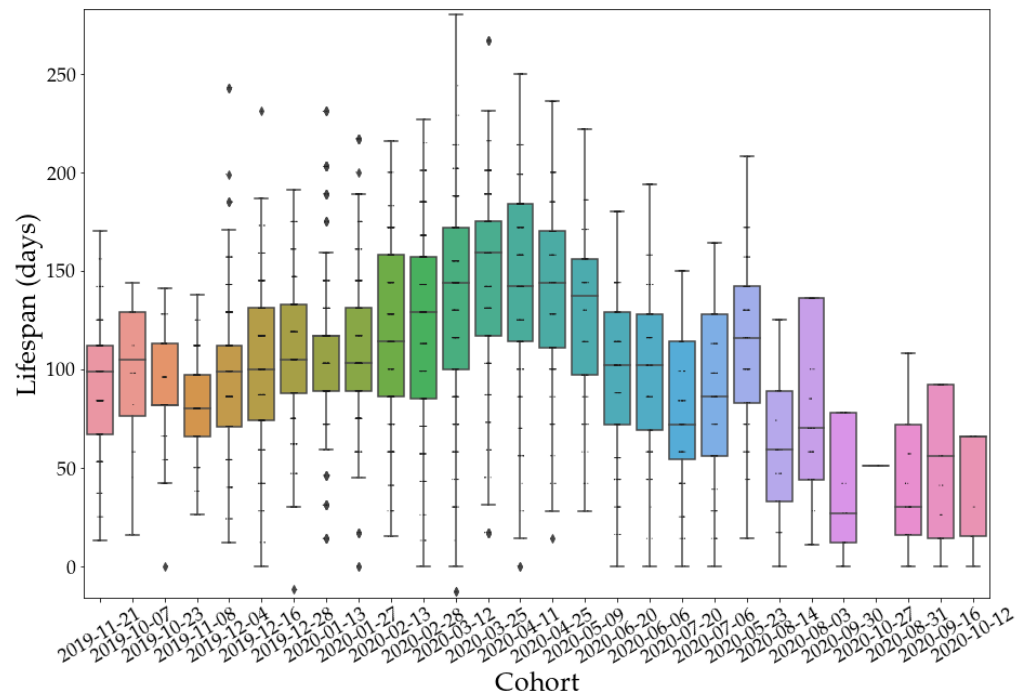
We will the response of different canopy processes to K availability using data from fertilization experiments.

Calibration of the canopy model

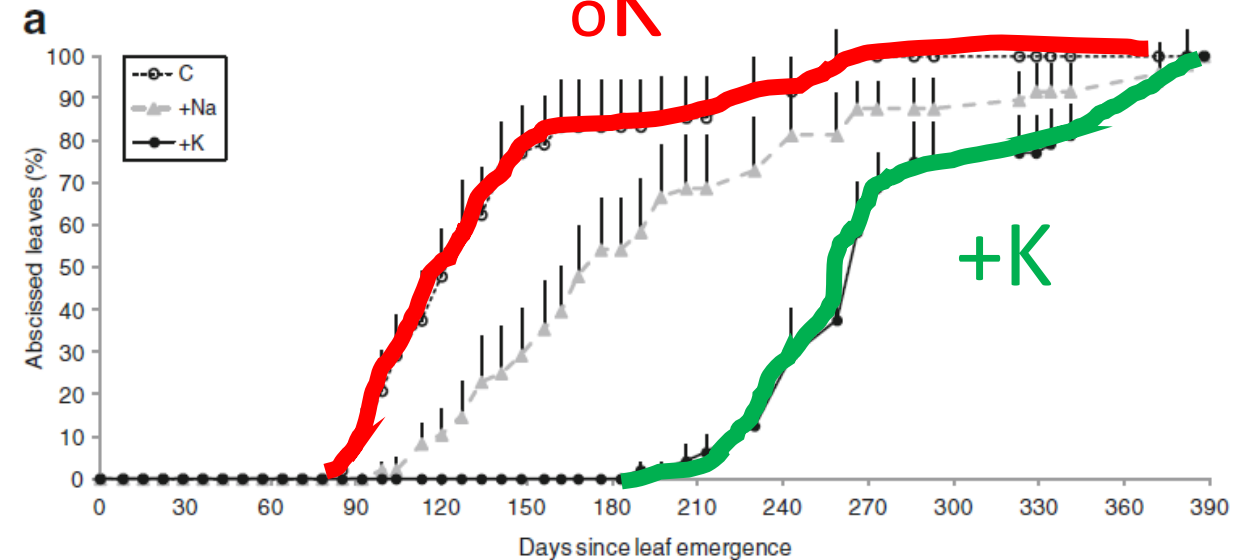
We need to integrate information from different sources to represent both the response of processes to the environment and nutrition.

For example here for leaf lifespan

Lifespan in function of the cohort

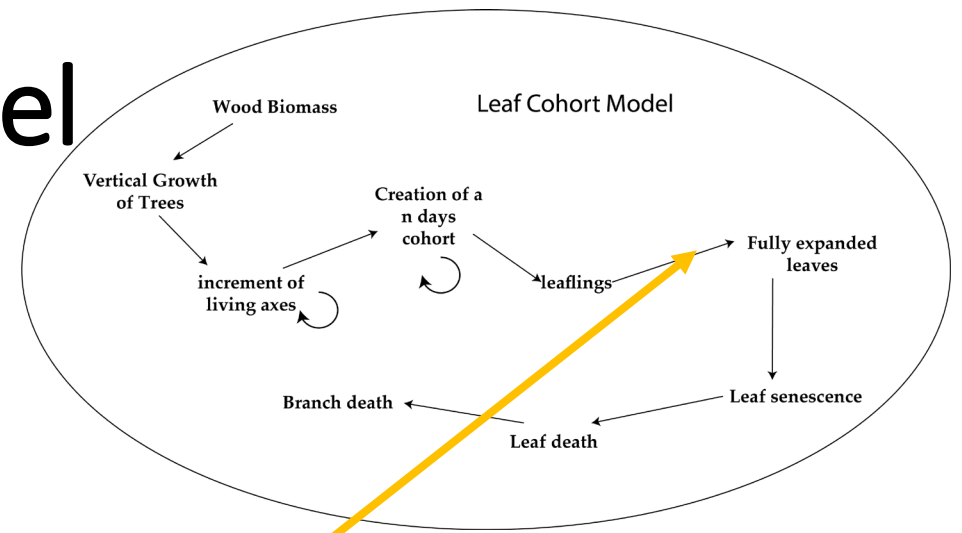
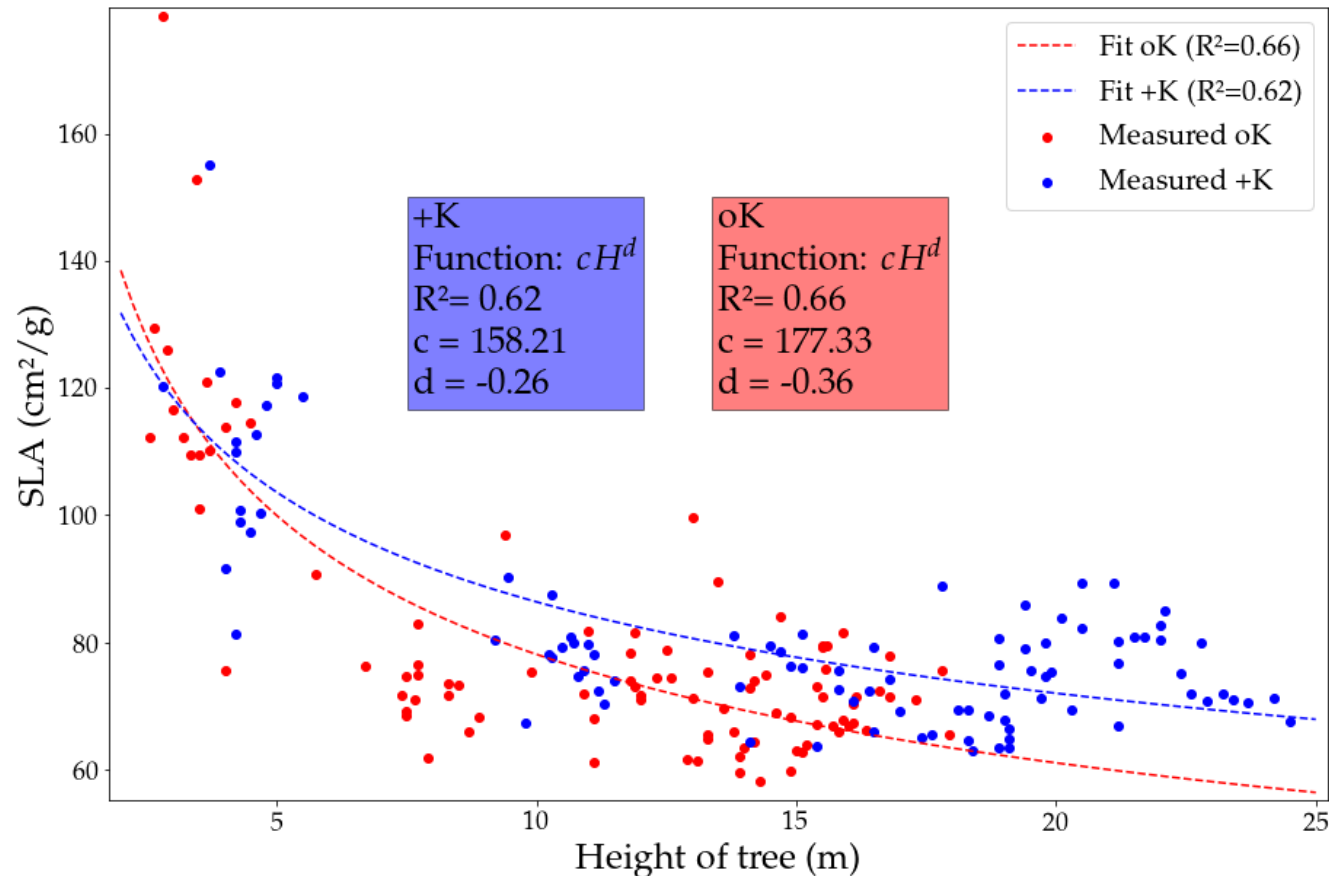


Leaf lifespan is greatly reduced



Calibration of the canopy model

SLA of trees in function of the height

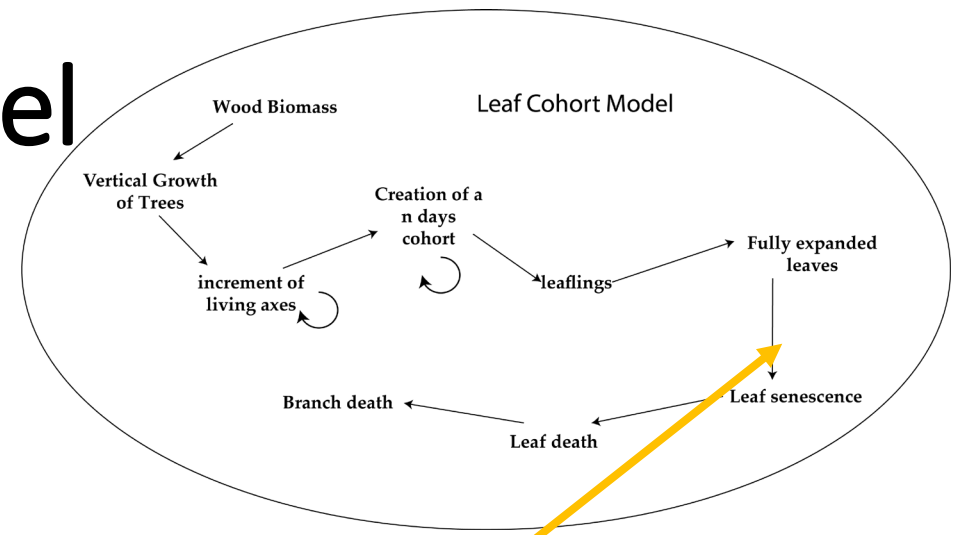
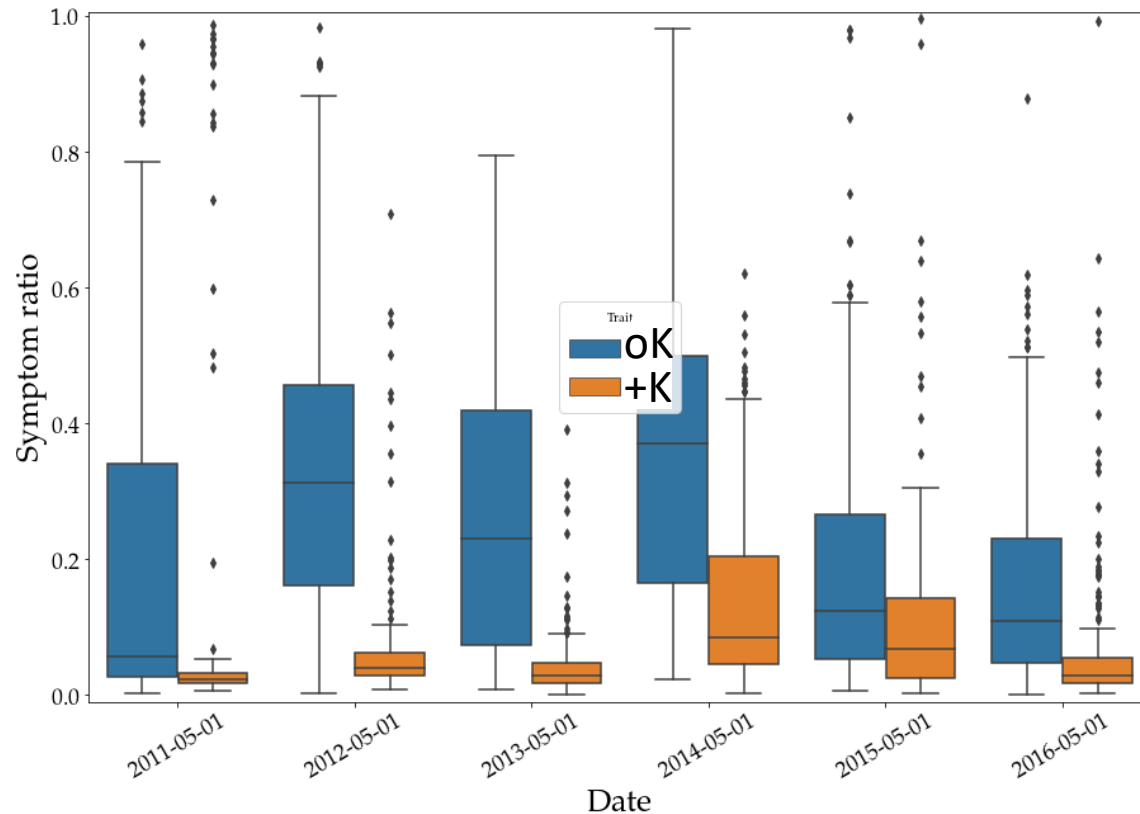


Another example using specific leaf area and its relationship to tree height.

Calibration of the canopy model



Symptom area in function of the date



Or leaf symptoms. There is a good relationship between leaf symptom area and leaf photosynthetic capacity (Battie-Laclau et al., 2013).

Integration in the model

Integrating this information to calibrate the model allows us to test the impact of K availability on the water and carbon fluxes.

