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Potassium limitation of forest productivity – Part 2: CASTANEA-MAESPA-K shows a reduction in photosynthesis rather than a stoichiometric limitation of tissue formation

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6 Supplementary Material

6.1 Parameters

Parameter	Symbol	Value	Units	Source
Number of leaves produced by height increment	κ	345	$nb_{leaves}.m^{-2}.m_{tree}^{-1}$	Calibrated using leaf production on the +K Itatinga stand
Leaf Lifespan	LLS	400	days	Calibrated using leaf production, biomass and fall measurements on the +K Itatinga stand
Target leaf area	S_{max}	2750	mm^2	Measured in scans from the +K stand

Table S1: Parameters related to the leaf cohort sub-model that were modified from Part 1

Parameter	Symbol	Value	Units	Source
Sensitivity parameter for soluble sugar allocation	p_{ss}	0.1	unitless	Assumed
Sensitivity parameter for fine roots allocation	p_{FR}	0.1	unitless	Assumed
Conversion from LAI to target root biomass	λ	80	$gC.m_{leaves}^{-2}$	Calibrated on the +K stand
Optimal wood K concentration at creation	$[K]_{Trunk}^{opti}$	7.5710^{-3}	$gK.gC^{-1}$	Maximum K wood concentration measured on the +K stand
Minimal wood K concentration in a cohort	$[K]_{Trunk}^{min}$	1.0010^{-3}	$gK.gC^{-1}$	Minimum K wood concentration measured on the +K stand
NPP driven rate of remobilisation of K in wood	T_{KTrunk}	0.00216	unitless	Calibrated on K wood concentrations measured on the +K stand
remobilisation efficiency of K in dying branches	$R_{KBranches}$	0.8	unitless	Measured difference in K content between live branches and dead branches in the +K stand
Annual turnover rate for branches	$M_{Branches}$	0.31	$.yr^{-1}$	Calculated from biomass and necromass measurements in the +K stand
Annual turnover rate for fine roots	M_{FR}	0.71	$.yr^{-1}$	(Lambais et al., 2017)
Annual turnover rate for bark	M_{Bark}	0.001	$.yr^{-1}$	Calculated from biomass and necromass measurements in the +K stand
Exponential factor	Q_{10}	2	unitless	(Ryan et al., 2009)
Reference Temperature	T_{MR}	25	$^\circ C$	(Ryan et al., 2009)
Trunk minimum rate of respiration per unit nitrogen	R_1^{trunk}	1.69×10^{-3}	$gC.gN^{-1}.hr^{-1}$	modified from Ryan et al. (2009)
Trunk maximum rate of respiration per unit nitrogen	R_2^{trunk}	2.63×10^{-2}	$gC.gN^{-1}.hr^{-1}$	modified from Ryan et al. (2009)
Slope between trunk biomass and respiration per unit nitrogen	R_2^{trunk}	4.18×10^{-6}	$.gN^{-1}.hr^{-1}$	modified from Ryan et al. (2009)

Table S2: New parameters related to C and K allocation

6.2 Figures

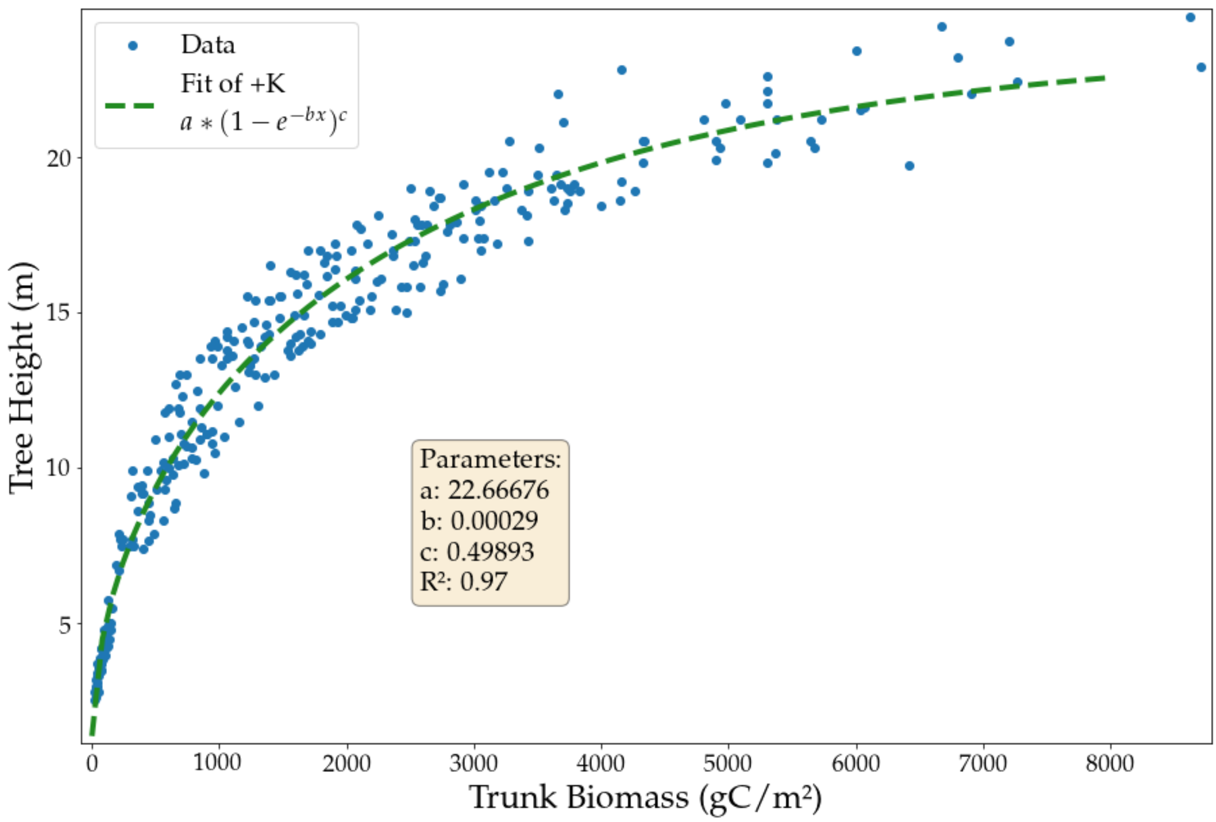


Figure S1: Tree height as a function of trunk biomass. The function was well adjusted.

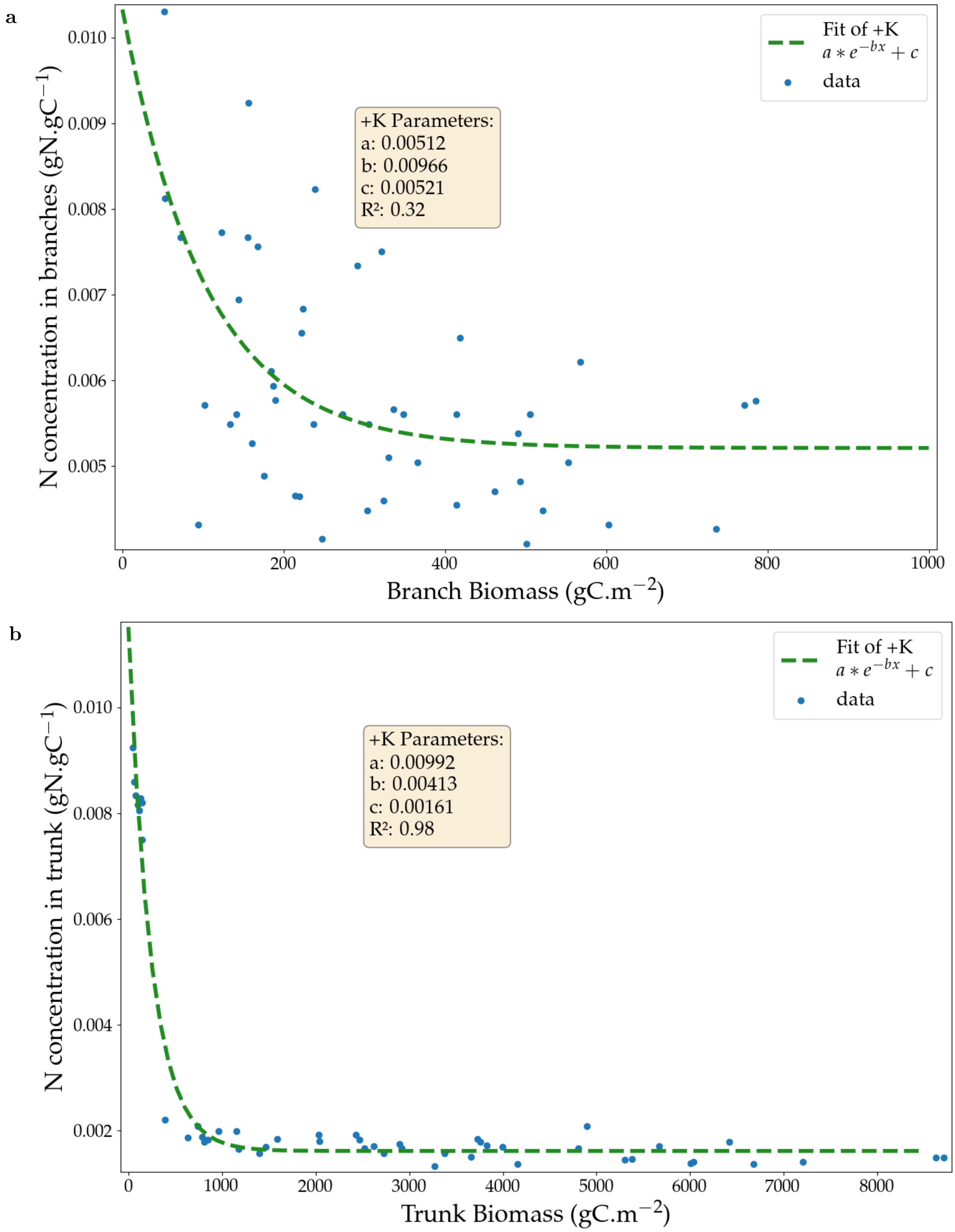


Figure S2: a) Branch N content in function of the biomass of living branches b) The trunk's N content in function of the trunk biomass.

a

b

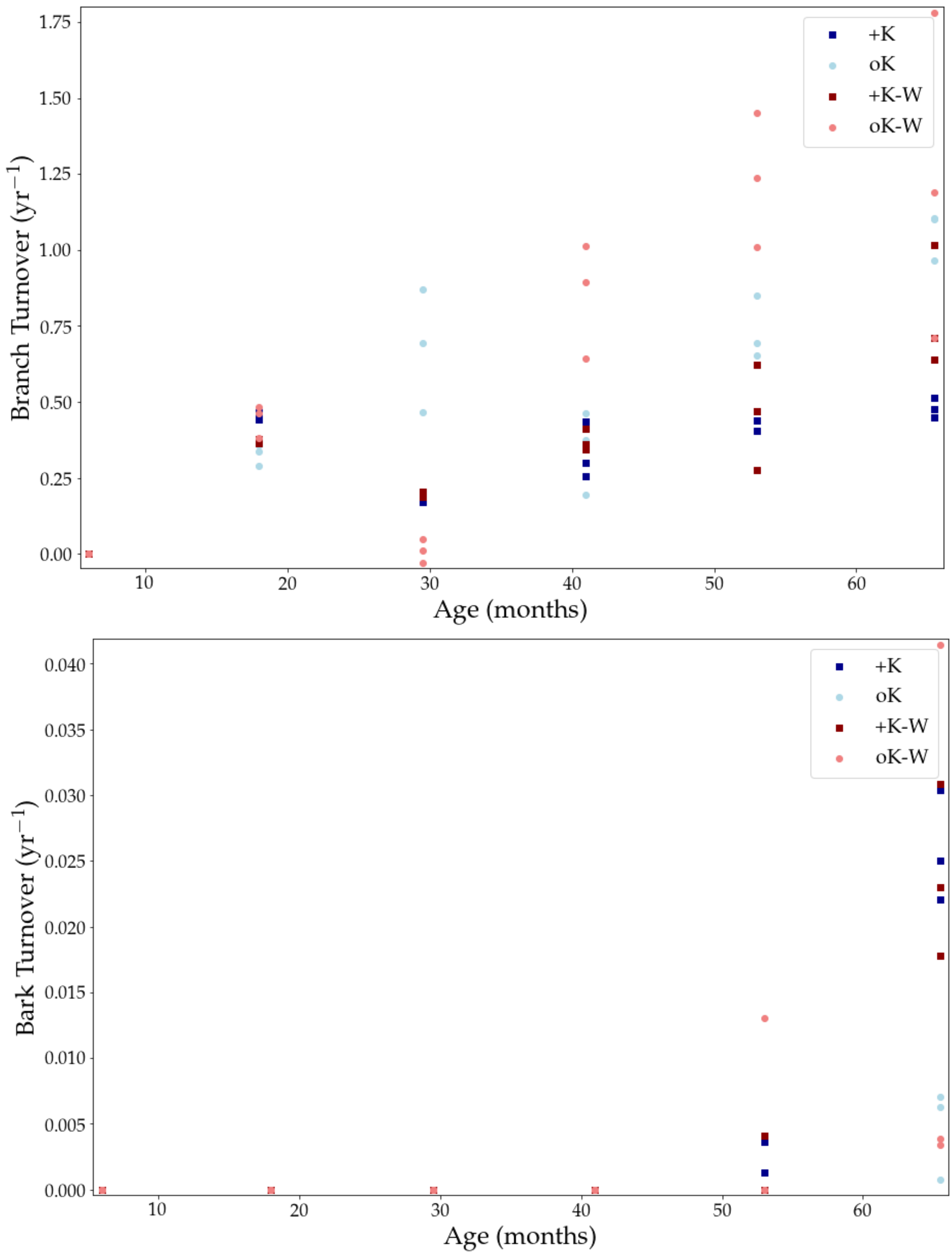
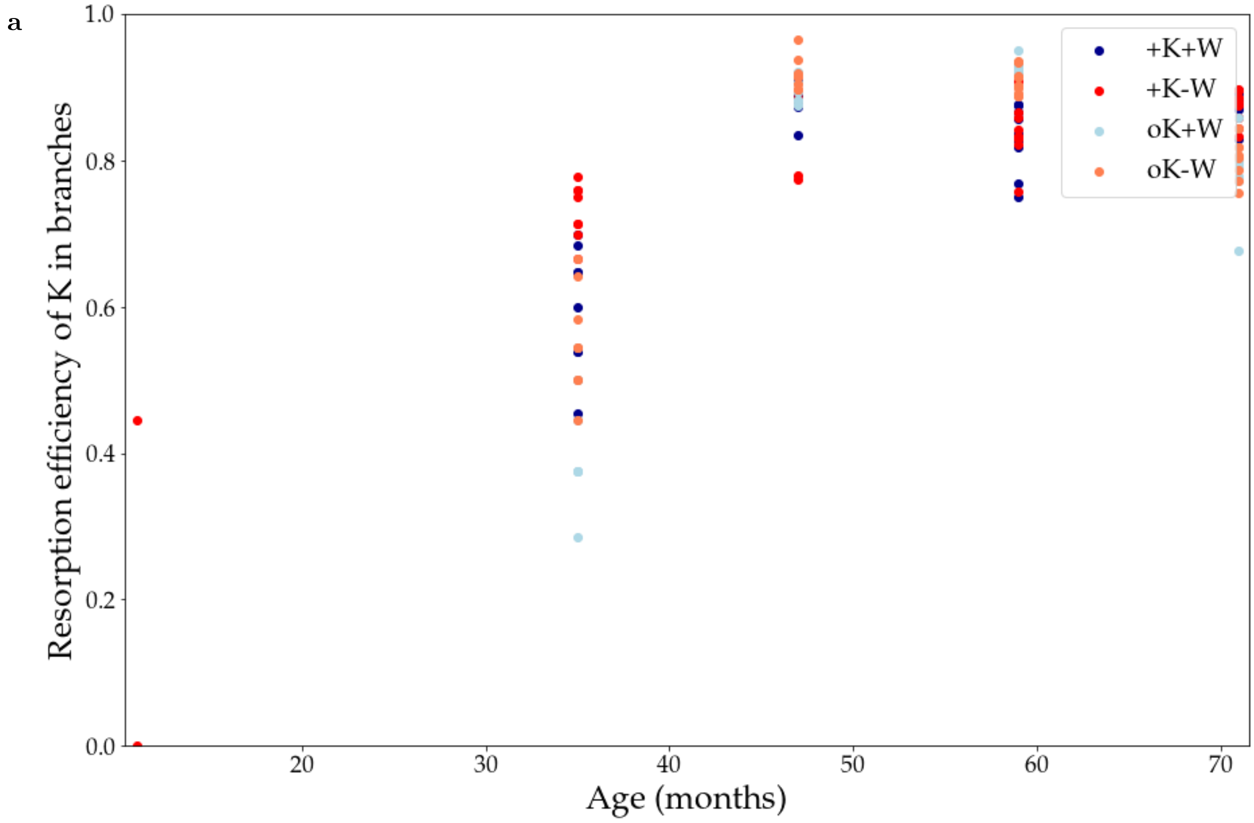


Figure S3: a) Turnover of bark in different fertilisation and rainfall exclusion plots (-W is 30% of rainfall removed). Each data is a separate data point. b) The turnover of branches in the same conditions.



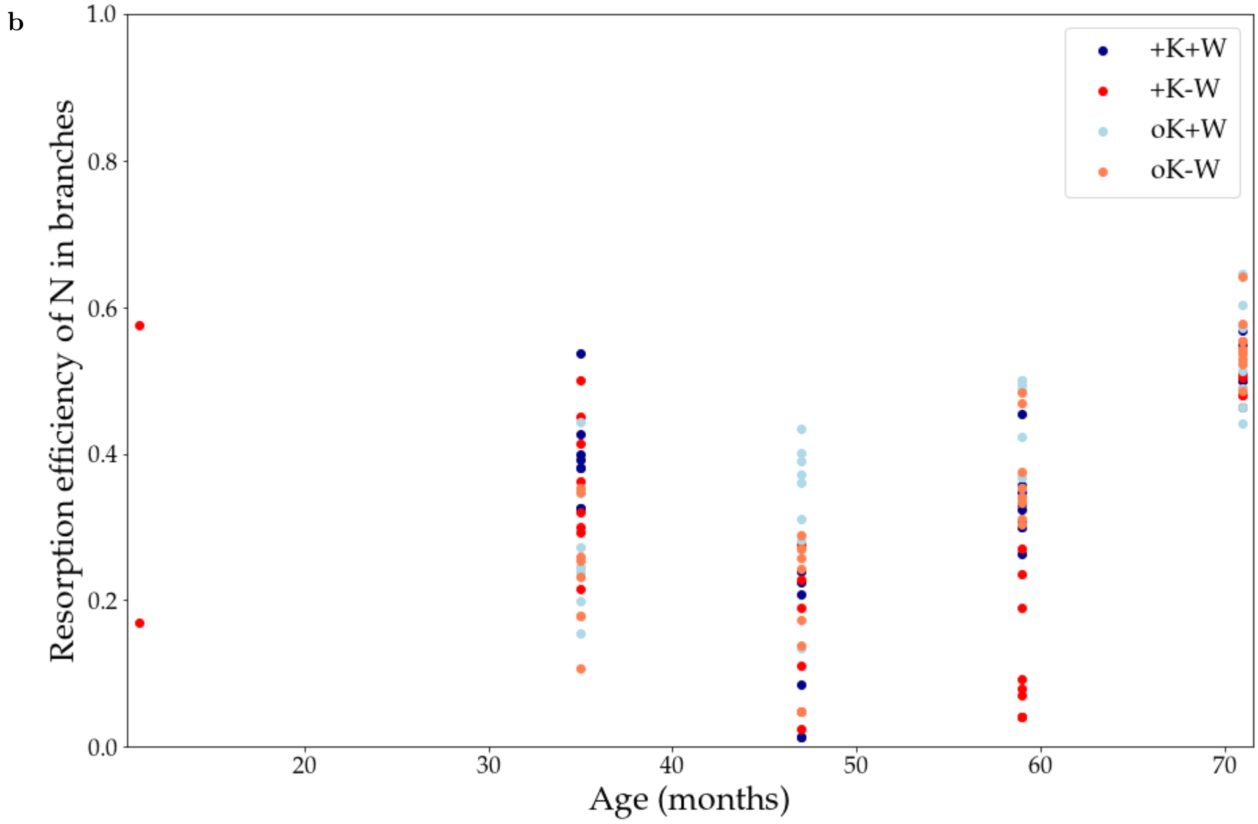


Figure S4: Branch resorption efficiencies for K (a) and N (b) that were calculated using annual measurements of K concentrations of live and dead branches on the same tree. Each data point is a tree in each treatment.

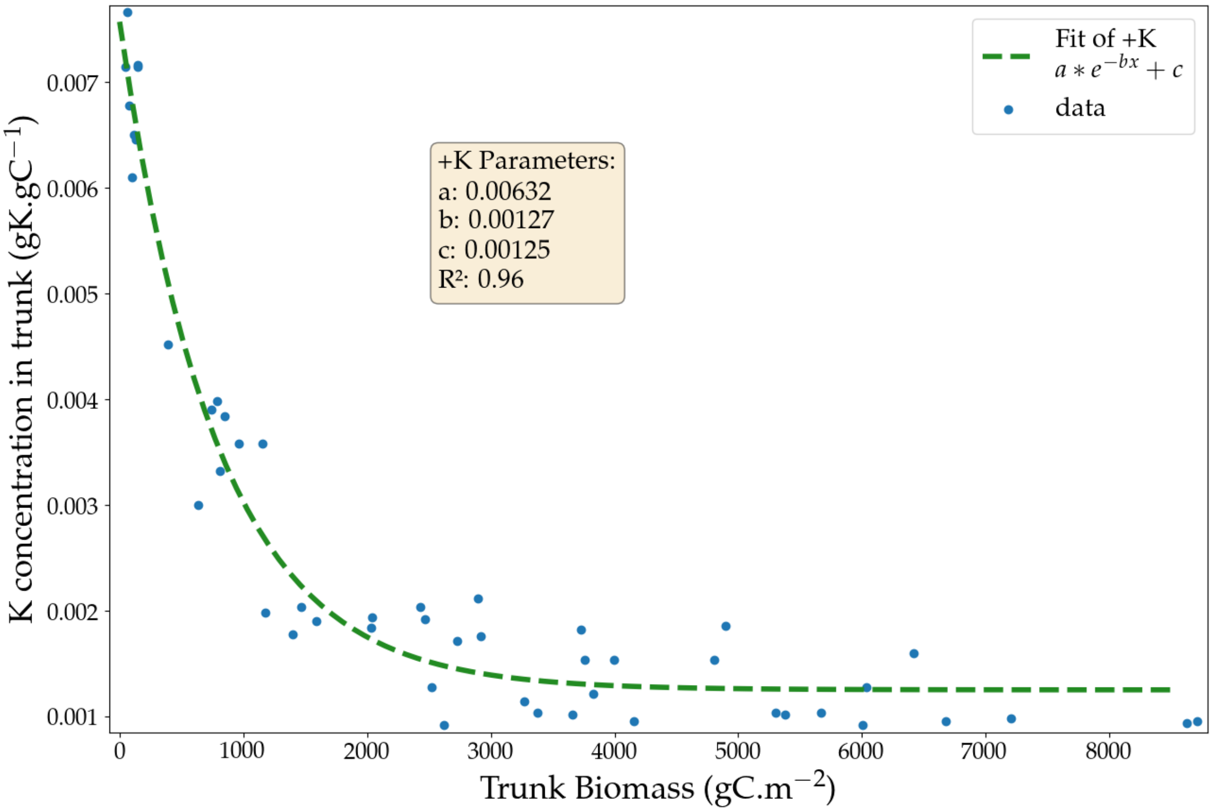


Figure S5: Trunk K content as a function of trunk biomass. A decreasing function was adjusted to the data. This function was not used in the model but the parameters were used to parametrise the K trunk wood cohort model. The non-limited trunk wood concentration at the creation of the cohort was equal to $a + c$ of the function shown in the inset and the minimal trunk wood K content was similar to c (but corrected to account for the newly created cohorts in trunk wood).

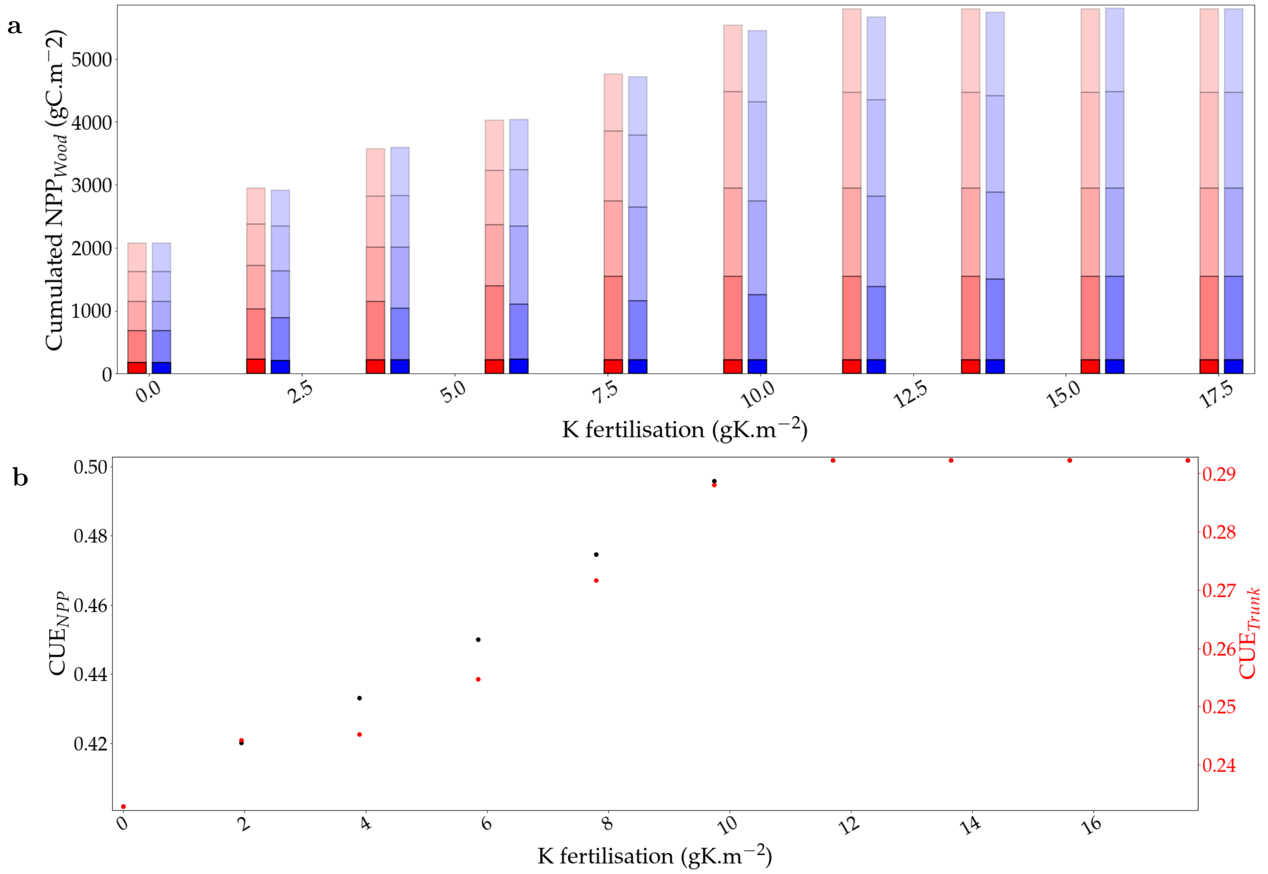


Figure S6: a) The response of cumulated NPP_{trunk} to two different fertilisation regimes (applied once at planting in red and over 4 application over the early growth in blue) along a fertilisation gradient. b) The response of NPP CUE and trunk CUE to K fertilisation ranging from 0gK.m^{-2} to 17gK.m^{-2}

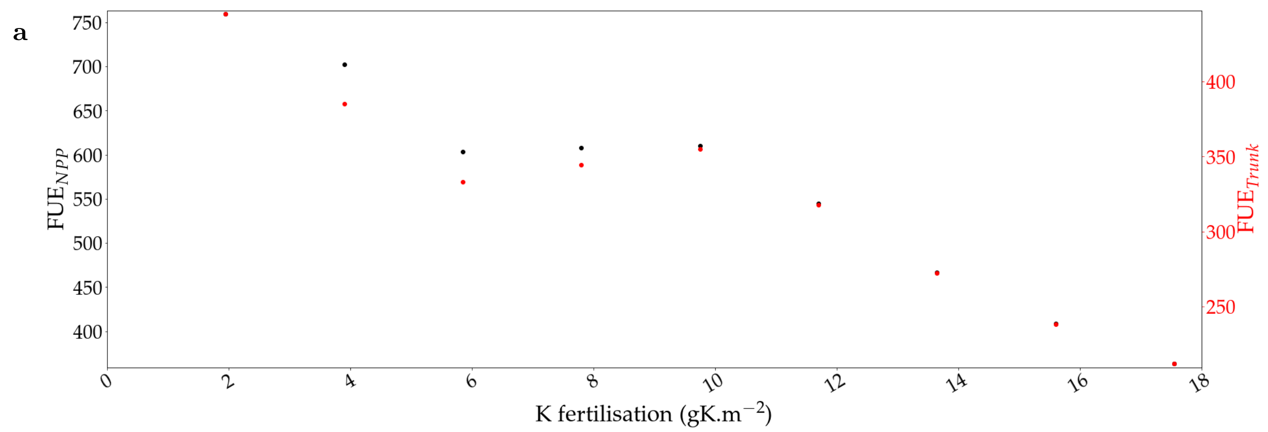


Figure S7: The fertiliser use efficiencies of NPP and of trunk production in function of the fertilisation level of the simulated stand.