Light competition

$H_{(i)}$ Height: $H_{(i)} = \min\left[H_{max\,(i)} ; \max\left(0.01; H_{max\,(i)} \cdot \frac{B^{C}_{(i,shoot)}}{B^{C}_{max\,(i,shoot)}} \right) \right]$ E18

with $B^{C}_{(i,shoot)} = B^{C}_{(i,leaf)} + B^{C}_{(i,stem)}$ and $B^{C}_{max\,(i,shoot)}$ the maximal value of $B^{C}_{(i,shoot)}$

$LAI_{(i)}$ Leaf area index: $LAI_{(i)} = \frac{B^{C}_{(i,leaf)}}{\chi \cdot LMA_{(i)}}$ with carbon content $\chi = 0.45$ E19

$LAI_{l\,(i)}$ Leaf area index in layer l, linearly related to height (for details see in Appendix II, annexe 1) E20

$A^{l}_{h\,(i)}$ Light interception: $A^{l}_{h\,(i)} = \frac{k_{(i)}}{\sum_{i'} k_{(i')} \cdot LAI_{l\,(i')}} \cdot I^{l}_{h} \cdot \left[1 - \exp\left(- \sum_{i'} k_{(i')} \cdot LAI_{l\,(i')} \right) \right]$ E21

I^{0}_{h} PAR above the canopy at solar time h: $I^{0}_{h} = \max\left[I_{max} \cdot \cos\left(\frac{h - 12}{\tau} \cdot \pi \right) ; 0 \right]$ E22

I_{max} Daily maximal instantaneous radiation: $I_{max} = \frac{\Gamma_{U} \cdot R_{g}}{\Gamma_{I} \cdot \tau}$ E23

with data inputs (R_g: daily radiation and τ: day length) and constants (Γ_U: unit change and Γ_I: integration)

I^{l+1}_{h} Instantaneous PAR above the layer l: $I^{l+1}_{h} = I^{l}_{h} \cdot \exp\left(- \sum_{i'} k_{(i')} \cdot LAI_{l\,(i')} \right)$ E24

Nitrogen competition

$U^{N}_{theo\,(i)}$ Potential nitrogen assimilation: $U^{N}_{theo\,(i)} = U^{C}_{theo\,(i)} \cdot \sum_{j} \left(f^{C}_{(i,j)} / \xi_{(i,j)} \right)$ E25

$V^{N}_{theo\,(i)}$ Plant nitrogen demand: $V^{N}_{theo\,(i)} = \max\left(U^{N}_{theo\,(i)} - \sum_{j} \Re^{N}_{a\,(i,j)} \; ; 0 \right)$ E26

$U^{N}_{soil\,(i)}$ Actual plant uptake: $U^{N}_{soil\,(i)} = \min\left(V^{N}_{theo\,(i)} ; \frac{SRL_{(i)} \cdot B^{C}_{(i,root)}}{\sum_{i'} SRL_{(i')} \cdot B^{C}_{(i',root)}} \cdot \frac{\Delta N_{m}}{\Delta t} \right)$ E27

N_m Soil mineral nitrogen [$\Delta N_m = N_m$ in limiting nitrogen]

$U^{N}_{atm\,(i)}$ N-fixing: $U^{N}_{atm\,(i)} = \left(1 - \gamma_{(i)}\right) \cdot \left(V^{N}_{theo\,(i)} - U^{N}_{soil\,(i)} \right)$ E28

$U^{C}_{max\,(i)}$ Actual carbon uptake: $U^{C}_{max\,(i)} = \left(\sum_{j'} \Re^{N}_{a\,(i,j')} + U^{N}_{atm\,(i)} + U^{N}_{soil\,(i)} \right) \cdot \sum_{j'} \left(\xi_{(i,j')} \cdot f^{N}_{(i,j')} \right)$ E29

5.4 - Seed cycle (cf. Table 4.3).

$G^{C}_{s\,(i)}$ Seed germination: $G^{C}_{s\,(i)} = \begin{cases} \text{if } t = t_{0\,(i)} \text{ then } G^{C}_{d\,(i)} \\ \text{if } t = t_{g\,(i)}\,[365] \text{then} \left[G^{C}_{r\,(i)} + \left(1 - \delta_{(i)}\right) \cdot H^{C}_{s\,(i,seed)} \right] \cdot \left(1 - \Omega\right) \end{cases}$ E30

with $\delta_{(i)}$ fraction of seed dispersion; $t_{g\,(i)}$ time of seed germination and $t_{0\,(i)}$ time of first germination

Ω Soil cover: $\Omega = 1 - \exp\left(- \sum_{i'} k_{(i')} \cdot LAI_{(i')} \right)$ E31

$H^{C}_{s\,(i,j)}$ Seed dispersion: $H^{C}_{s\,(i,j)} = \left\{ \text{if } t = t_{d\,(i)}\,[365] \text{ and } j = seed, \text{then } B^{C}_{(i,seed)}, \text{ else } 0 \right\}$ E32

with $t_{d\,(i)}$ time of seed dispersion

5.5 - Nitrogen cycling through soil (cf. Table 4.2 and Figure 4-c).

$\Delta N_m / \Delta t = \delta + a_{qd} L^{N} + a_{sd} SOM^{N} - N_{leached} - U^{N}_{soil}$ E33

$\Delta L^{N} / \Delta t = F^{N} - a_{qd} L^{N} - \beta L^{N}$ E34

$\Delta SOM^{N} / \Delta t = \beta L^{N} - a_{sd} SOM^{N}$ E35

$N_{leached}$ Nitrogen leached: $N_{leached} = \min\left(\lambda \rho W, \Delta N_m / \Delta t - U^{N}_{soil} \right)$ E36

U^{N}_{soil} Plant uptake: $U^{N}_{soil} = \sum_{i} U^{N}_{soil(i)}$ E37

F^{N} Litter fall: $F^{N} = \sum_{i} \sum_{j} F^{N}_{(i,j)}$ E38

β, δ, λ, ρ, a_{qd} and a_{sd} are defined in Table 4.2.