Table S1 Main model input and output variables

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| **Category** | **Parameters** | **Descriptions** |
| Parameters to be estimated directly by fitting model to *Vc,max* data |  | Duration of time (days) that the nitrogen storage can support the current rate of carbon assimilation if nitrogen uptake were to cease altogether |
|  | Proportion of plant storage nitrogen allocated to leaf |
| Parameters to be estimated indirectly, based on the estimation of *Dns* and *fs* |  | Proportion of nitrogen allocated for growth in functional nitrogen pool |
|  | Proportion of nitrogen allocated for photosynthesis in growth nitrogen pool |
|  | Proportion of nitrogen allocated for light harvesting in photosynthetic nitrogen pool |
|  | Proportion of nitrogen allocated for light capture in light harvesting nitrogen pool |
|  | Proportions of storage nitrogen within the functional nitrogen pool |
|  | Proportions of respiratory nitrogen within the functional nitrogen pool |
|  | Proportions of carboxylation nitrogen within the functional nitrogen pool |
|  | Proportions of light capture nitrogen within the functional nitrogen pool |
|  | Proportions of structural nitrogen within the leaf nitrogen pool |
|  | Proportions of storage nitrogen within the leaf nitrogen pool |
|  | Proportions of respiratory nitrogen within the leaf nitrogen pool |
|  | Proportions of carboxylation nitrogen within the leaf nitrogen pool |
|  | Proportions of light capture nitrogen within the leaf nitrogen pool |
| Model outputs |  | Rubisco-limited maximum rate of carboxylation rate (*µmol* CO2/m2/s) |
|  | Maximum electron transportation rate (*µmol* electron/m2/s) |
| Model input parameters | *Cv* | Conversion factor from CO2 (*µmol*) to biomass (g); *Cv* =2.410-5 |
|  | *Cgr* | Proportion of gross primary production allocated for respiration; *C****g****r=0.25.* |
|  |  | Day-time and nighttime length (seconds) |
|  |  | Night-time length (seconds) |
|  |  | Proportion of respiratory nitrogen allocated to leaf; =0.5. |
|  |  | Structural nitrogen content (*g* structural N/g plant biomass), =0.001. |
|  |  | Leaf-mass-based plant functional nitrogen availability (g plant functional N/g leaf), calculated as the ratio of total plant functional nitrogen to total plant leaf biomass |
|  |  | Leaf-area-based plant functional nitrogen availability (*g* plant functional N/*m*2 leaf), = |
|  |  | Reference amount of plant functional nitrogen, including those in leaves, root, and sapwood, required to support the growth and maintenance of one gram leaf (*g* plant functional N/*g* leaf). |
|  | *k* | Ratio of total plant functional nitrogen to the amount of total nitrogen allocated to leaf |
|  | *Kc* | Michealis constant for CO2 in Rubisco reactions (*Pa*) |
|  | *Ko* | Competitive inhibition constant for O2 in Rubisco reactions (*Pa*) |
|  | LMA | Leaf mass per unit area (*g* leaf biomass/*m*2) |
|  |  | Measured mean leaf nitrogen content (*g* N/*g* leaf biomass) |
|  |  | Maintenance respiration demand per gram of functional nitrogen (*µmol* CO2/*g* functional nitrogen/day) |
|  |  | Carboxylation nitrogen use efficiency (*µmol* CO2/ *g* N/ s). |
|  |  | Bioenergetic electron transport nitrogen use efficiency (*µmol* electron/g N/*s*) |
|  |  | Photosynthetic nitrogen use efficiency (*µmol* CO2/*g* photosynthetic N/day) |
|  |  | Respiratory nitrogen use efficiency (*µmol* CO2/*g* respiratory N/day) |
|  | PAR | Photosynthetic active radiation (*µmol* photon/*g* N/*s*) |
|  |  | Day-time mean temperature (oC) |
|  |  | Night-time mean temperature (oC) |
|  | [CO2] | CO2 concentrations (*ppm*) |
|  |  | Proportion of net carbon assimilation rate allocated to leaf |
| Model state/intermediate variables |  | Light absorption efficiency |
|  | Net carbon assimilation rate (*µmol CO2/m2/day*) |
| *Ci* | Internal leaf CO2 concentration (*Pa*) |
|  |  | chlorophyll content (*mmol* Chl/*m*2 leaf) |
|  |  | Leaf-area-based plant functional nitrogen availability (*g* plant functional N/*m*2 leaf), LMA× |
|  | *Jl* | Light harvesting rate (*µmol* electron/*m*2/*s*) |
|  |  | Leaf-area-based nitrogen content (*g* N/*g* leaf biomass) |
|  |  | Nitrogen requirement for new tissue biomass (*g* N/*g* biomass) |
|  |  | Photosynthetic nitrogen content (*g* photosynthetic N/*m2* leaf); |
|  |  | CO2 concentration adjustment factor for  Rubisco-limited carboxylation rate () |
|  |  | CO2 concentration adjustment factor  for electron-transport-limited carboxylation rate () |
|  |  | Maintenance respiration (*µmol* CO2/*m*2/day) |
|  |  | Rubisco-limited carboxylation rate (*µmol* CO2/*m*2/s) |
|  |  | Electron-limited carboxylation rate (*µmol* CO2/*m*2/s) |
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