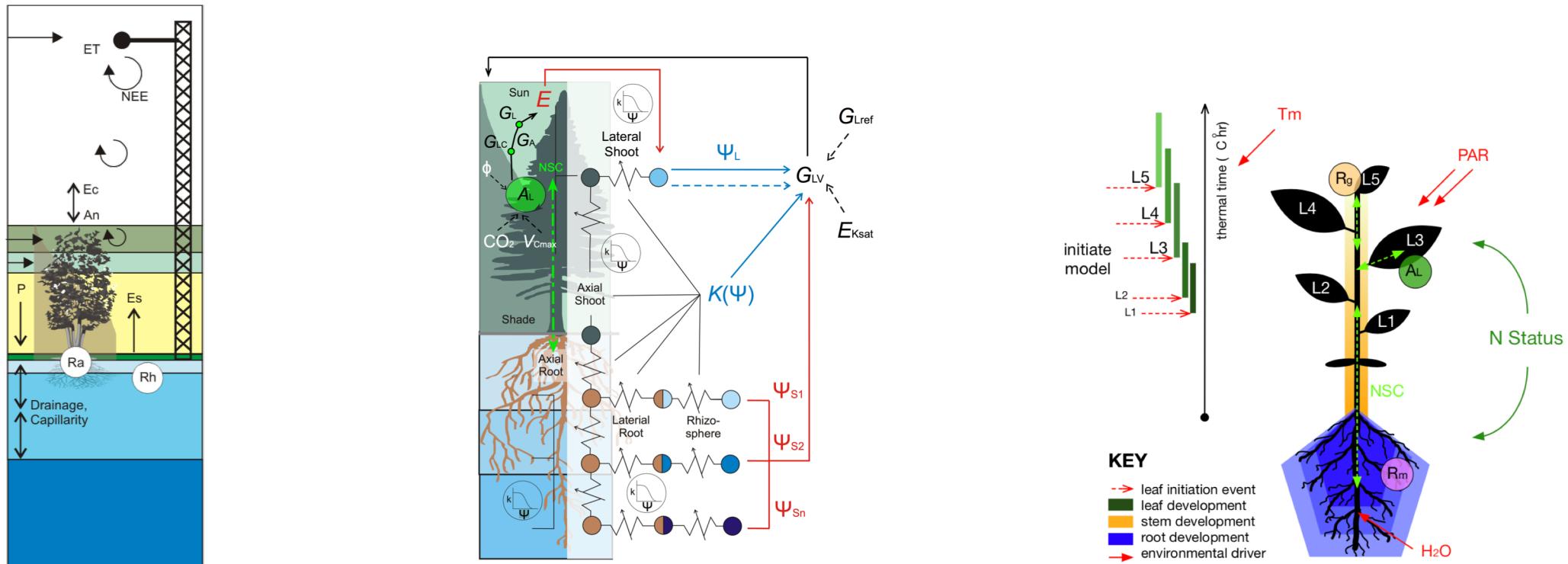


# TREES Workshop: Theory, Research Questions, and Hands-on Use

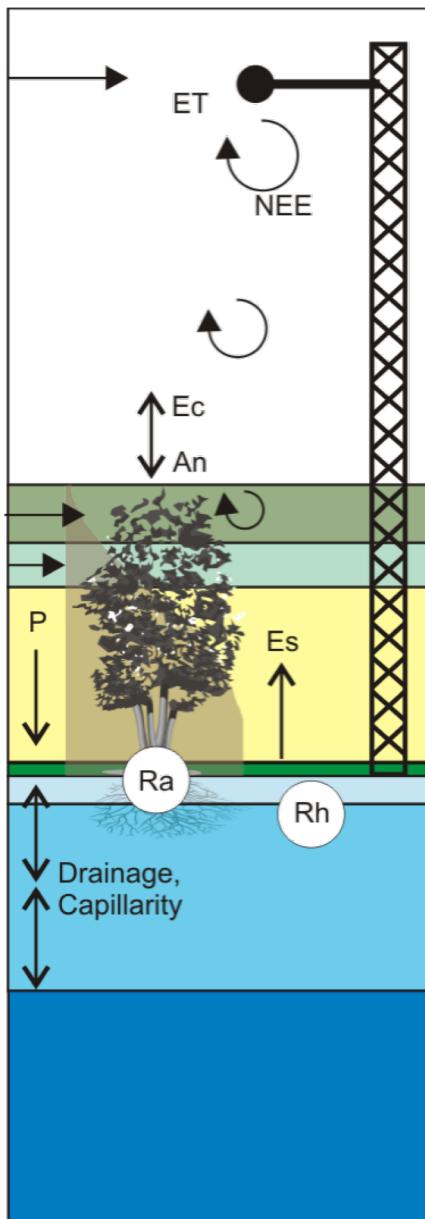
D. Scott Mackay and Diane R. Wang  
University at Buffalo



# TREES Workshop – Learning Objectives

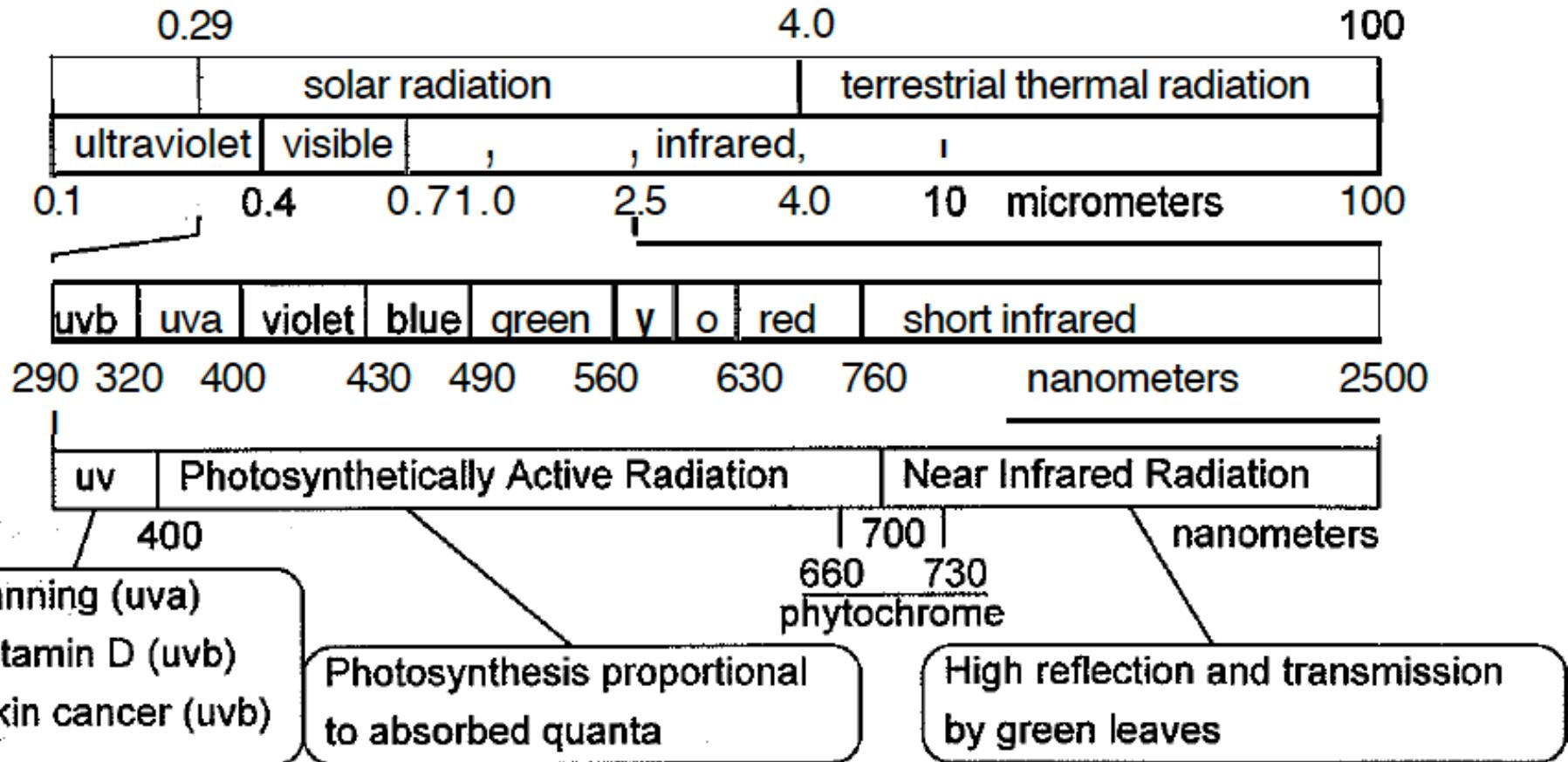
- 1) Understand the major processes in TREES
- 2) Think scientifically about how TREES can be applied to research questions
- 3) Become comfortable with running TREES (second session only)

# Major Processes in TREES



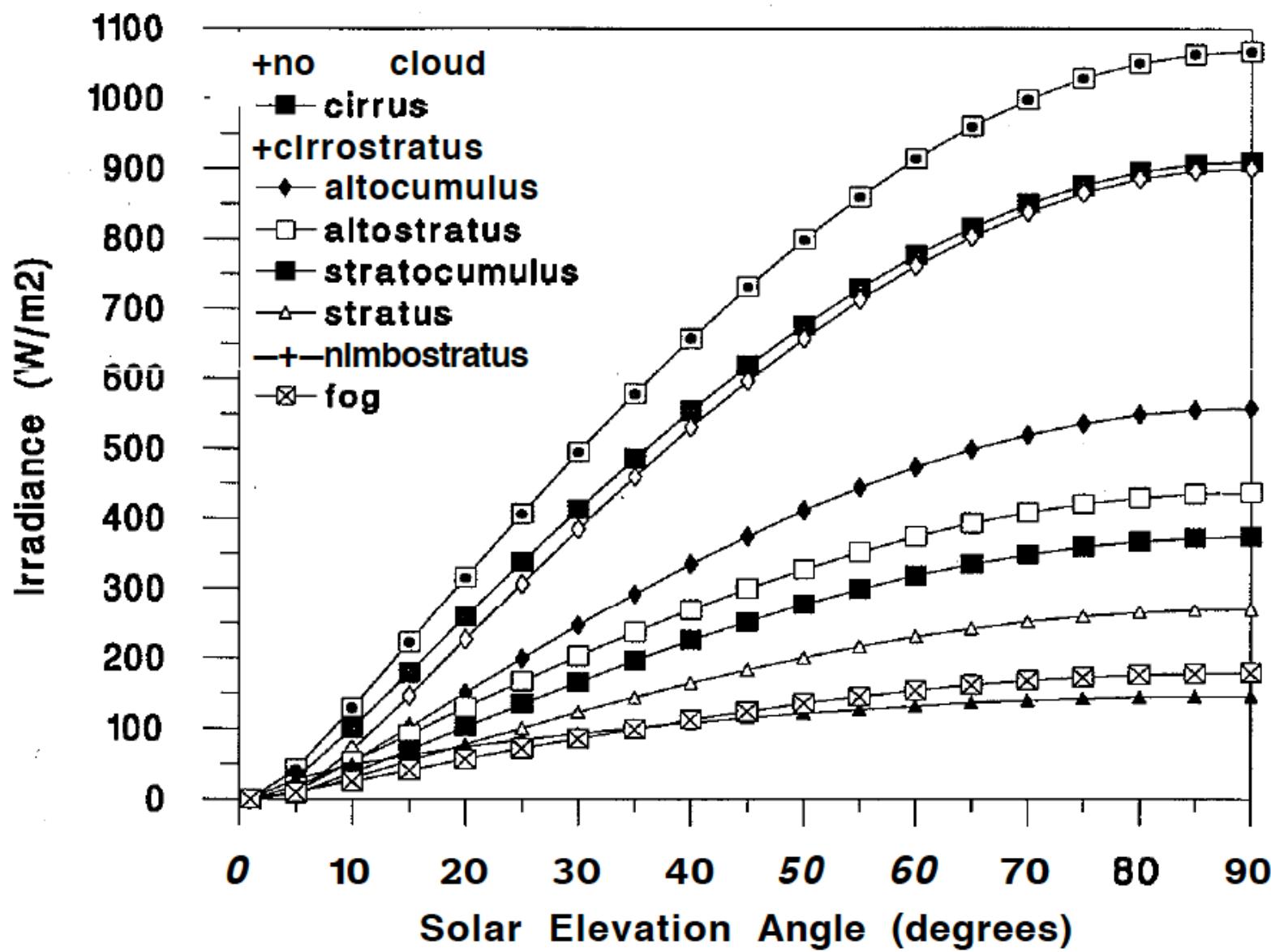
1. Leaf/Canopy – energy relations
2. Leaf/Canopy diffusive conductance
3. Photosynthesis (C3 and C4)
4. Vegetative growth
5. Soil-xylem hydraulics
6. Vadose zone soil physics
7. Nitrogen dynamics

# 1. Leaf/Canopy– energy relations



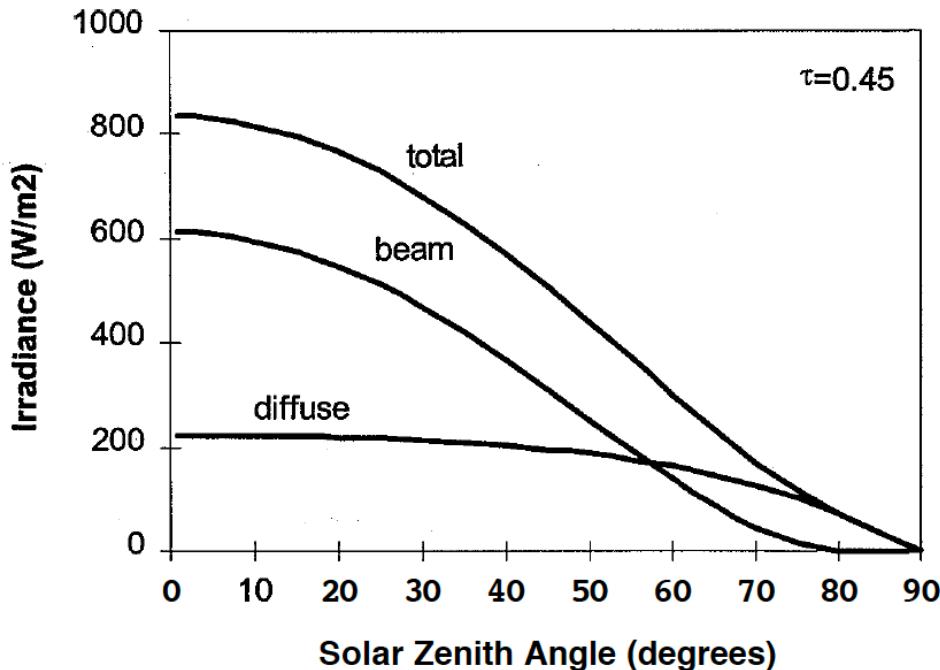
Campbell & Norman 1998

# 1. Leaf/Canopy– energy relations



Campbell & Norman 1998

# 1. Leaf/Canopy– energy relations



$$Q_{od} = f_d \cdot Q_o$$

↑

$$\tau_{atm} = \frac{Q_o}{Q_e}$$

$$Q_e = S_c \cdot \sin(S_{el}) \cdot \left[ 1 + 0.033 \cos\left(\frac{360D_J}{365}\right) \right]$$

$$S_{el} = 0.5\pi - S_{ze}$$

41.367  
-105.238      latitude  
longitude

$$Q_{ob} = Q_o - Q_{od}$$

Campbell & Norman 1998

# 1. Leaf/Canopy– energy relations

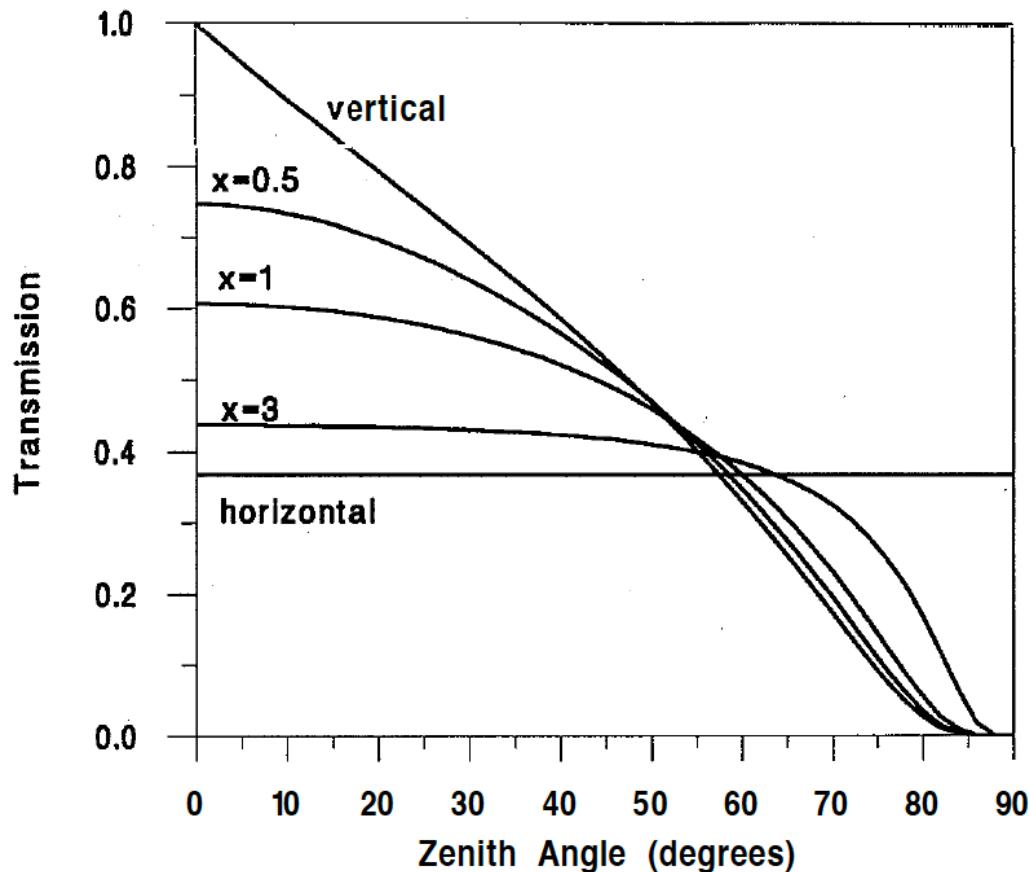


TABLE 15.1. Values of the leaf angle distribution parameter  $x$  for various crop canopies (from Campbell and van Evert, 1994)

Crop	$x$	Crop	$x$
Ryegrass	0.67–2.47	Cucumber	2.17
Maize	0.76–2.52	Tobacco	1.29–2.22
Rye	0.8–1.27	Potato	1.70–2.47
Wheat	0.96	Horse Bean	1.81–2.17
Barley	1.20	Sunflower	1.81–4.1
Timothy	1.13	White clover	2.47–3.26
Sorghum	1.43	Strawberry	3.03
Lucerne	1.54	Soybean	0.81
Hybrid swede	1.29–1.81	Maize	1.37
Sugar beet	1.46–1.88	J. artichoke	2.16
Rape	1.92–2.13		

$$K_{be}(S_{ze}) = \frac{(x^2 + \tan^2 S_{ze})^{0.5}}{x + 1.774(x + 1.182)^{-0.733}}$$

$$L_{\text{sun}} = \frac{1 - e^{-K_{be}(S_{ze})L}}{K_{be}(S_{ze})}$$

1.0 l\_angle, spherical, may sample

Campbell & Norman 1998

# 1. Leaf/Canopy– energy relations

$$K_d(S_{ze}) = \frac{-\log(\tau_d)}{L}$$

$$\tau_d = 2 \int_0^{\pi/2} \tau_{be}(S_{ze}) \sin(S_{ze}) \cos(S_{ze}) dS_{ze}$$

$$\tau_{be} = e^{-K_{be}(S_{ze}) \cdot L \cdot \Omega} \quad 0.5 \text{ omega}$$

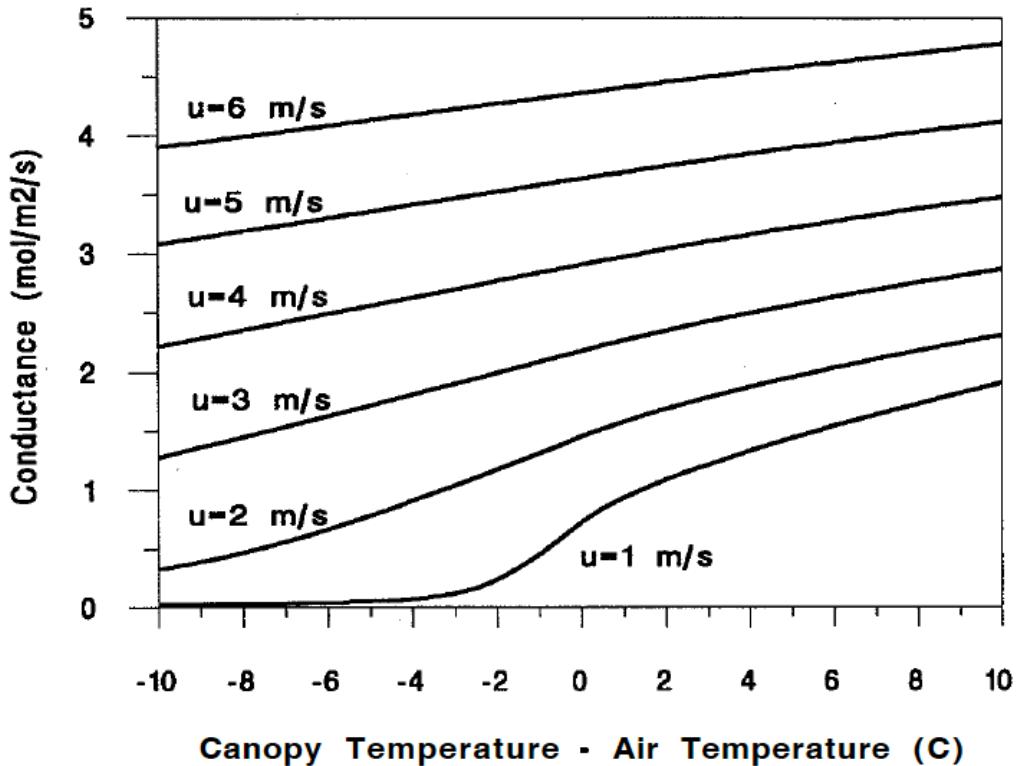
$$I_d = f_{PARdiffuse} \cdot Q_{od} \cdot \frac{1 - e^{-\alpha_{PAR}^{0.5} \cdot K_d(S_{ze}) \cdot L}}{\alpha_{PAR}^{0.5} \cdot K_d(S_{ze}) \cdot L} \quad 0.8 \text{ alpha_PAR}$$

$$I_{ob} = f_{PARbeam} \cdot Q_{ob} \quad 0.5 \text{ fPAR_beam}$$
$$0.5 \text{ fPAR_diff}$$

Scattered light is also computed

Campbell & Norman 1998

## 2. Leaf/Canopy diffusive conductance



0.3 canopy\_height, m

0.5 d\_factor, C&Nfig5.5

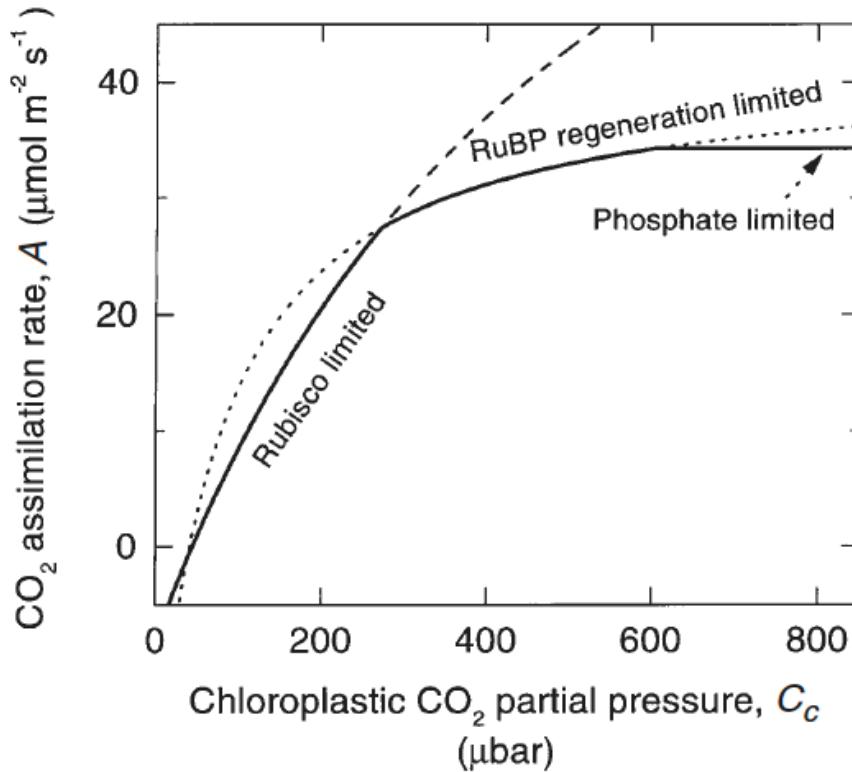
X 0.1 zm\_factor, C&Nfig5.5

0.2 zh\_factor, 7.19

0.45 z\_ref, m

$$g_{va} = g_{Ha} = \frac{k^2 \hat{\rho}_a u(z)}{\left[ \ln\left(\frac{z-d}{z_M}\right) + \Psi_M \right] \left[ \ln\left(\frac{z-d}{z_H}\right) + \Psi_H \right]}$$

### 3. Photosynthesis



$$A_c = \frac{(C_c - \Gamma_*)}{C_c + K_c(1+O/K_o)} V_{\text{cmax}} - R_d$$
$$A_j = \frac{(C_c - \Gamma_*)J}{4C_c + 8\Gamma_*} - R_d$$
$$J = \frac{I_2 + J_{\text{max}} - \sqrt{(I_2 + J_{\text{max}})^2 - 4\theta I_2 J_{\text{max}}}}{2\theta}$$

$$A_p = 3T_p - R_d = 0.5 V_{\text{cmax}}$$

0.01 Rd\_mult,  $Rd=Rd\_mult*Vcmax$   
1.85 Jmax\_mult, ratio of  $J_{\text{max}}$  to  $V_{\text{cmax}}$   
0.80 thetaJ, curvature parameter  
0.4 phiJ\_sun, quantum yield, e-/photon  
0.4 phiJ\_shd, quantum yield, e-/photon

von Caemmerer 2013

### 3. Photosynthesis (Original C3 model)

$$V_{cmax} = [N_L] \cdot f_{Nrub} \cdot M_{perN} \cdot a_{rub} \cdot 10^6 / 60$$

umol m<sup>-2</sup> s<sup>-1</sup> = kg Nleaf m<sup>-2</sup> x kg Nrub kg<sup>-1</sup> Nleaf x kg Rub kg<sup>-1</sup> Nrub x umol kg<sup>-1</sup> Rub s<sup>-1</sup>

$f_{Nrub}$  = weight of Rubisco to its N content weight = 7.16 kg Rub kg<sup>-1</sup> Nrub

Using the parameters below yields Vcmax = 155.9 umol m<sup>-2</sup> s<sup>-1</sup>

3.6 act25, (umol/mgRubisco/min) Rubisco activity

0.001815 Nleaf

0.2 Nrubisco, proportion

### 3. Photosynthesis (new C3 model)

$$A_{Ref} = G_T(C_a - C_c)$$

$A_{ref}$  declines as  $C_c$  increases

$$G_T = \frac{1}{\frac{1}{G_c} + \frac{1}{G_m}}$$

$A_n$  increases as  $C_c$  increases

$$A_n = \min(A_c, A_j, A_p)$$

Find where  $A_n = A_{ref}$

$$A_c = \frac{(C_c - \Gamma_*)}{C_c + K_c(1+O/K_o)} V_{cmax} - R_d \quad A_j = \frac{(C_c - \Gamma_*)J}{4C_c + 8\Gamma_*} - R_d \quad A_p = 3T_p - R_d$$

von Caemmerer 2013

80.0 Vcmax25, maximum Rubisco activity at 25 C, umol m<sup>-2</sup> s<sup>-1</sup>

140.0 Jmax25, maximum electron transport rate at 25 C, umol m<sup>-2</sup> s<sup>-1</sup>

38.6 gammaStar25, compensation point at 25 C, umol

### 3. Photosynthesis (C4 model)

$$A_{Ref} = G_T(C_a - C_m)$$

$A_{ref}$  declines as  $C_c$  increases

$$G_T = \frac{1}{\frac{1}{G_c} + \frac{1}{G_m}}$$

$A_n$  increases as  $C_c$  increases

$$A_n = \min(A_c, A_j)$$

Find where  $A_n = A_{ref}$

$$A_c = \min[(V_p - C_m/r_s - R_m), (V_{cmax} - R_d)] \quad V_p = \min \left\{ \frac{C_m V_{pmax}}{C_m + K_p}, V_{pr} \right\}$$
$$A_j = \min \left\{ \left[ \frac{x J_t}{2} - R_m + \frac{C_m}{R_s} \right], \left[ \frac{(1-x) J_t}{3} - R_d \right] \right\}$$

von Caemmerer 2013

60.0 Vcmax25, maximum Rubisco activity at 25 C, umol m<sup>-2</sup> s<sup>-1</sup>

100.0 Vpmax25, maximum PEP carbolylase activity at 25 C, umol m<sup>-2</sup>

400.0 Jmax25, maximum electron transport rate at 25 C, umol m<sup>-2</sup> s<sup>-1</sup>

38.6 gammaStar25, compensation point at 25 C, umol

80.0 Kp25, Michaelis constant of PEP carboxylase for CO<sub>2</sub> at 25 C, umol

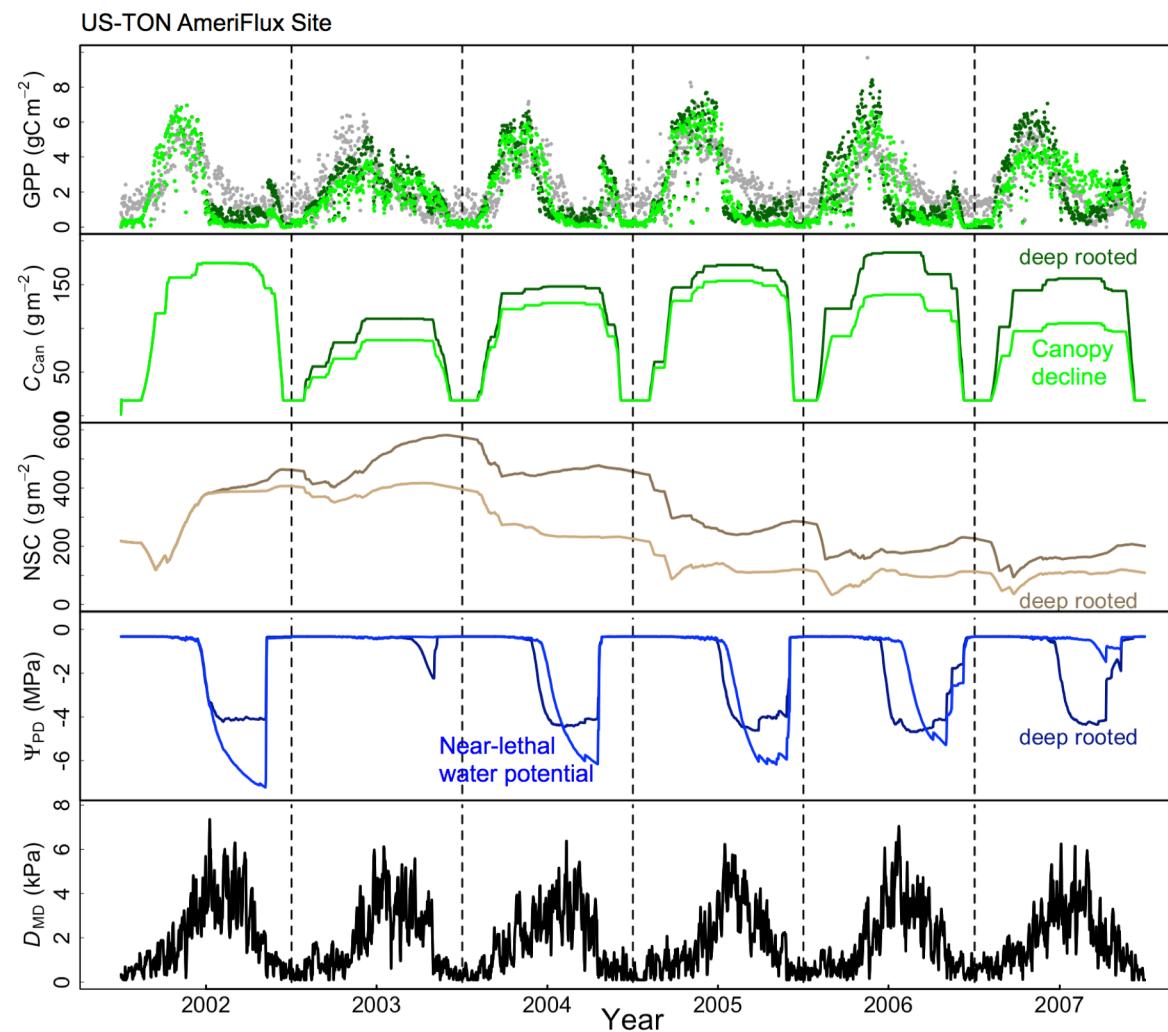
80.0 Vpr, PEP regeneration rate, umol m<sup>-2</sup> s<sup>-1</sup>

# 4. Vegetative growth: Big leaf

$$L = \min(L_{target} \cdot GSI_i, C_{Can} \cdot L_{specific})$$

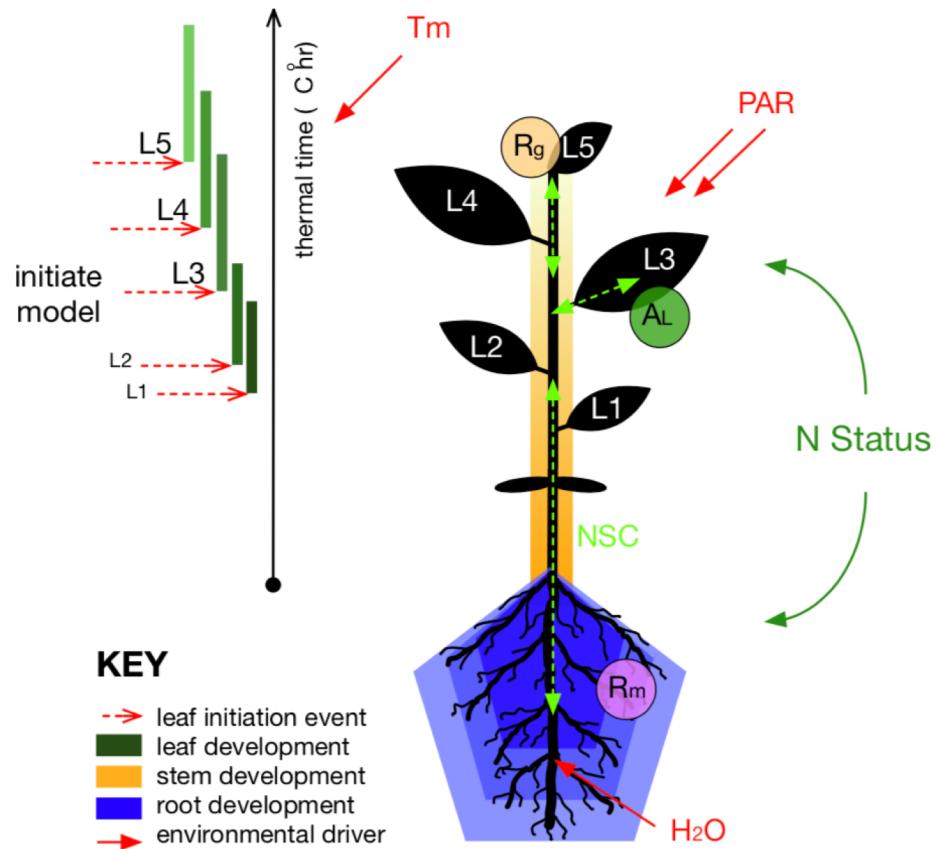
Savoy & Mackay 2015

28.6 SLA,  $\text{m}^2 \text{ kgC}^{-1} \text{ leaf}$



## 4. Vegetative growth: Leaf (Brassica)

$$r_{ij} = \frac{A'(\tau_{ij})}{A(\tau_{ij})} \quad A(\tau_{ij}) = \frac{K}{1 + \frac{K-N_0}{N_0} \cdot \exp(-r \cdot \tau_{ij})}$$



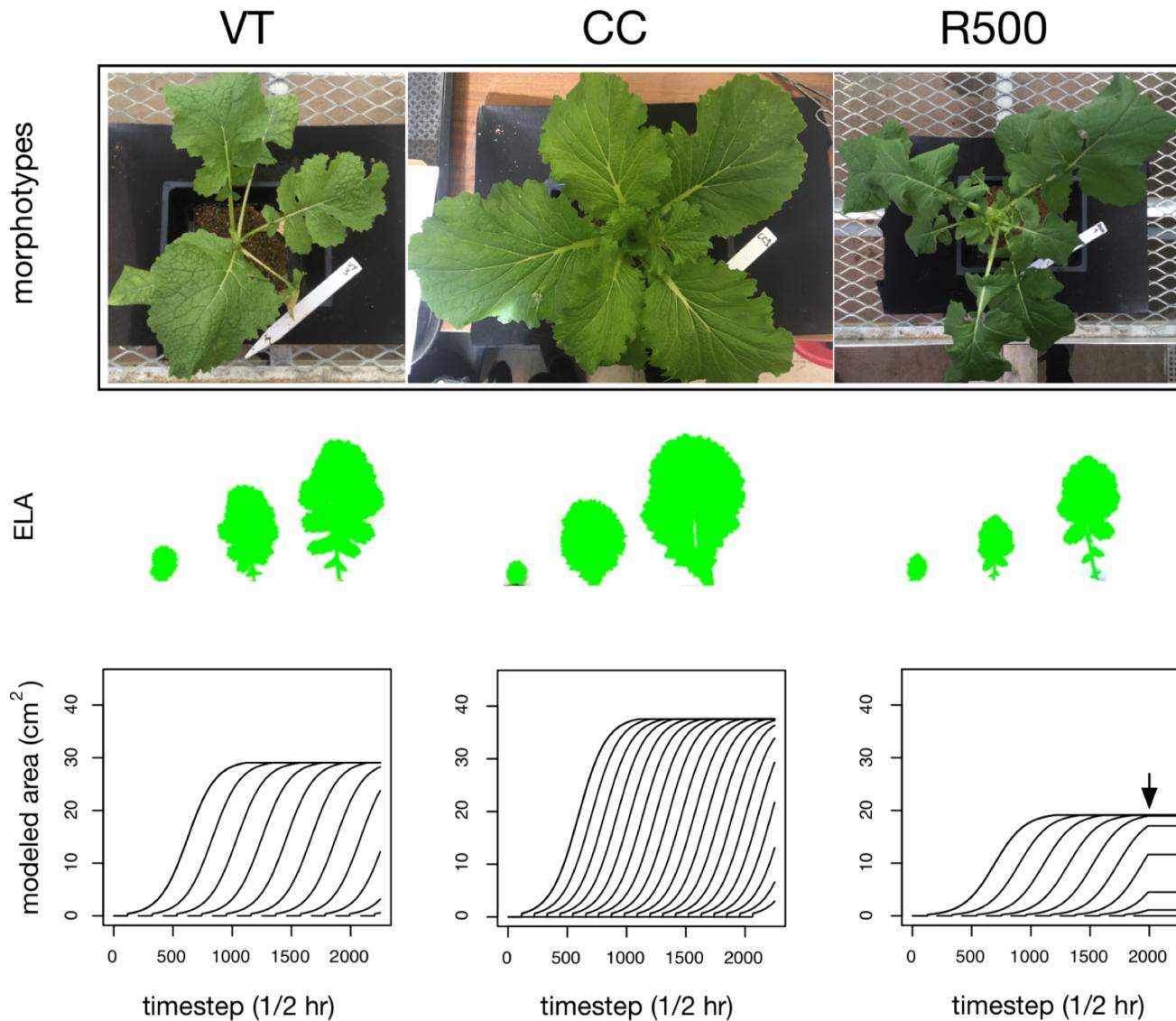
```

11.211 leafAreaMax // K
0.939134 initialLeafSize //A_pot_in
0.000495803 leafArea_Rate //r
11024.02 dur_LeafExpansion//d_exp
400.0 SLA_max //SLA_max
71.1034 SLA_min //SLA_min
60 leaf_insertAngle //
2.5 leaf_len_to_width //
0.90 proportion_CD //a
1970.534 phyllochron //phyllochron
13507.5 floweringTime //TTF
0.96 Tbase //Tb
4926.335 therm_plant
15.0 projectedArea_init
40.0 pot_size //max projected area, cm2
0.43 root_to_shoot
1.59 leaf_to_stem

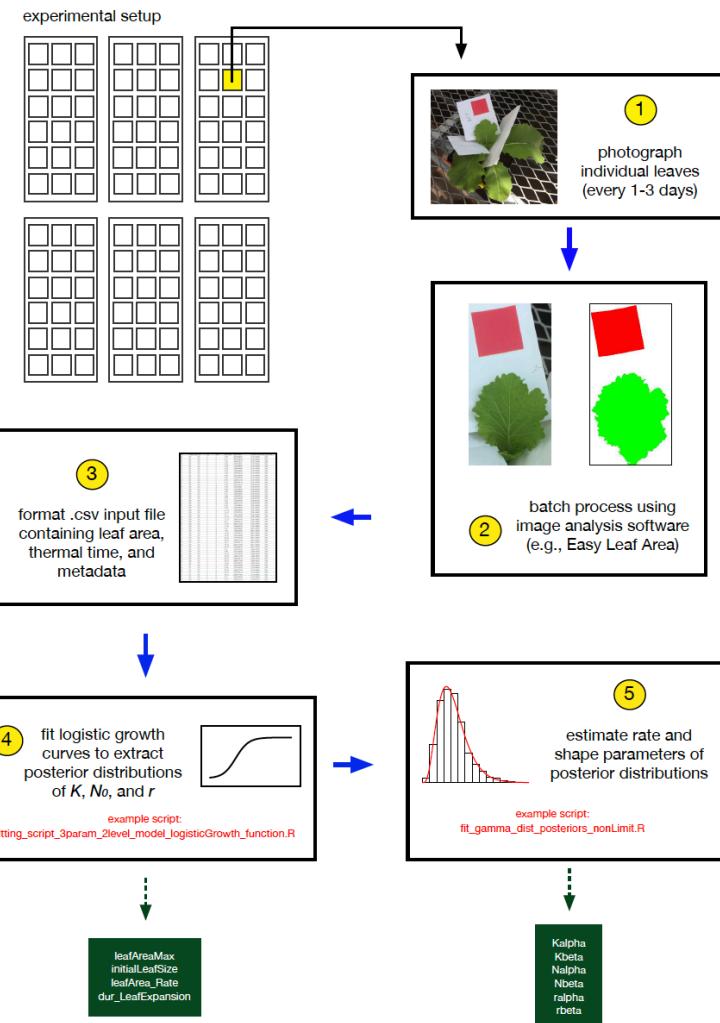
```

Wang et al., 2019, Journal of Experimental Botany

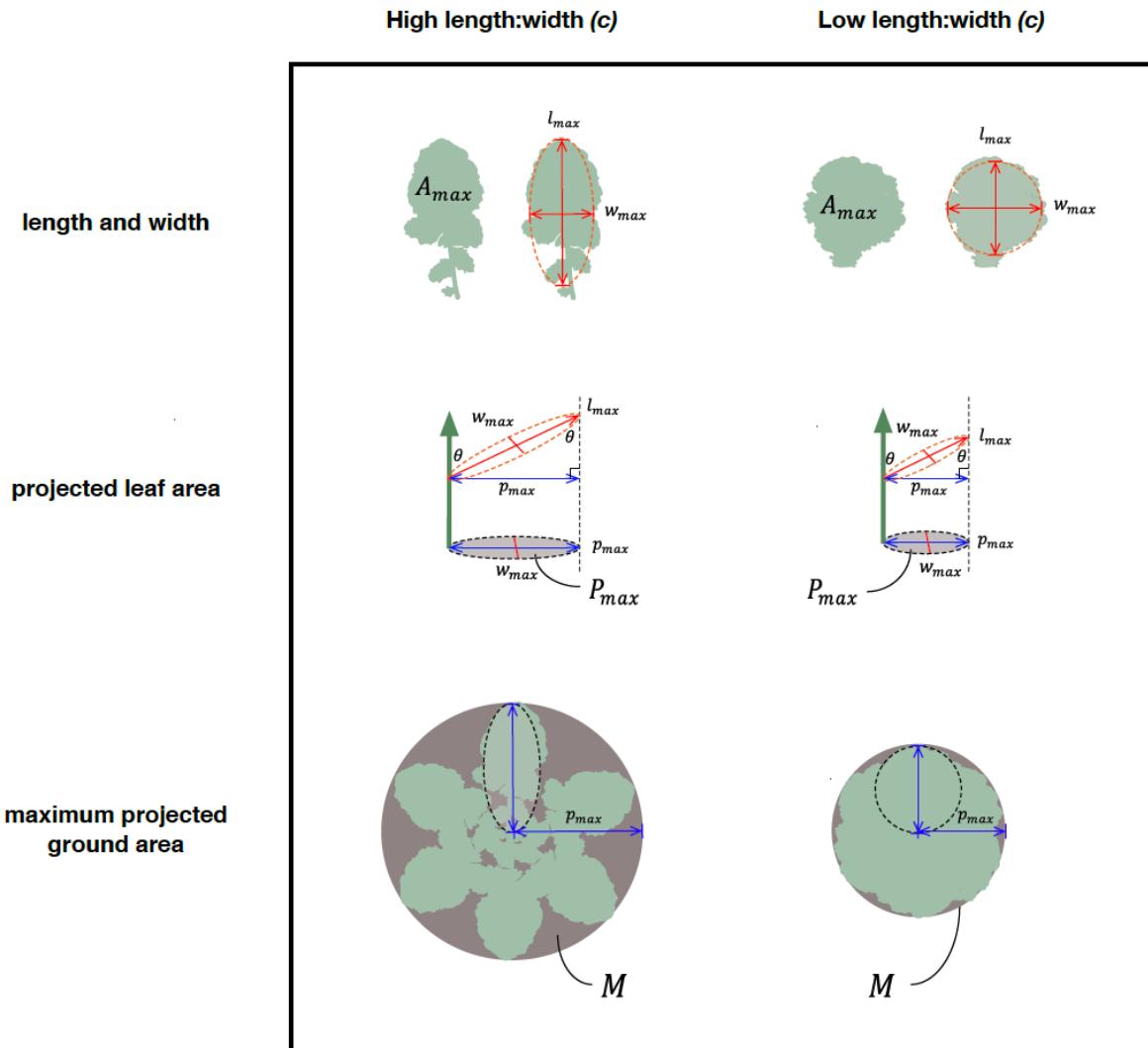
## 4. Vegetative growth: Leaf (*Brassica*)



Wang *et al.*, 2019, Journal of Experimental Botany

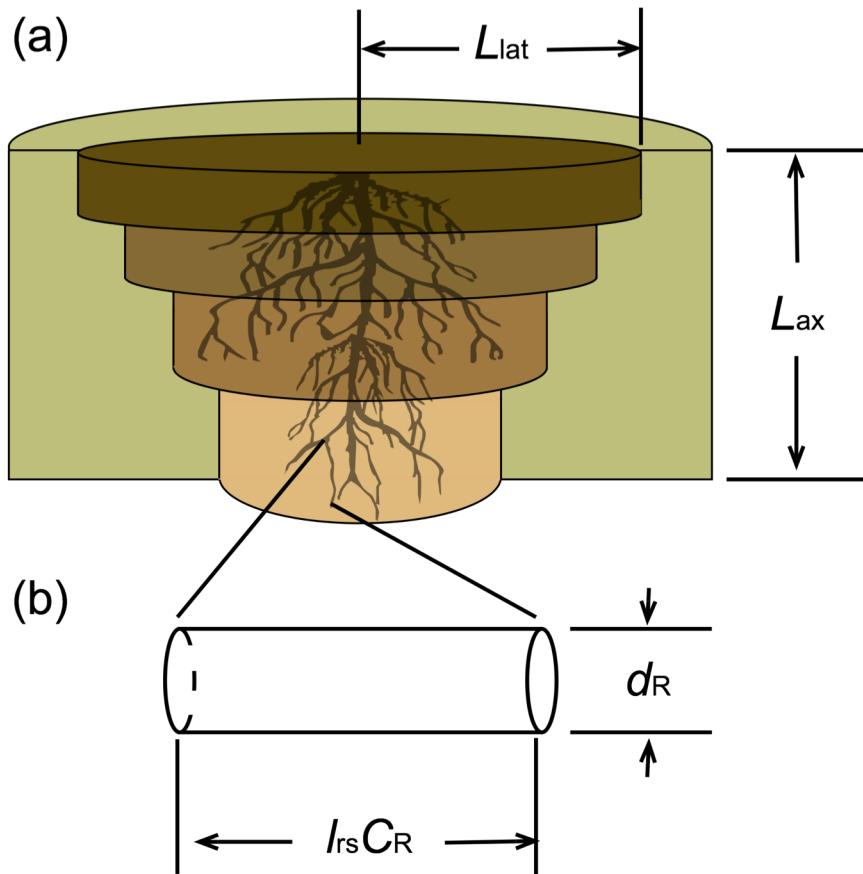


# 4. Vegetative growth: Leaf (Brassica)



Wang *et al.*, 2019, Journal of Experimental Botany

## 4. Vegetative growth: Roots



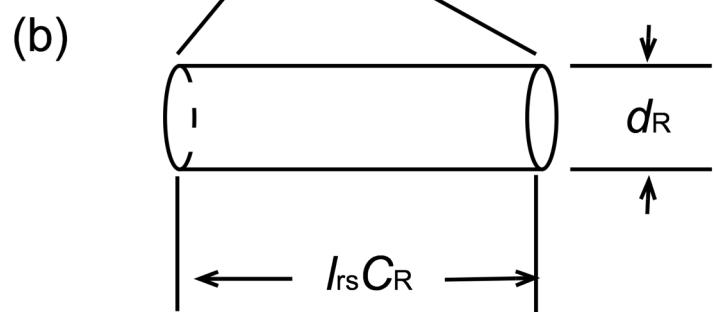
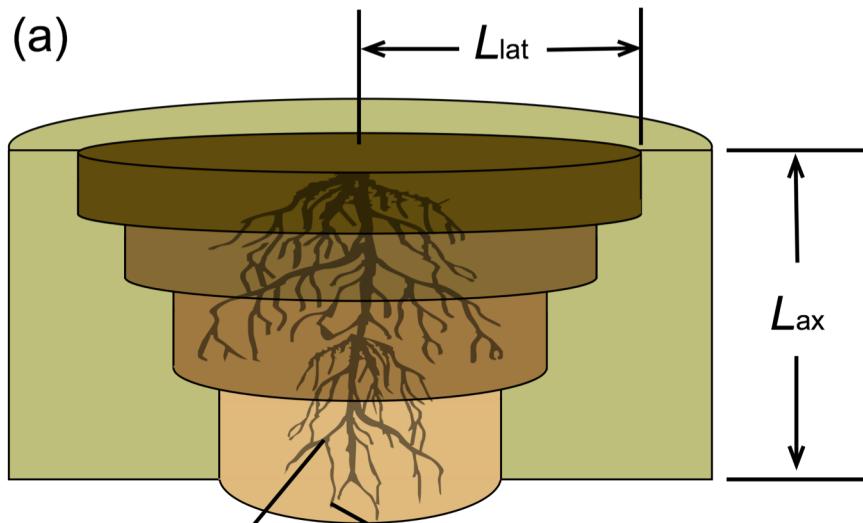
$$V_R = \pi \left(1 - \frac{\rho_{\text{bulk}}}{\rho_{\text{max}}}\right) \sum_{j=1}^m L_{\text{lat}_j}^2 L_{\text{ax}_j}$$

```
#_of_shoot_modules 1
leaf_area_fraction 1
length_lateral 0.48
length_axial 0.2
#_of_root_modules 4
leaf_area_fraction 0.2
length_lateral 1.0
length_axial 0.008
leaf_area_fraction 0.2
length_lateral 1.0
length_axial 0.016
leaf_area_fraction 0.3
length_lateral 1.0
length_axial 0.024
leaf_area_fraction 0.3
length_lateral 1.0
length_axial 0.048
```

Axial length = 0.96 m  
 Lateral0 length =  $0.96 \times 1.0 = 0.96$  m

Mackay et al., 2019, New Phytologist

## 4. Vegetative growth: Roots



$$A_R = \sum_{j=1}^m \sum_{k=1}^n l_{\text{rs}_k} C_{R_{jk}} \pi d_{R_k}$$

$$\left( \frac{dC_R}{dt} \right)_{jk} = \frac{dC_{\text{Rtot}}}{dt} f_k(k_R)_j r_k - C_{RD_{jk}}$$

$$d_{\text{Rmult}} = \left( \frac{d_{\text{collar}}}{d_{\text{min}}} \right)^{\frac{1}{n-1}}$$

$$l_{\text{rs}_k} = \frac{l_{\text{rs}_1}}{d_{\text{Rmult}}^{2k-2}}$$

$$d_{R_k} = d_{\text{min}} d_{\text{Rmult}}^{k-1}$$

79200.0 Cbelowground, kg ha<sup>-1</sup>

0.00024 Croot\_frac, dim

1454.0 SRL1, m gC<sup>-1</sup> at root diameter of 250 um

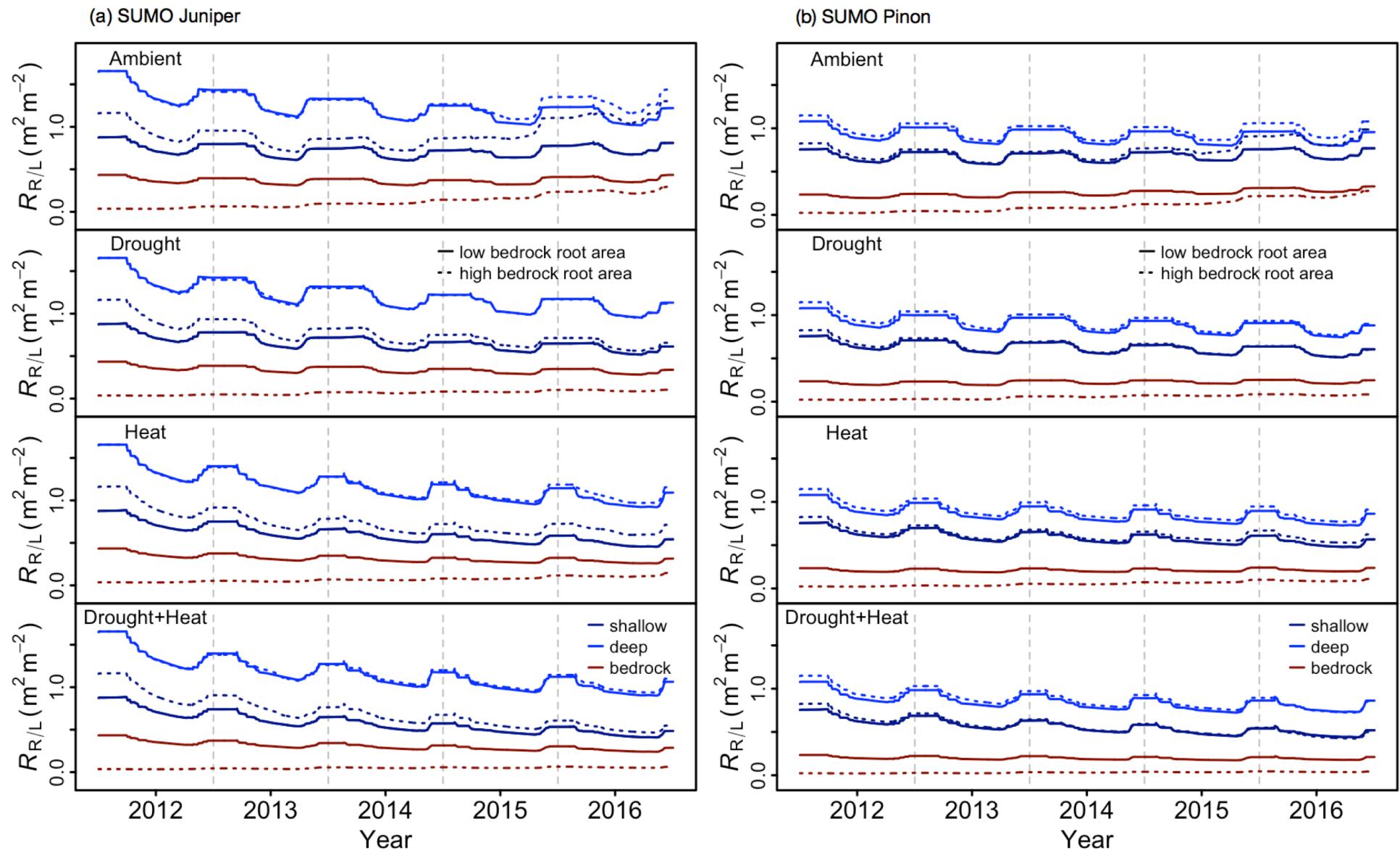
0.000125 minRootDiam, m diameter of thickest root

0.004 maxRootDiam, m diameter of thickest root

1.0 minRootLifespan, years,

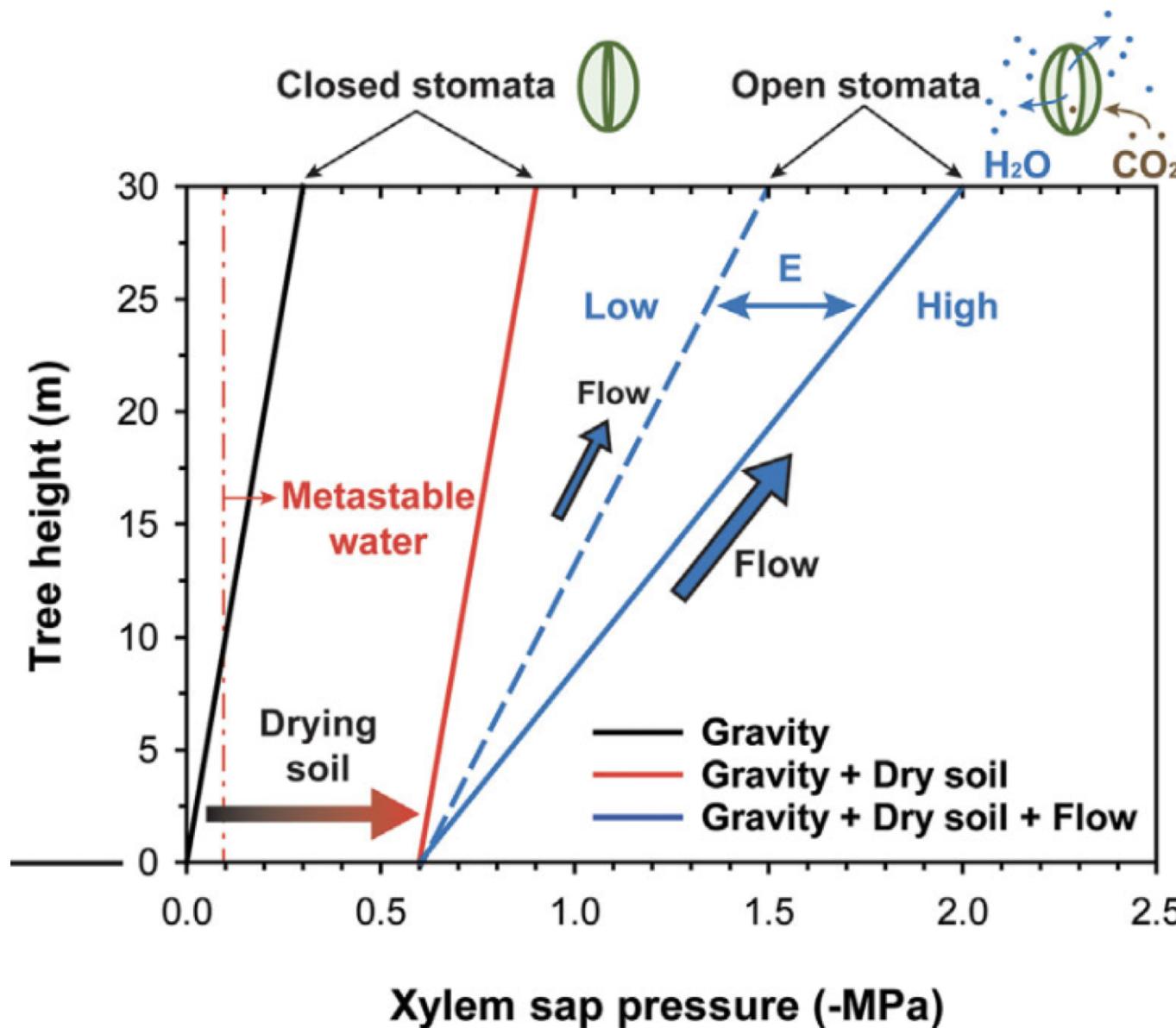
Mackay et al., 2019, New Phytologist

# 4. Vegetative growth: Roots



Mackay et al., 2019, New Phytologist

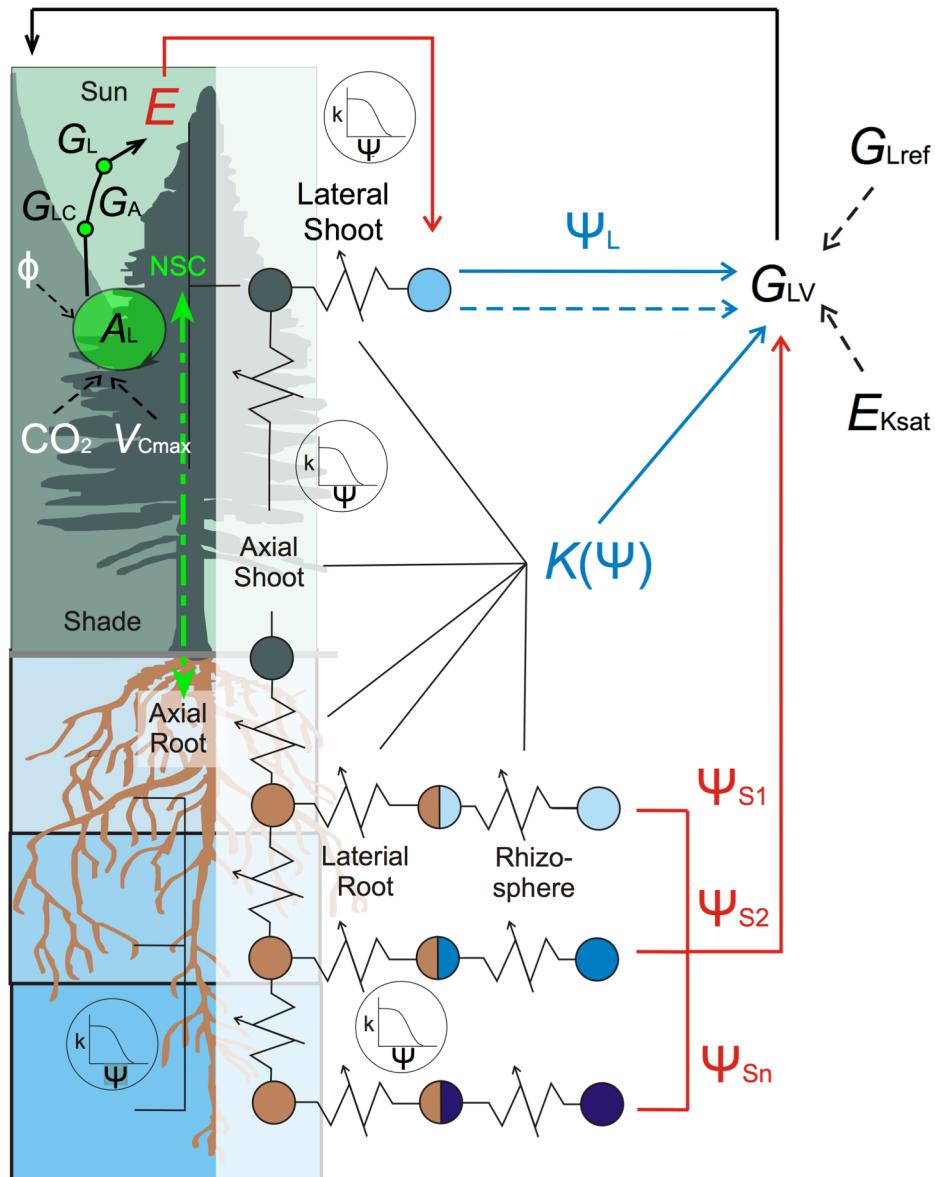
## 5. Soil-Xylem hydraulics



Venturas *et al.* 2017 Journal of Integrative Plant Biology

Mackay/Wang 2019

## 5. Soil-Xylem hydraulics



$$G_{LV0} = w_s(G_{Lref} - m \ln D)$$

## 0.15 Gsref

0.54 m (proportion of Gsref)

$$G_{LV} = \frac{(\Psi_S - \Psi_L)}{D_M}$$

$$E_i = \int_{\Psi_{up}}^{\Psi_{down}} K(\Psi)_i d\Psi$$

$$K_i = K_{max} e^{[-(\Psi_i/b)^c]}$$

Mackay et al., 2015, Water Resources Research

## 5. Soil-Xylem hydraulics

-0.1 Md (If critical pressure is more positive, then hydraulic failure)

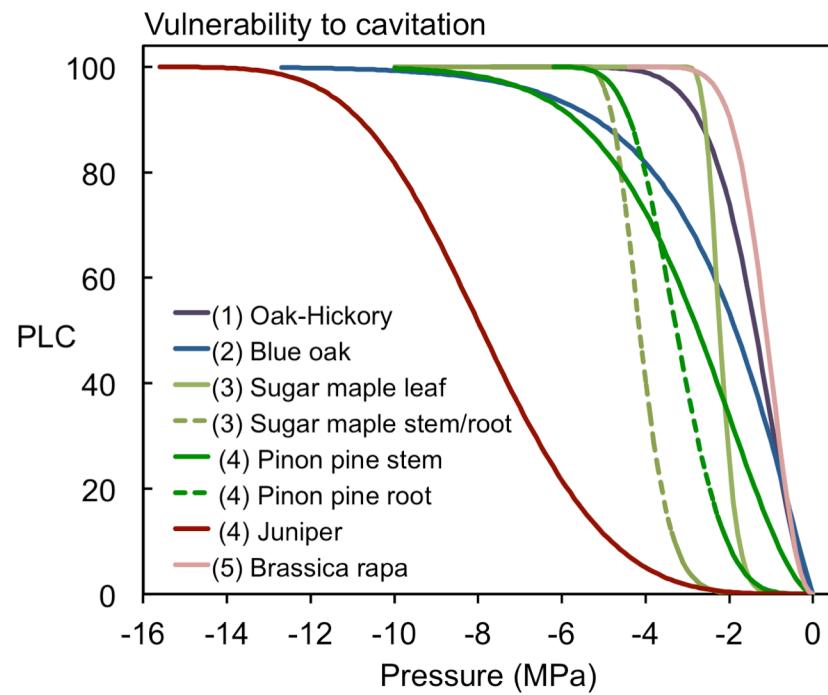
-0.5 midday\_at\_sat\_kl  
2.5 e\_at\_saturated\_kl  
-0.3 pd\_at\_sat\_kl

}

(Empirical observations to set up the hydraulics)

1.57 ax\_Shoot-b\_value\_(weibull)  
2.38 ax\_Shoot-c\_value\_(weibull)  
1.57 lat\_Shoot-b\_value\_(weibull)  
2.38 lat\_Shoot-c\_value\_(weibull)  
1.57 ax\_Root-b\_value\_(weibull)  
2.38 ax\_Root-c\_value\_(weibull)  
1.57 lat\_Root-b\_value\_(weibull)  
2.38 lat\_Root-c\_value\_(weibull)

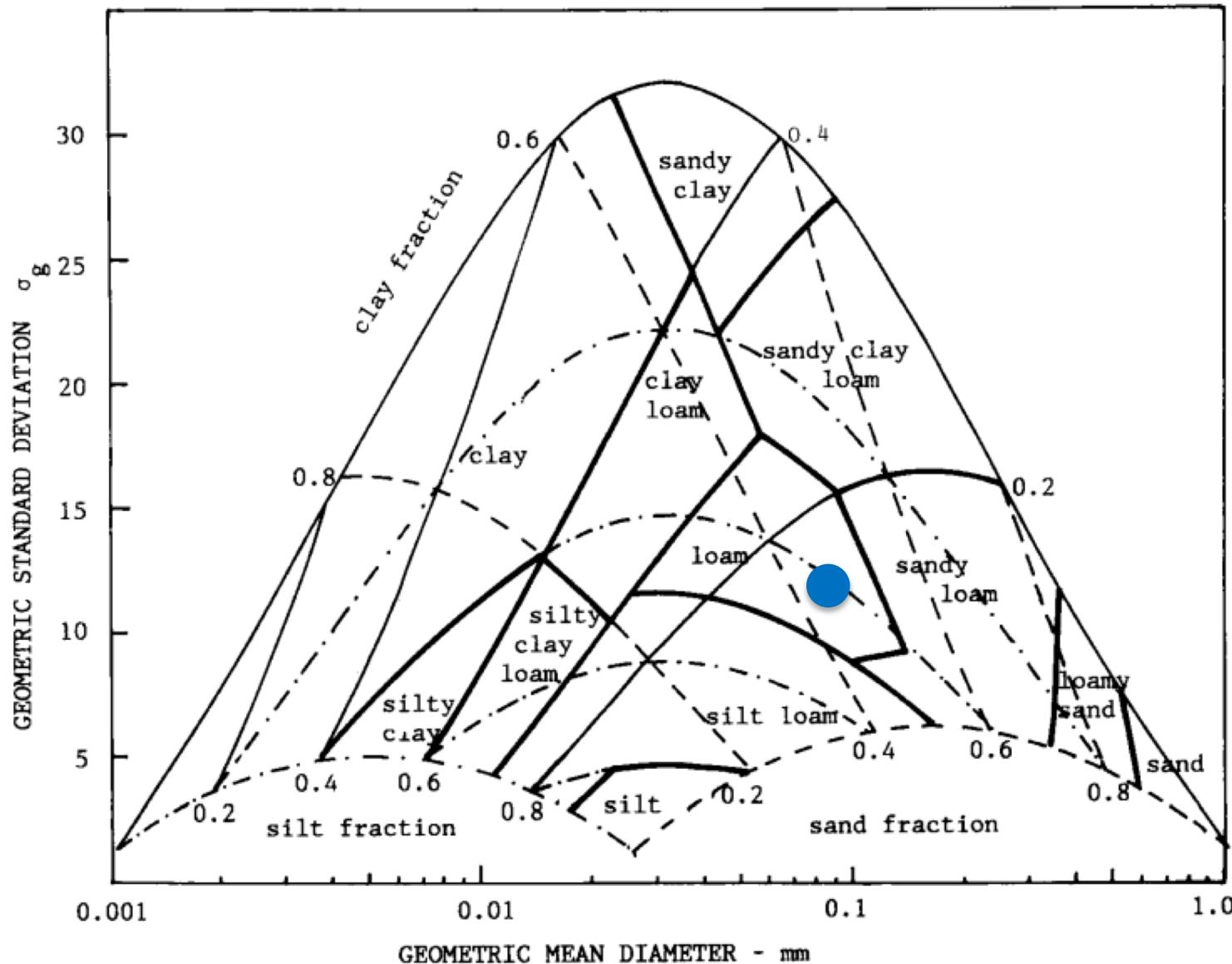
$$K_i = K_{max} e^{[-(\Psi_i/b)^c]}$$



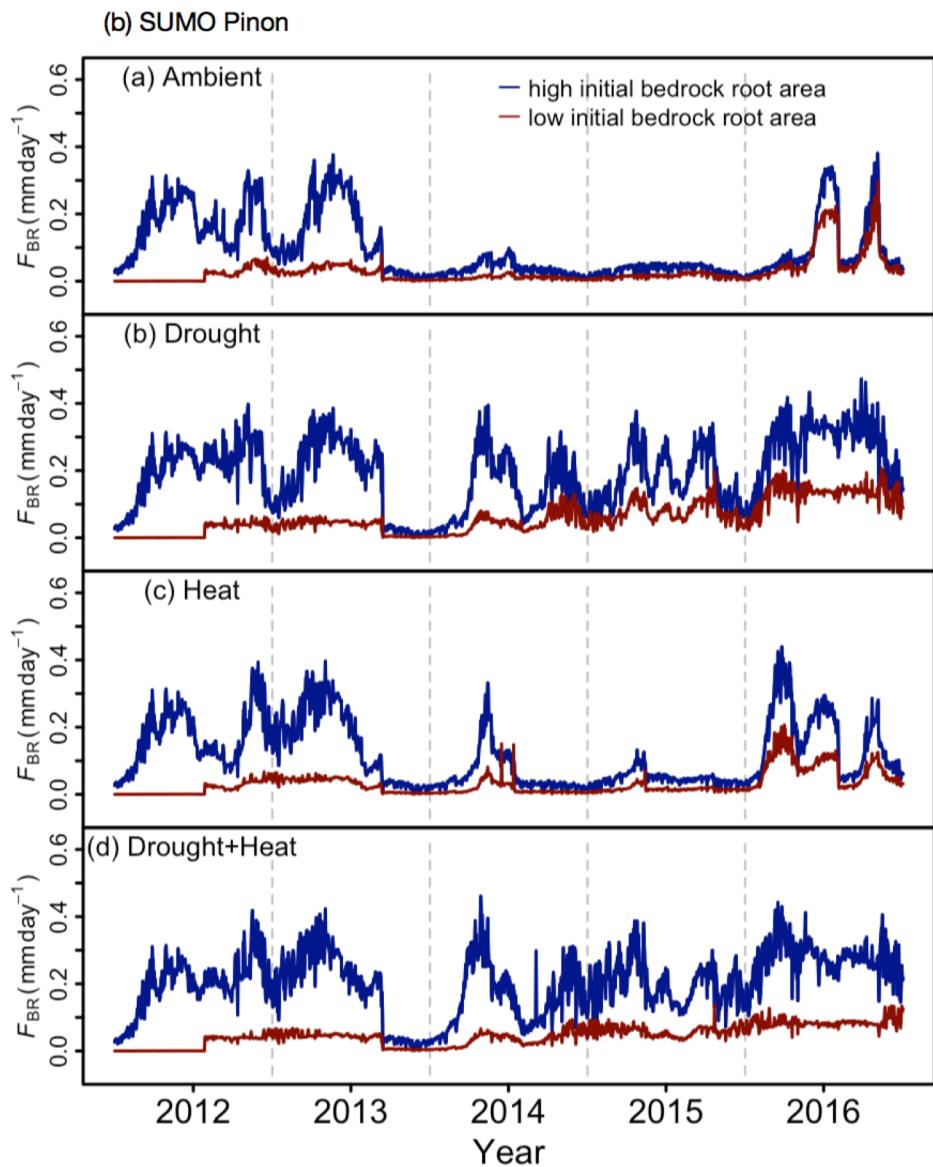
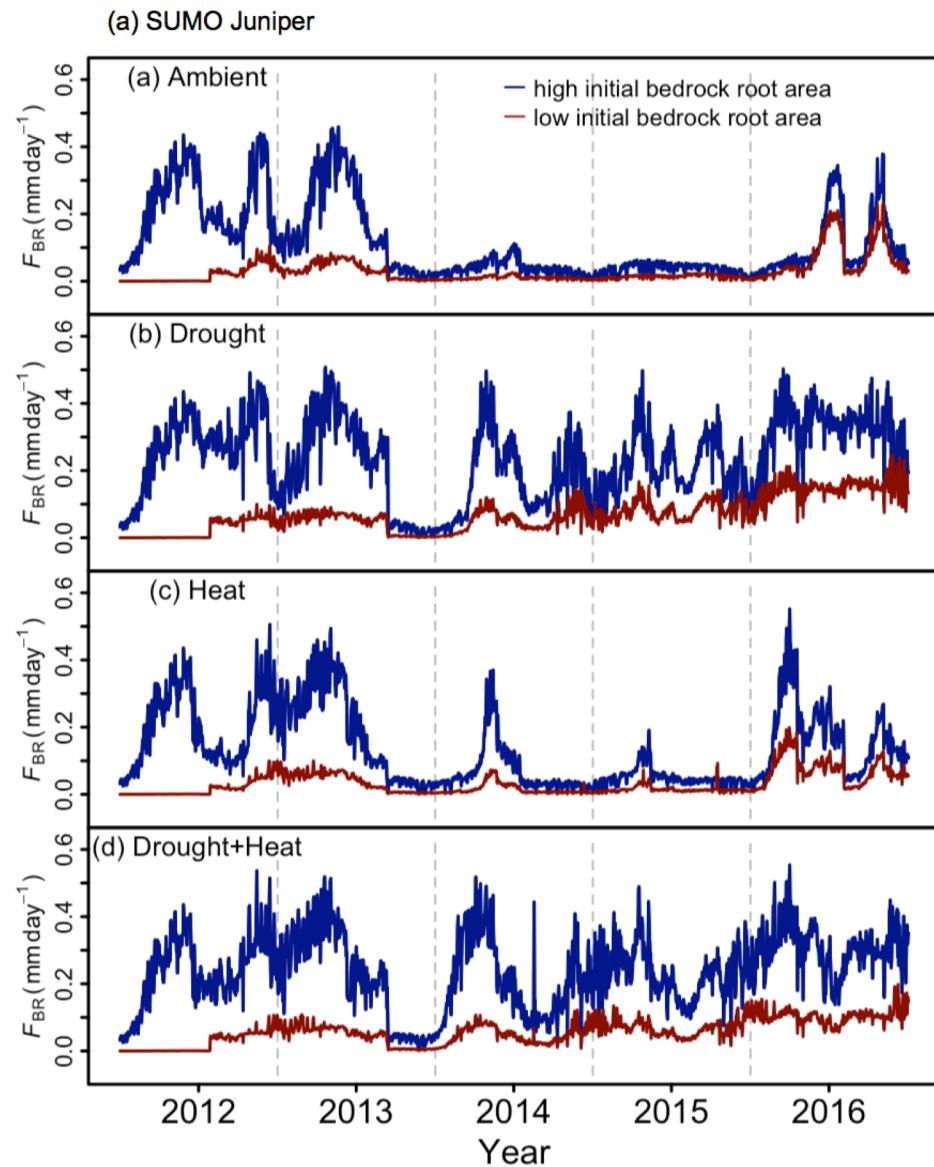
# 5. Soil-Xylem hydraulics

0.1 GMP\_(mm)\_geometric\_mean\_particle\_diameter

12.0 GSD\_geometric\_standard\_deviation\_of\_particle\_size

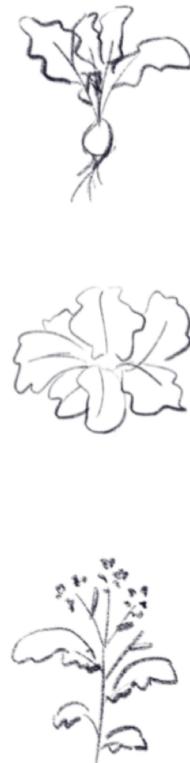
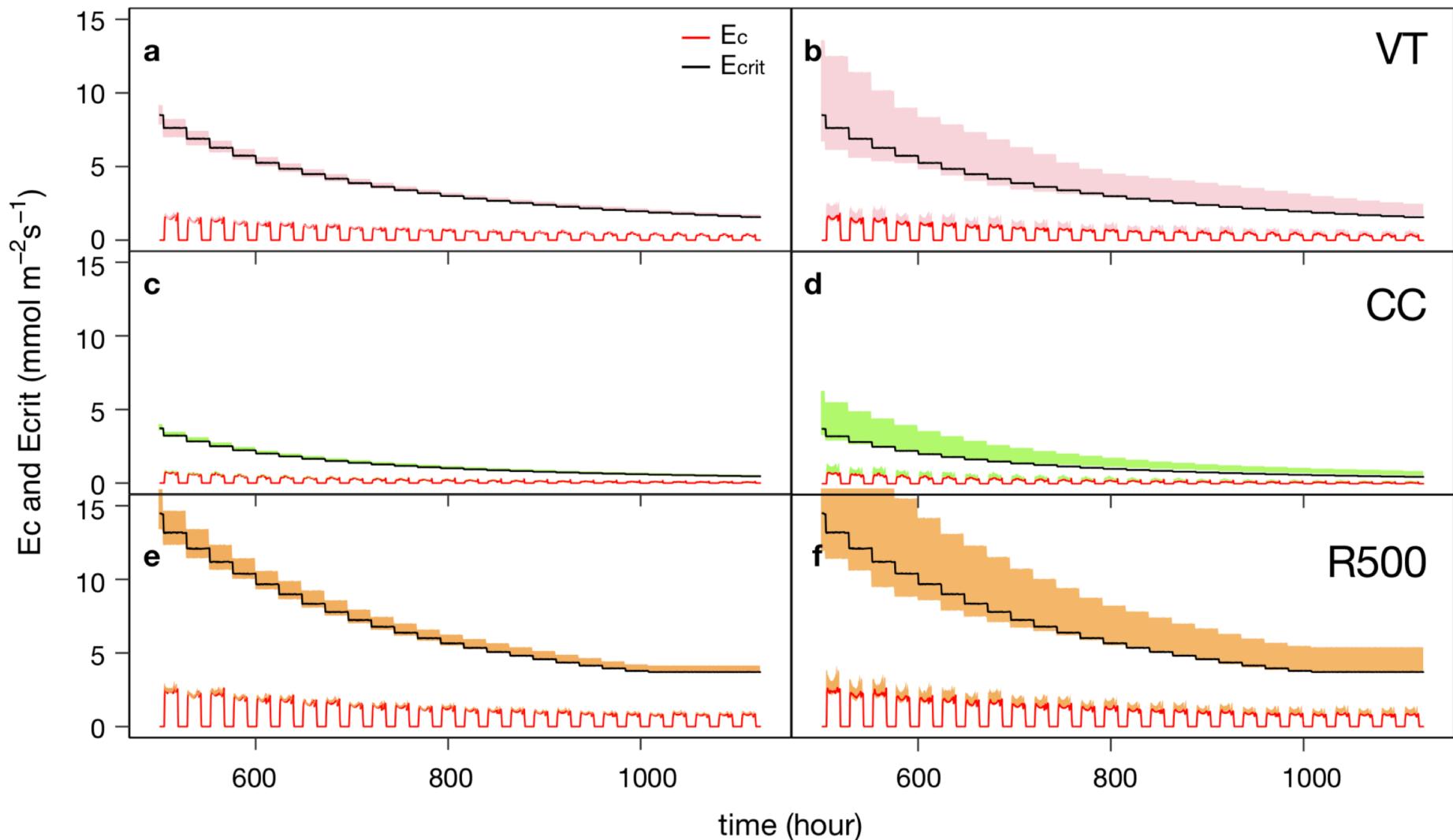


# 5. Soil-Xylem hydraulics



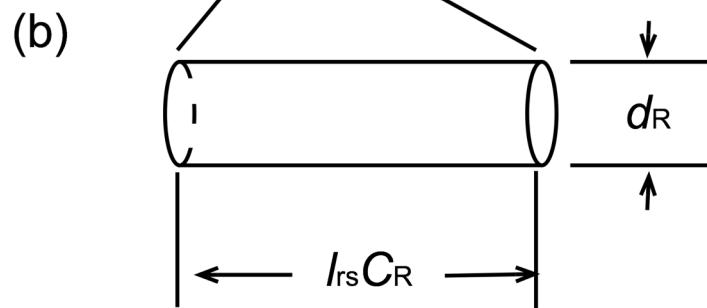
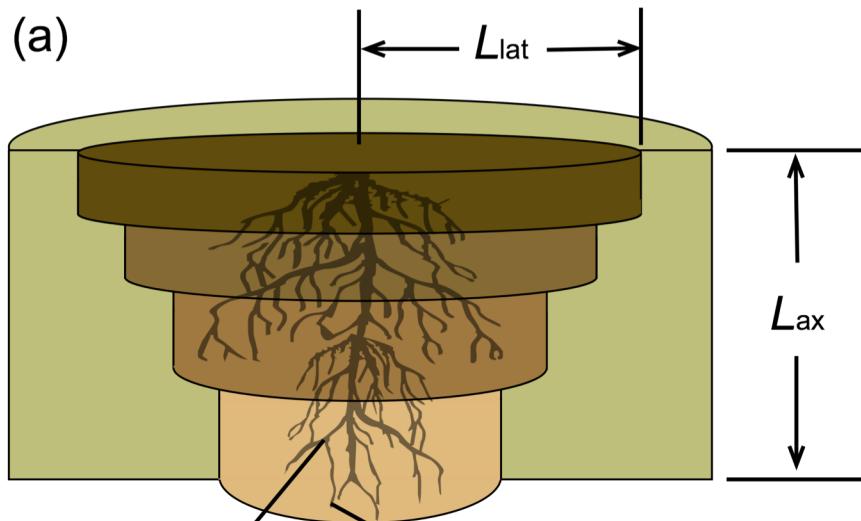
Mackay et al., 2019, New Phytologist

## 5. Soil-Xylem hydraulics



Wang et al., 2019, Journal of Experimental Botany

# 6. Soil Physics



0.4 porosity

0.3 silt\_fraction

0.3 clay\_fraction

$$k = k_{\max} v^{(n-1)/2n} \left[ (1 - v)^{(n-1)/n} - 1 \right]^2$$

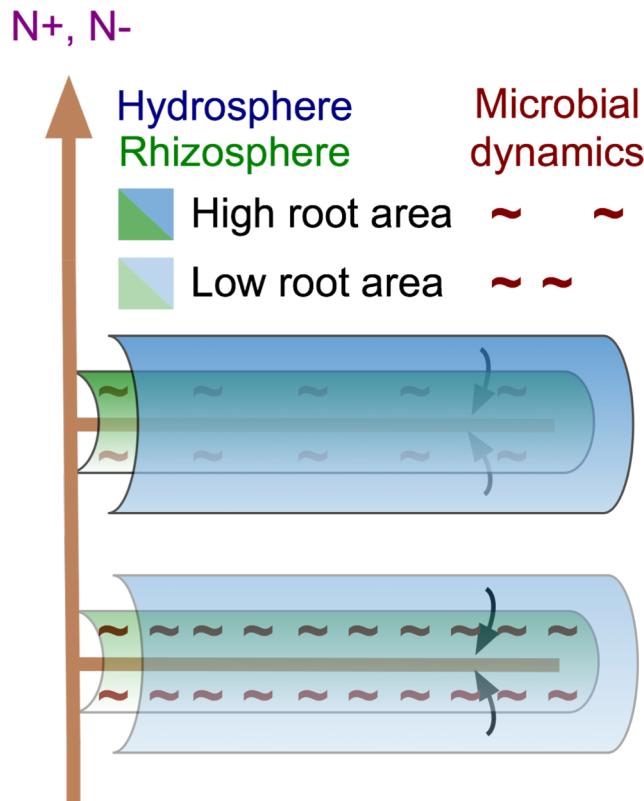
$$v = [(\alpha P_{\text{soil}})^n + 1]^{-1}$$

Drainage:

- 1) Explicit Richards Equation
- 2) Film flow (macropores)

# 7. Nitrogen dynamics

$$N_P = \frac{C_L}{C_L + C_R} \frac{N_L^+}{C_{LNS}} \left( \frac{C}{N} \right)_L + \left( 1 - \frac{C_L}{C_L + C_R} \right) \sum_{j=1}^m \sum_{k=1}^n \left[ \frac{N_R^+}{C_{RNS}} \left( \frac{C}{N} \right)_R \right]_{jk}$$



$$N_{passive_{i,j}}^\pm = a^\pm \frac{N_{i,j}^\pm \theta_i^d}{V_{rhiz_{i,j}}} F_{rhiz_i} \frac{A_{r_{i,j}}}{A_{r_i}} f_{aff}(N_{PD})$$

$$N_{active_{i,j}}^\pm = a^\pm D_{rhiz} \frac{N_{i,j}^\pm}{V_{rhiz_{i,j}}} \frac{1}{0.5W_{rhiz_{i,j}}} A_{r_{i,j}} p_{abs_{i,j}}$$

$$\left( \frac{dN^+}{dt} \right)_{i,j} = M_{i,j} - I_{i,j}^+ - N_{nit_{i,j}} - N_{leach_{i,j}}^+ - N_{uptake_{i,j}}^+$$

$$\left( \frac{dN^-}{dt} \right)_{i,j} = N_{nit_{i,j}} - I_{i,j}^- - N_{leach_{i,j}}^- - N_{uptake_{i,j}}^-$$

# 7. Nitrogen dynamics

$$\left( \frac{dN_l}{dt} \right)_{j,k} = \left( \frac{dC_{rp}}{dt} \right)_{j,k} \frac{1}{(C/N)_{rp_{j,k}}} + \frac{B_{D_{j,k}}}{(C/N)_{b_{j,k}}} - \frac{D_{Cl_{j,k}}}{(C/N)_{l_{j,k}}}$$

$$\left( \frac{dN_h}{dt} \right)_{j,k} = r_h \frac{D_{Cl_{j,k}}}{(C/N)_{l_{j,k}}} - \frac{D_{Ch_{j,k}}}{(C/N)_{h_{j,k}}}$$

$$\left( \frac{dN_{ea}}{dt} \right)_{j,k} = - \frac{D_{Cea_{j,k}}}{(C/N)_{ea_{j,k}}}$$

$$\left( \frac{dN_b}{dt} \right)_{j,k} = \left[ 1 - r_h \frac{(C/N)_{l_{j,k}}}{(C/N)_{h_{j,k}}} \right] \frac{D_{Cl_{j,k}}}{(C/N)_{l_{j,k}}} - \frac{D_{Ch_{j,k}}}{(C/N)_{h_{j,k}}} - \frac{B_{D_{j,k}}}{(C/N)_{b_{j,k}}} - \Phi_{j,k}$$

$$D_{X_{i,j}} = [\varphi_{i,j} f_d(s)_{i,j} \textcolor{blue}{k_X} C_{b_{i,j}}] C_{X_{i,j}}$$

0.0085 kd, d-1  
 0.6 kn, m3 d-1 gC-1  
 0.4 kea, m3 d-1 gC-1 (for exudates)  
 0.6 kes, m3 d-1 gC-1 (for exudates)  
 0.000065 kl, m3 d-1 gC-1  
 0.0000025 kh, m3 d-1 gC-1

# 7. Nitrogen dynamics

Mineralization (positive) – Immobilization (negative):

$$\Phi_{i,j} = D_{Ch_{i,j}} \left[ \frac{1}{(C/N)_{h_{i,j}}} - \frac{1-r_h}{(C/N)_{b_{i,j}}} \right] +$$

Humus

$$+ D_{Cl_{i,j}} \left[ \frac{1}{(C/N)_{l_{i,j}}} - \frac{r_h}{(C/N)_{h_{i,j}}} - \frac{1-r_h-r_r}{(C/N)_{b_{i,j}}} \right] +$$

Litter

$$+ D_{cea_{i,j}} \left[ \frac{1}{(C/N)_{ea_{i,j}}} - \frac{1-r_r}{(C/N)_{b_{i,j}}} \right] +$$

Amino acid

$$+ D_{ces_{i,j}} \left[ -\frac{1-r_r}{(C/N)_{b_{i,j}}} \right]$$

Sugar (glucose)

Mineralization or Immobilization rate function:

$$\varphi_{i,j} = - \left( k_l^+ N_{i,j}^+ + k_l^- N_{i,j}^- \right) \left/ \left\{ k_h C_{h_{i,j}} \left[ \frac{1}{(C/N)_{h_{i,j}}} - \frac{1-r_h}{(C/N)_{b_{i,j}}} \right] + k_l C_{l_{i,j}} \left[ \frac{1}{(C/N)_{l_{i,j}}} - \frac{r_h}{(C/N)_{h_{i,j}}} - \frac{1-r_h-r_r}{(C/N)_{b_{i,j}}} \right] \right\} \right.$$

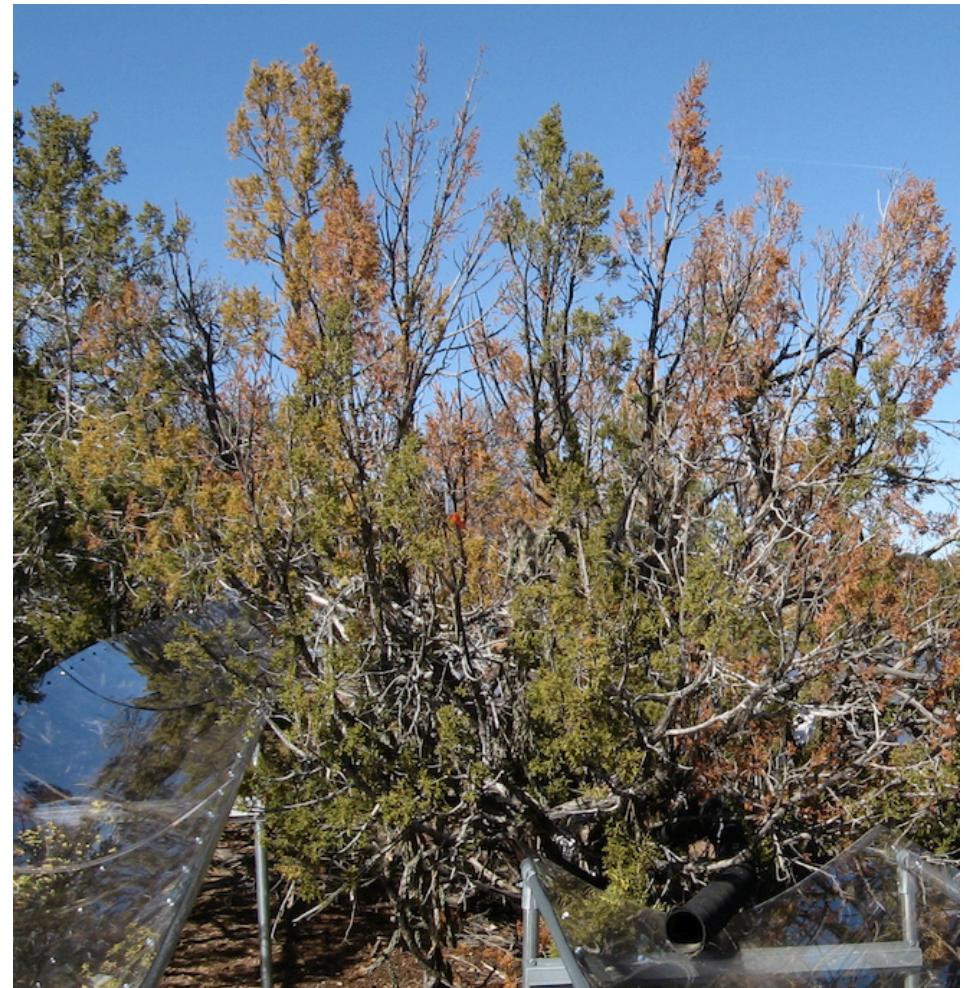
# TREES Workshop – Learning Objectives

- 1) Understand the major processes in TREES
- 2) Think scientifically about how TREES can be applied to research questions
- 3) Become comfortable with running TREES (second session only)

# Piñon-juniper have different drought responses

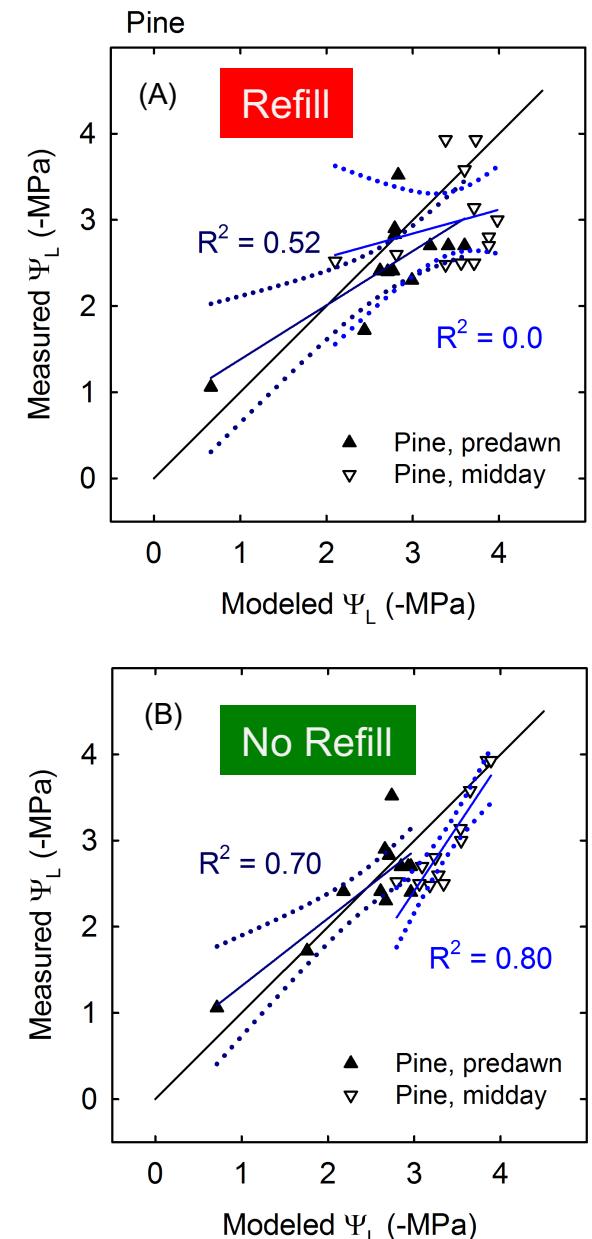
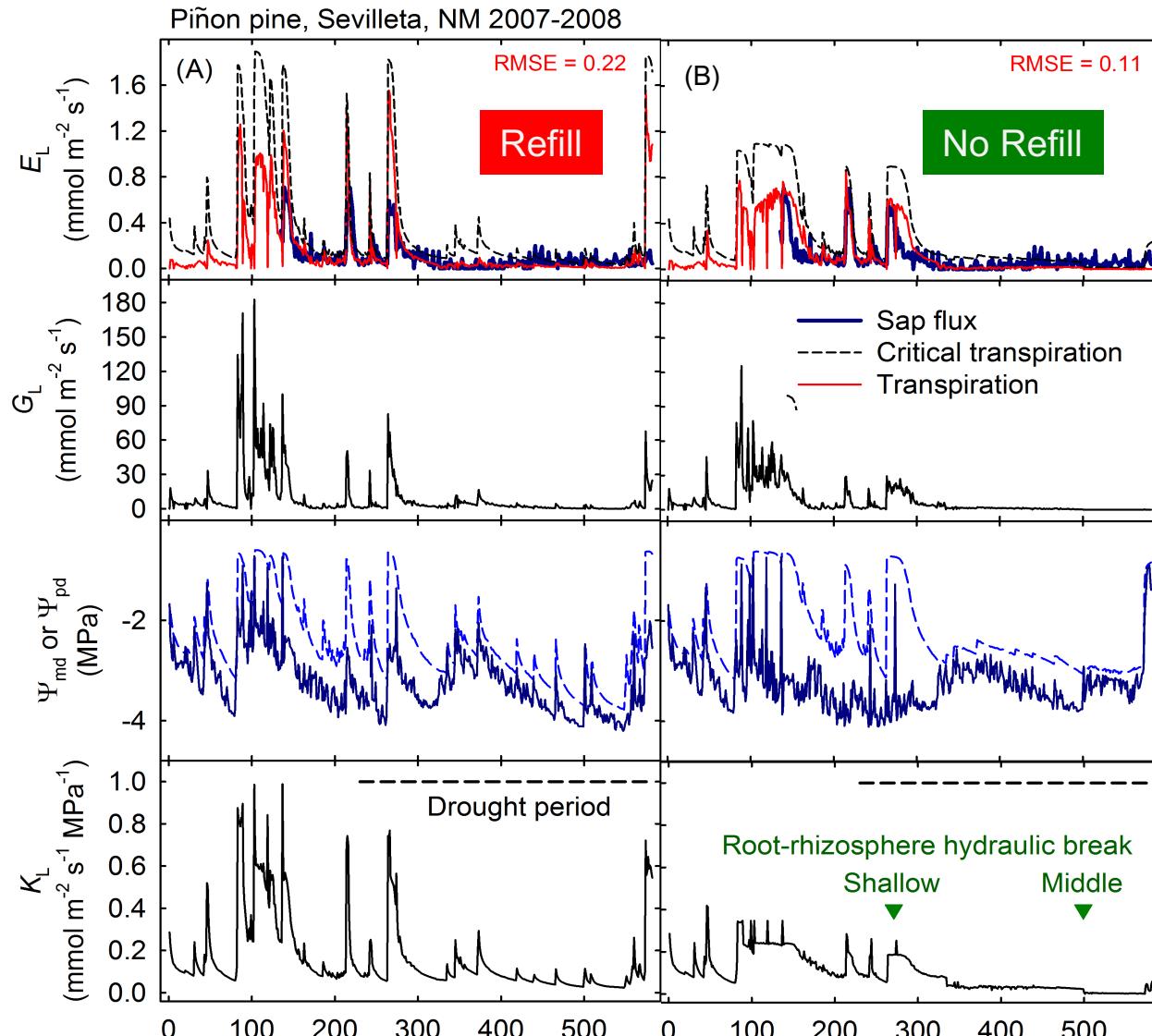


Piñon turns from green to orange just before death



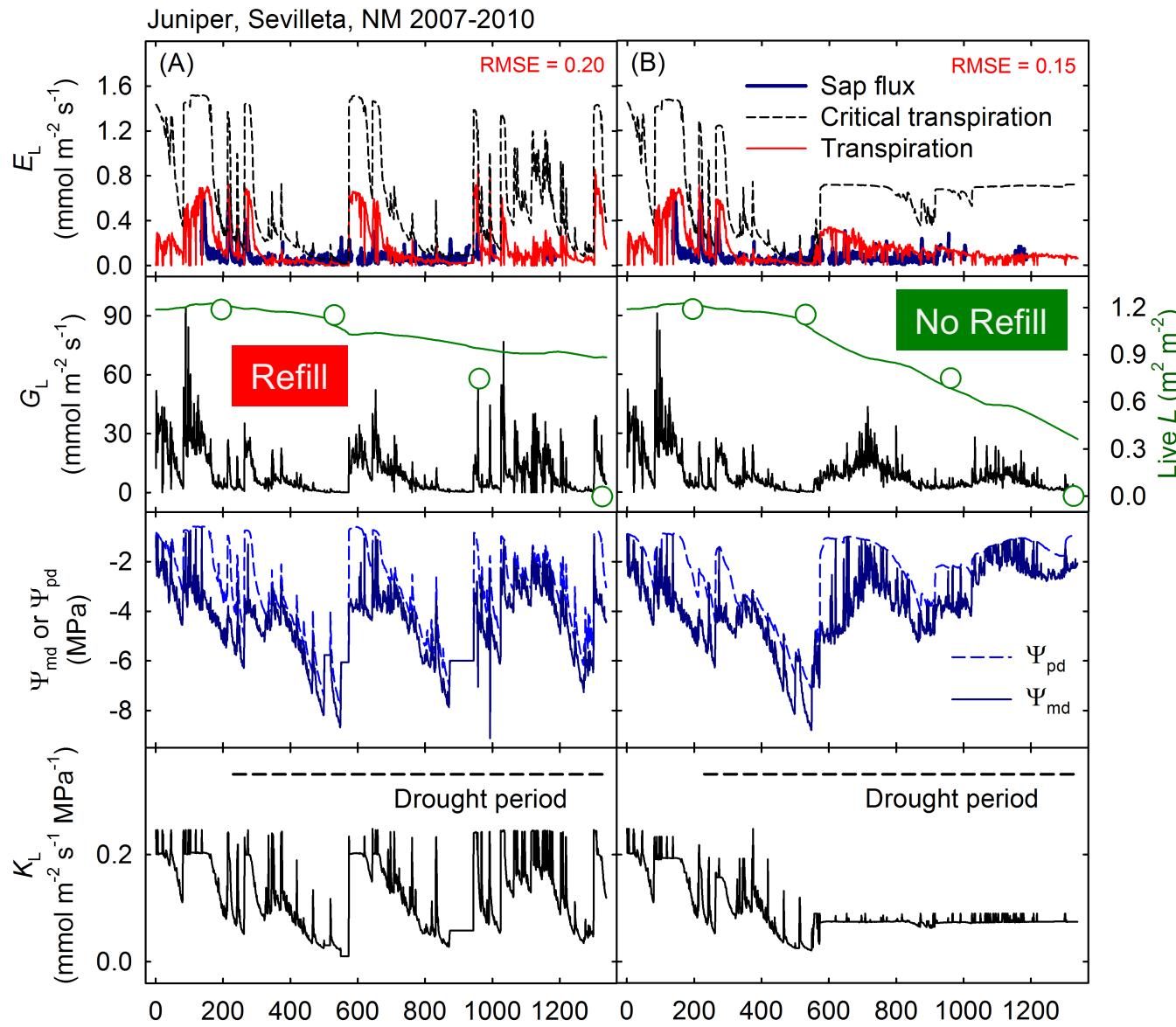
Juniper dies off gradually over several years

# Piñon: No xylem refilling and root mortality

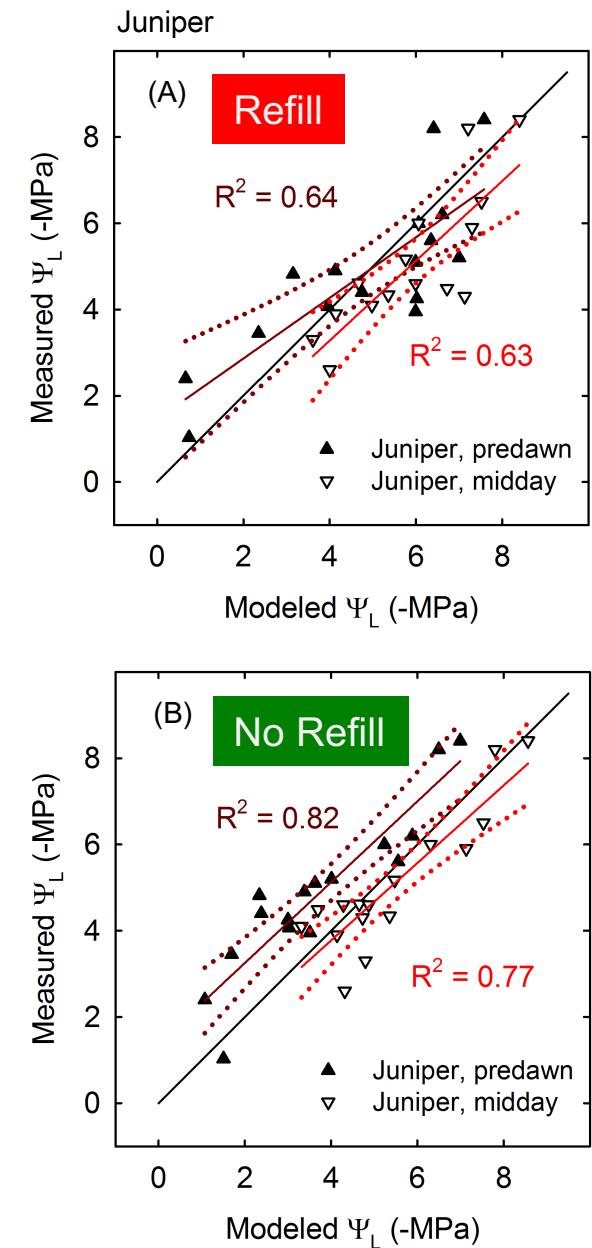


Mackay et al., 2015, Water Resources Research

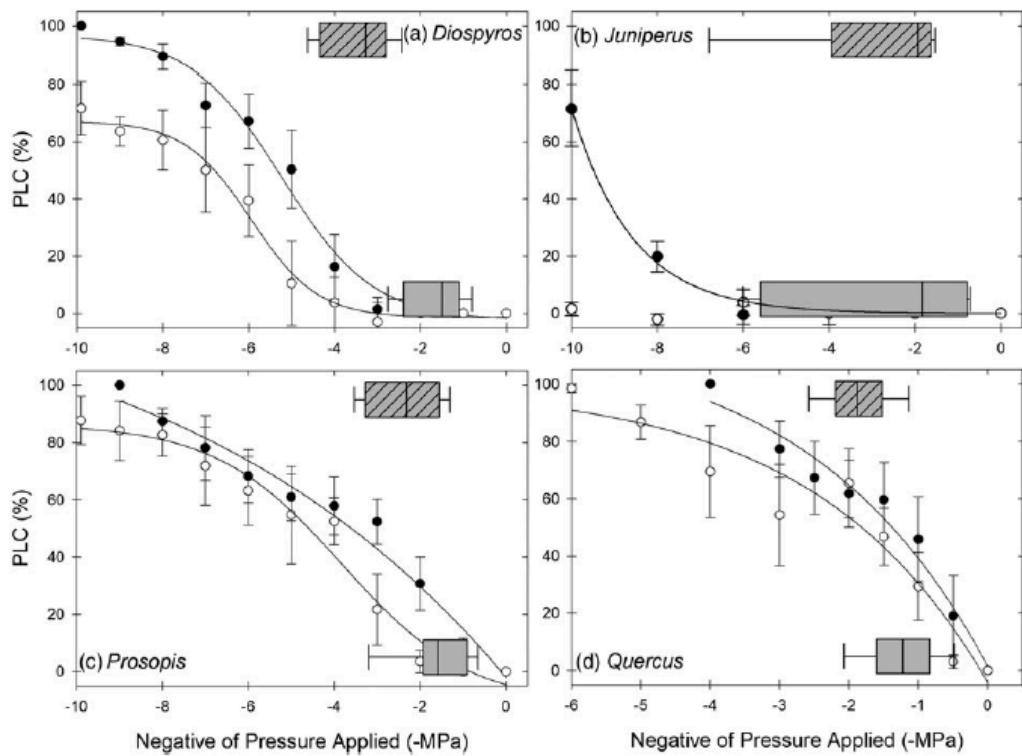
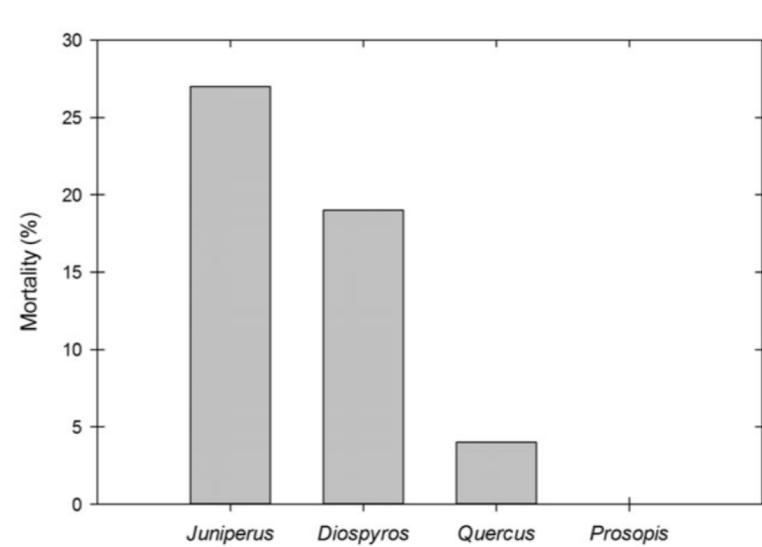
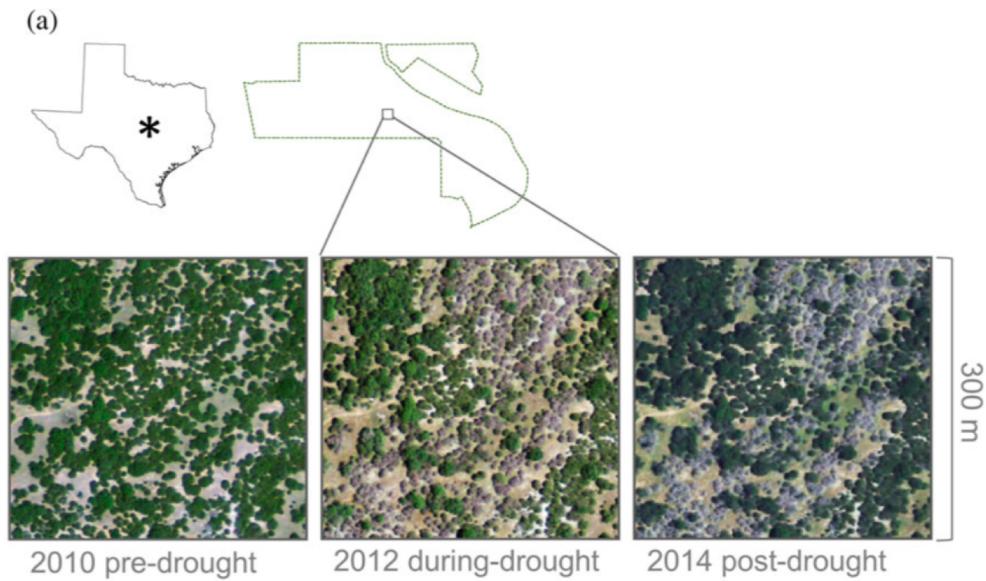
# Juniper: No xylem refilling and canopy mortality



Mackay et al., 2015, Water Resources Research



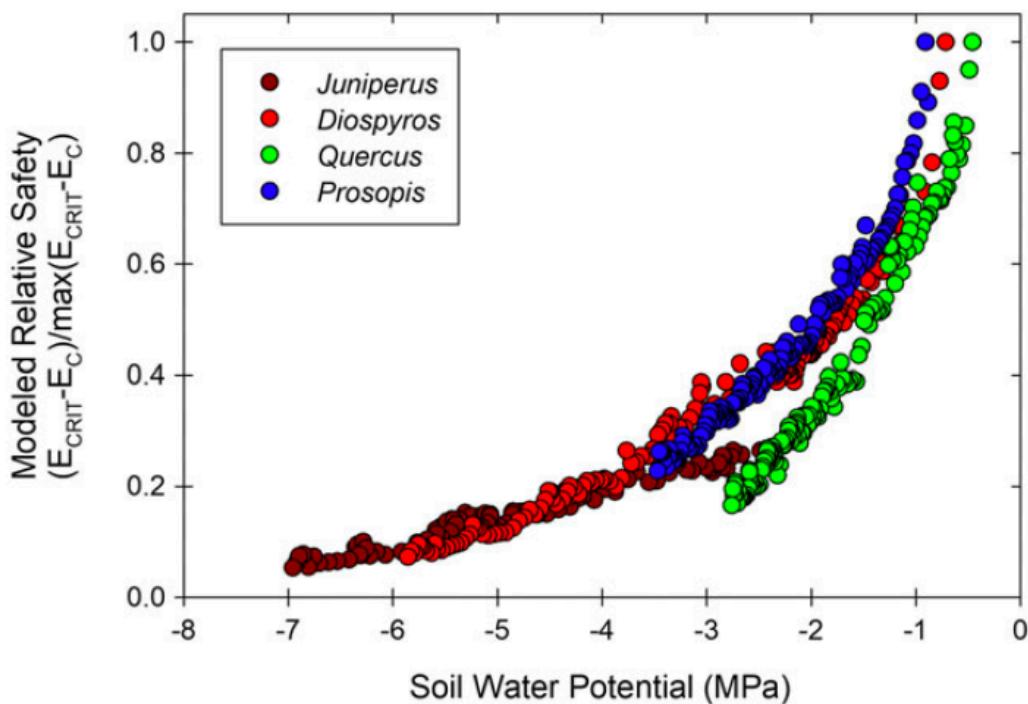
# Low vulnerable species experience more mortality



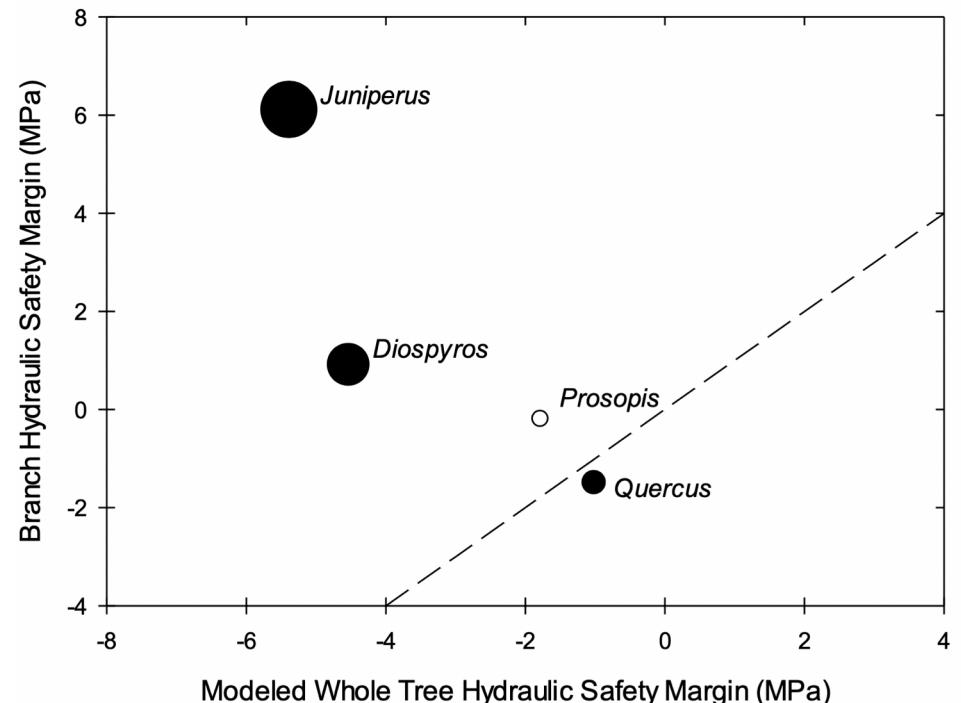
Johnson et al., 2018  
Plant, Cell & Environment

# Whole plant hydraulic safety is emergent

Whole tree (TREES) flux-based safety margins



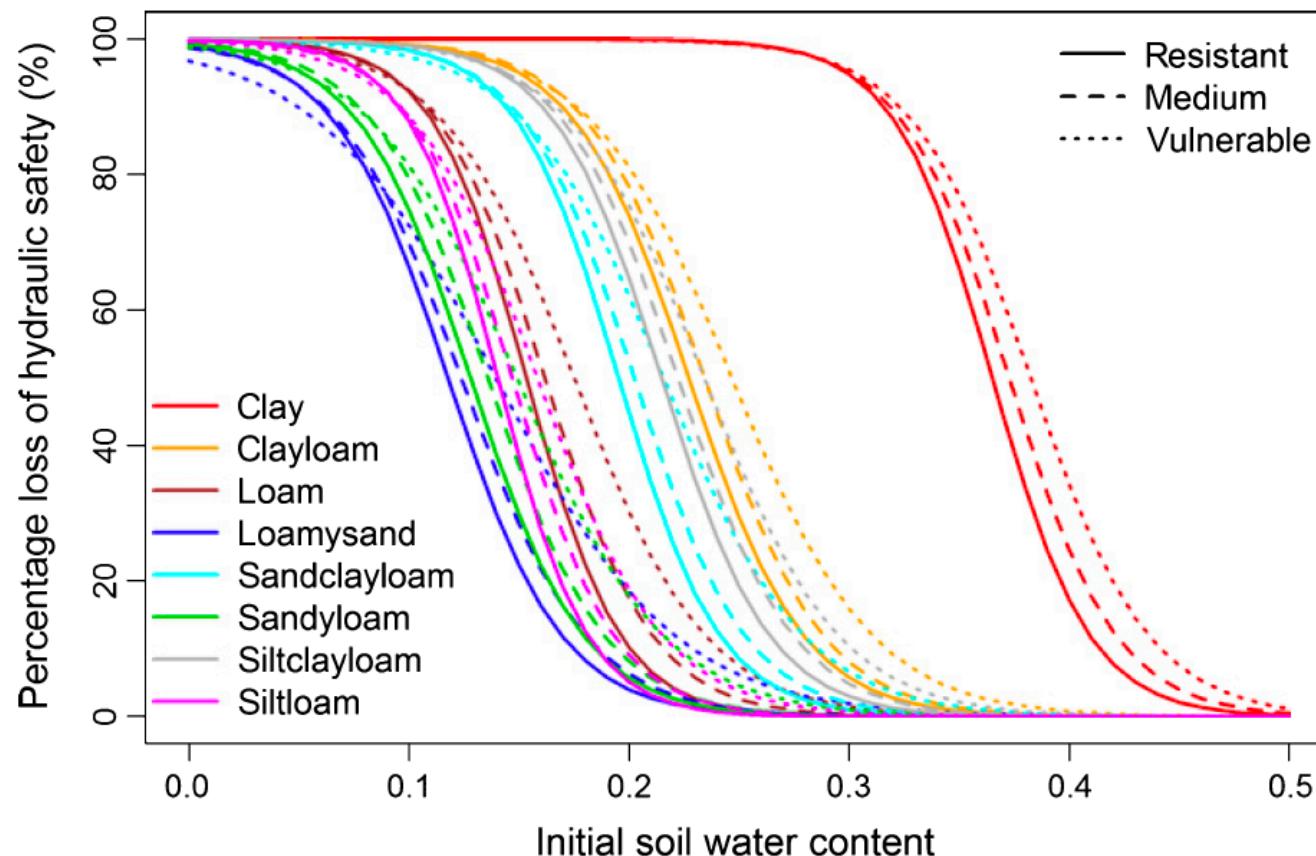
Branch (measured)  
versus whole tree (TREES)  
pressure-based safety margins



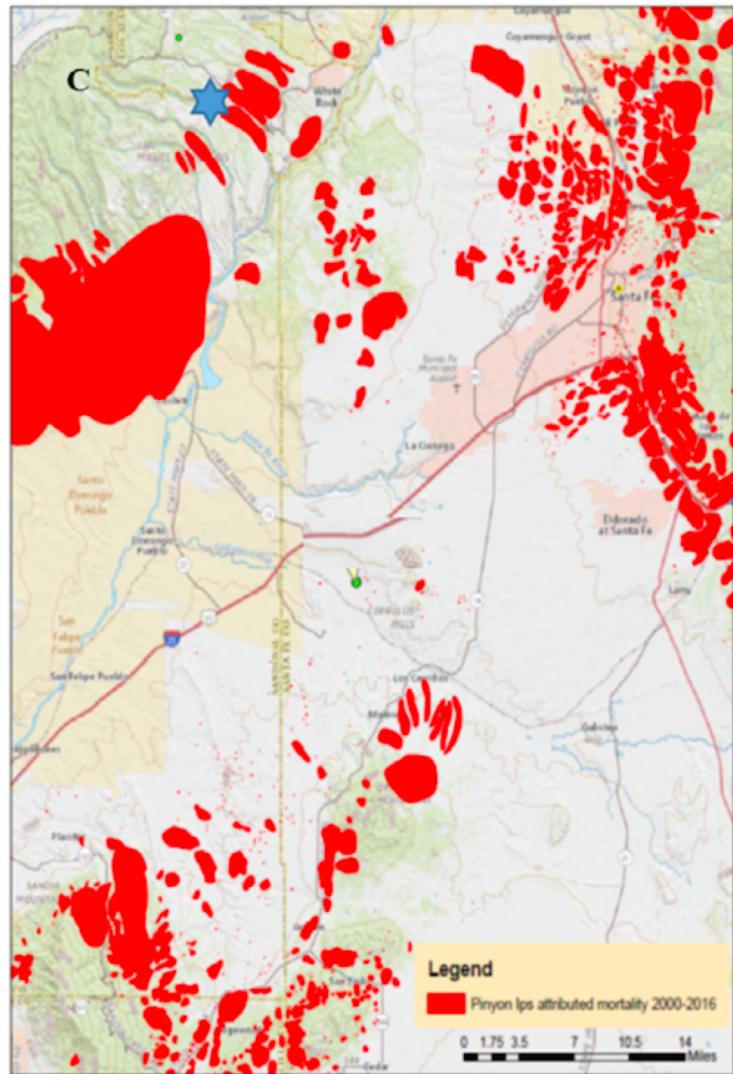
Johnson et al., 2018  
Plant, Cell & Environment

Mackay/Wang 2019

$$p(\theta_{\text{init}}, \text{soil texture}) = 100\% * \left(1 - \frac{(E_{\text{crit}} - E_c)}{(E_{\text{crit}} - E_c)_{\max}}\right)$$



# Piñon can survive in islands of refugia



# Piñon-juniper survival mortality experiment



ambient



warming

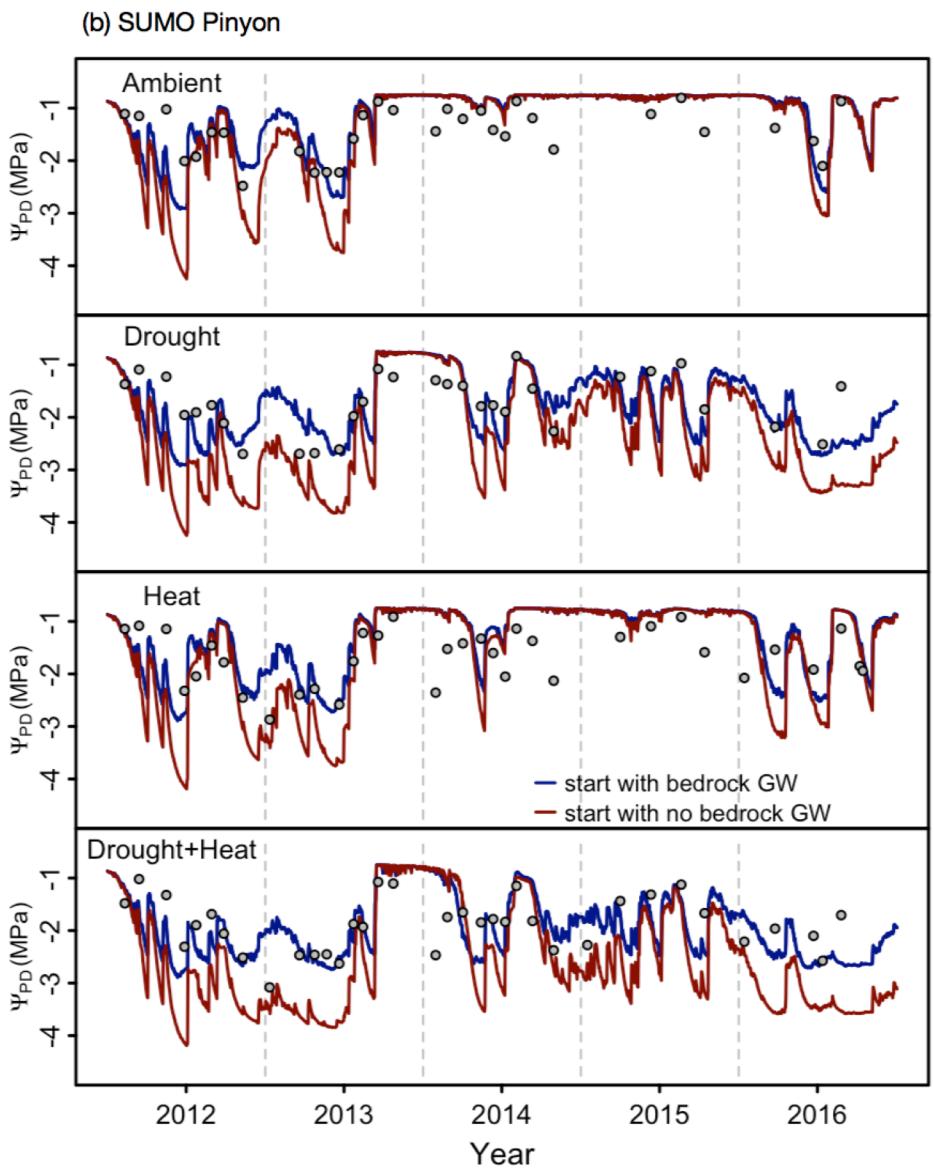
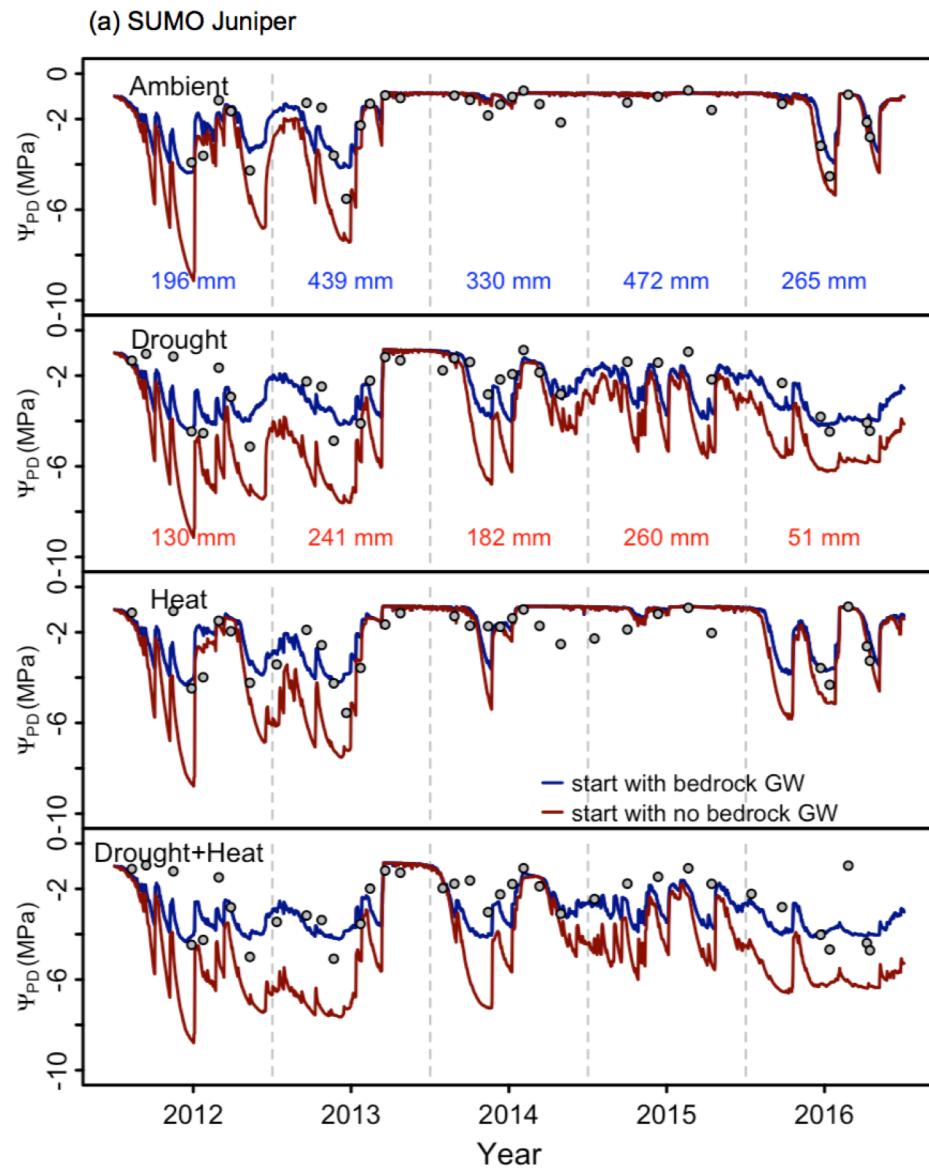


drought



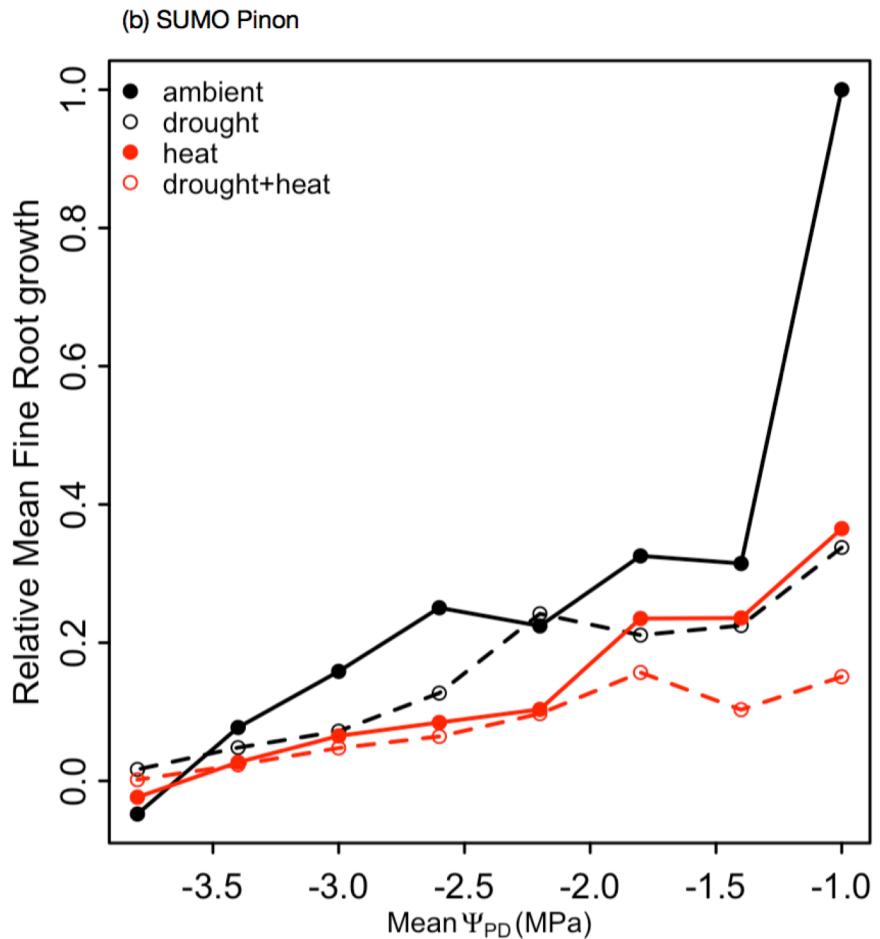
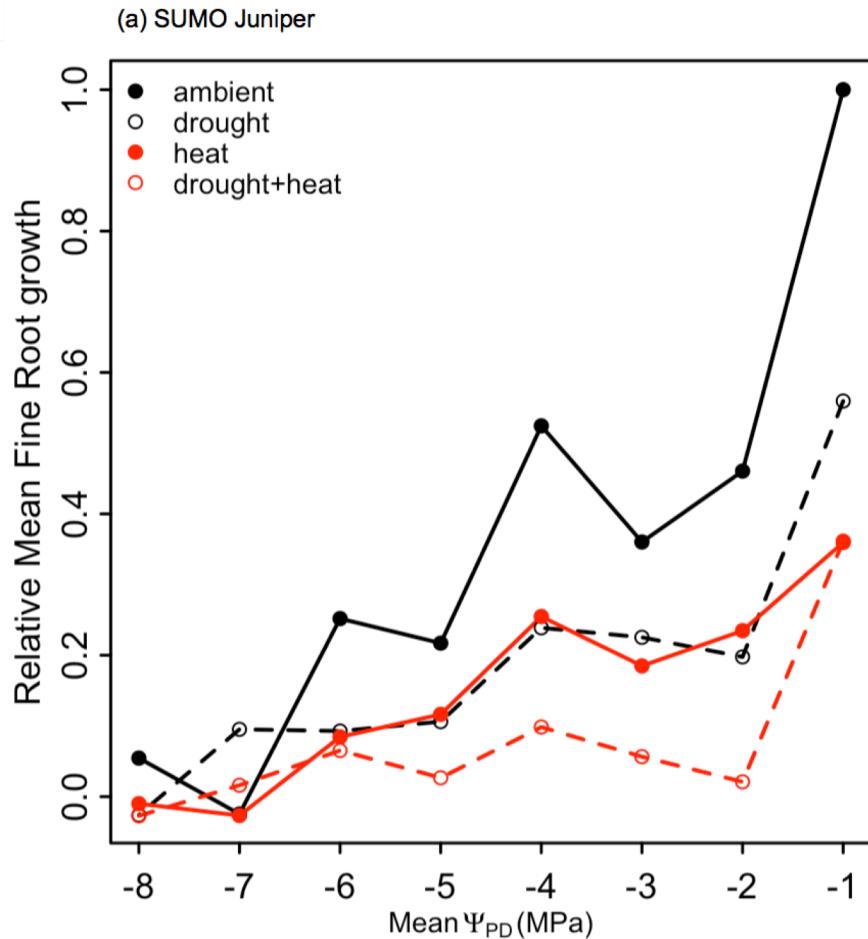
warming+drought

# Piñon-juniper require roots accessing bedrock water



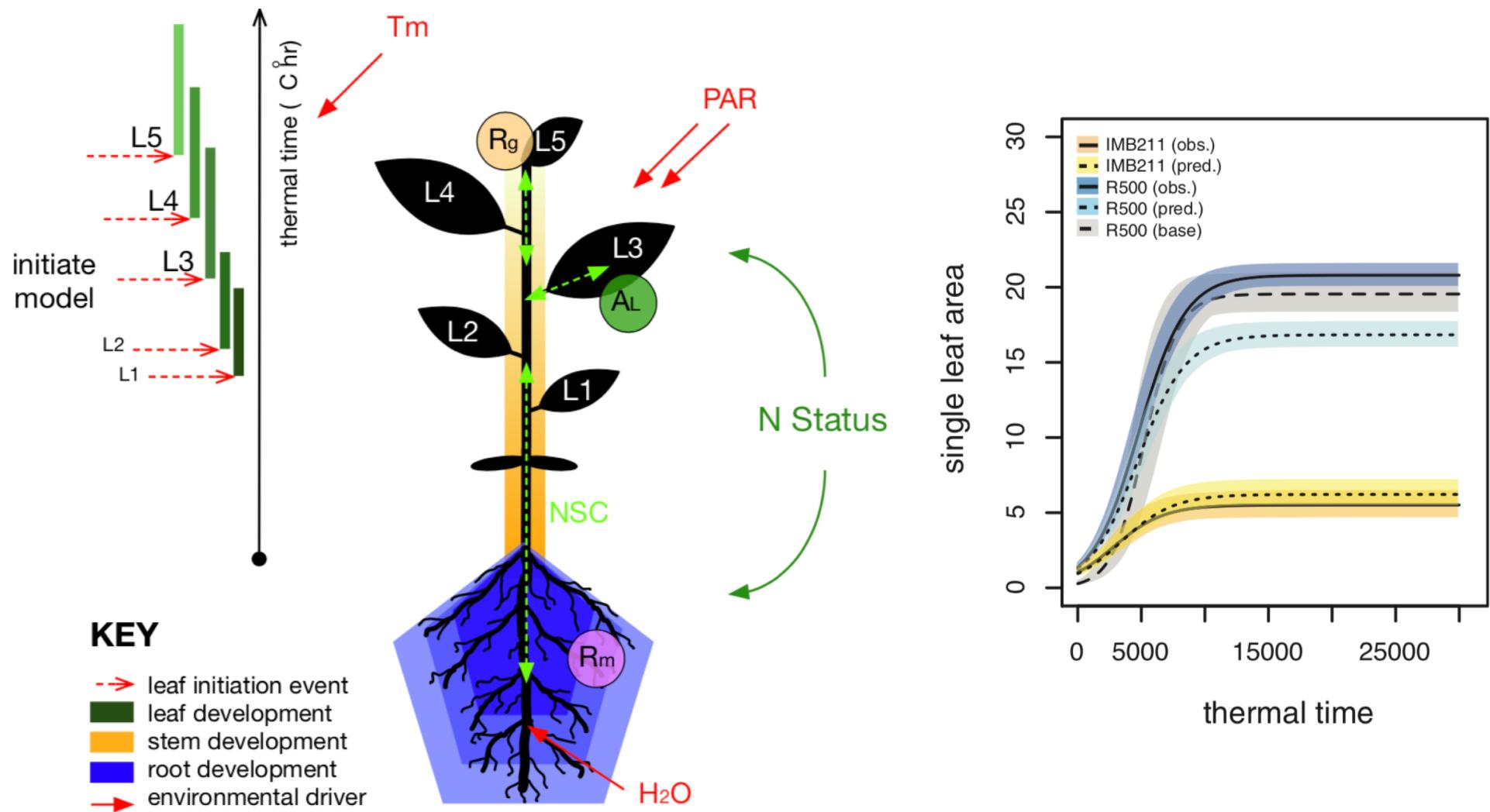
Mackay et al., 2019, New Phytologist

# Roots cannot grow fast enough after onset of drought



Mackay et al., 2019, New Phytologist

# TREES Mach III – General plant growth



Wang et al., 2019, Journal of Experimental Botany

# TREES Workshop – Learning Objectives

- 1) Understand the major processes in TREES
- 2) Think scientifically about how TREES can be applied to research questions
- 3) Become comfortable with running TREES (second session only)

# TREES Inputs – Forcing variables



Year-day: Year is first four digits, day starts at 1 and represents January 1

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



Time of day (half-hour steps): 0 represents midnight to 12:30 am period

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



Wind speed ( $\text{m s}^{-1}$ )

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



## Reference height temperature (degrees C)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



## Reference height vapor pressure deficit (kPa)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



## Precipitation (mm 30min<sup>-1</sup>)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

## Photosynthetically active radiation above canopy (umol m<sup>-2</sup> s<sup>-1</sup>)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



Canopy temperature (degrees C) – may differ from ref

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



Canopy vapor pressure deficit (kPa) – may differ

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables



## Atmospheric pressure (kPa)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

## Atmospheric CO<sub>2</sub> partial pressure (ubars)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

## Soil surface temperature (degrees C)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

## Shallow soil temperature (degrees C)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

## Root zone temperature (degrees C)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

## Reserved for water table depth (m)

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

Reserved for interacting with hydraulic model

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999

# TREES Inputs – Forcing variables

Reserved for Bayesian analysis functions

Date	Time	u_ref	t_ref	d_ref	precip	Qpar	t_canopy	d_canopy	p_atm	CO2_atm	Ts0	Tsurf	Troot	Zw	xylemScalar	NEEobs	Ec
2012001	0	2.05	-0.45	0.42	0	0.00	-0.45	0.42	81	390	-0.45	2.17	5.47	10	1	-999	-999
2012001	0.5	1.25	-0.55	0.42	0	-0.91	-0.55	0.42	81	390	-0.55	2.12	5.47	10	1	-999	-999
2012001	1	1.80	-0.50	0.43	0	-0.91	-0.50	0.43	81	390	-0.50	2.14	5.46	10	1	-999	-999
2012001	1.5	3.70	-1.80	0.38	0	-1.82	-1.80	0.38	81	390	-1.80	1.53	5.46	10	1	-999	-999
2012001	2	3.60	-1.75	0.38	0	-0.91	-1.75	0.38	81	390	-1.75	1.56	5.45	10	1	-999	-999
2012001	2.5	1.90	-2.10	0.37	0	0.00	-2.10	0.37	81	390	-2.10	1.39	5.44	10	1	-999	-999
2012001	3	2.10	-2.05	0.36	0	0.00	-2.05	0.36	81	390	-2.05	1.42	5.44	10	1	-999	-999
2012001	3.5	1.65	-2.25	0.35	0	0.00	-2.25	0.35	81	390	-2.25	1.32	5.43	10	1	-999	-999
2012001	4	1.65	-2.15	0.35	0	0.00	-2.15	0.35	81	390	-2.15	1.37	5.43	10	1	-999	-999
2012001	4.5	1.80	-2.00	0.33	0	0.00	-2.00	0.33	81	390	-2.00	1.44	5.42	10	1	-999	-999
2012001	5	1.00	-1.85	0.34	0	0.00	-1.85	0.34	81	390	-1.85	1.51	5.41	10	1	-999	-999
2012001	5.5	0.95	-2.55	0.31	0	-0.91	-2.55	0.31	81	390	-2.55	1.18	5.41	10	1	-999	-999
2012001	6	0.55	-1.85	0.32	0	0.00	-1.85	0.32	81	390	-1.85	1.51	5.40	10	1	-999	-999
2012001	6.5	1.85	-1.55	0.33	0	0.00	-1.55	0.33	81	390	-1.55	1.65	5.39	10	1	-999	-999
2012001	7	1.10	-2.00	0.37	0	2.74	-2.00	0.37	81	390	-2.00	1.44	5.39	10	1	-999	-999
2012001	7.5	1.60	-2.40	0.36	0	48.34	-2.40	0.36	81	390	-2.40	1.25	5.38	10	1	-999	-999
2012001	8	2.30	-1.95	0.39	0	152.30	-1.95	0.39	81	390	-1.95	1.46	5.37	10	1	-999	-999
2012001	8.5	2.15	-0.90	0.42	0	343.82	-0.90	0.42	81	390	-0.90	1.96	5.36	10	1	-999	-999
2012001	9	2.70	-0.35	0.43	0	579.12	-0.35	0.43	81	390	-0.35	2.21	5.36	10	1	-999	-999
2012001	9.5	3.15	0.30	0.45	0	780.67	0.30	0.45	81	390	0.30	2.52	5.35	10	1	-999	-999
2012001	10	2.20	1.00	0.47	0	853.63	1.00	0.47	81	390	1.00	2.85	5.34	10	1	-999	-999
2012001	10.5	1.90	2.10	0.52	0	962.16	2.10	0.52	81	390	2.10	3.37	5.33	10	1	-999	-999
2012001	11	1.75	3.30	0.57	0	1058.83	3.30	0.57	81	390	3.30	3.93	5.33	10	1	-999	-999
2012001	11.5	1.95	3.10	0.53	0	1122.67	3.10	0.53	81	390	3.10	3.84	5.32	10	1	-999	-999
2012001	12	1.90	4.35	0.58	0	1154.59	4.35	0.58	81	390	4.35	4.42	5.31	10	1	-999	-999
2012001	12.5	2.25	4.70	0.61	0	1154.59	4.70	0.61	81	390	4.70	4.59	5.30	10	1	-999	-999
2012001	13	1.15	5.40	0.66	0	1125.41	5.40	0.66	81	390	5.40	4.92	5.30	10	1	-999	-999
2012001	13.5	2.55	6.00	0.65	0	1067.95	6.00	0.65	81	390	6.00	5.20	5.29	10	1	-999	-999
2012001	14	3.10	5.40	0.58	0	974.02	5.40	0.58	81	390	5.40	4.92	5.28	10	1	-999	-999
2012001	14.5	3.05	5.40	0.58	0	853.63	5.40	0.58	81	390	5.40	4.92	5.27	10	1	-999	-999
2012001	15	2.45	5.15	0.58	0	706.80	5.15	0.58	81	390	5.15	4.80	5.26	10	1	-999	-999
2012001	15.5	1.50	5.30	0.60	0	530.78	5.30	0.60	81	390	5.30	4.87	5.26	10	1	-999	-999
2012001	16	5.00	5.20	0.62	0	337.44	5.20	0.62	81	390	5.20	4.82	5.25	10	1	-999	-999
2012001	16.5	0.65	5.10	0.60	0	136.80	5.10	0.60	81	390	5.10	4.78	5.24	10	1	-999	-999
2012001	17	0.75	4.05	0.52	0	12.77	4.05	0.52	81	390	4.05	4.28	5.24	10	1	-999	-999
2012001	17.5	1.35	3.15	0.46	0	-0.91	3.15	0.46	81	390	3.15	3.86	5.23	10	1	-999	-999
2012001	18	2.00	2.20	0.40	0	-0.91	2.20	0.40	81	390	2.20	3.41	5.22	10	1	-999	-999
2012001	18.5	2.10	2.70	0.43	0	0.00	2.70	0.43	81	390	2.70	3.65	5.22	10	1	-999	-999
2012001	19	2.40	2.40	0.42	0	0.00	2.40	0.42	81	390	2.40	3.51	5.21	10	1	-999	-999
2012001	19.5	3.45	2.15	0.44	0	0.00	2.15	0.44	81	390	2.15	3.39	5.20	10	1	-999	-999
2012001	20	4.05	1.65	0.40	0	-0.91	1.65	0.40	81	390	1.65	3.15	5.20	10	1	-999	-999
2012001	20.5	4.05	1.80	0.42	0	0.00	1.80	0.42	81	390	1.80	3.23	5.19	10	1	-999	-999
2012001	21	4.10	2.20	0.47	0	0.00	2.20	0.47	81	390	2.20	3.41	5.18	10	1	-999	-999
2012001	21.5	3.65	2.30	0.50	0	0.00	2.30	0.50	81	390	2.30	3.46	5.18	10	1	-999	-999
2012001	22	3.50	2.35	0.52	0	0.00	2.35	0.52	81	390	2.35	3.48	5.17	10	1	-999	-999
2012001	22.5	2.50	2.05	0.52	0	-0.91	2.05	0.52	81	390	2.05	3.34	5.16	10	1	-999	-999
2012001	23	2.75	-0.25	0.41	0	-1.82	-0.25	0.41	81	390	-0.25	2.26	5.16	10	1	-999	-999
2012001	23.5	1.45	-0.40	0.39	0	-0.91	-0.40	0.39	81	390	-0.40	2.19	5.15	10	1	-999	-999