Symbol	Description	Value	Units	Comment
a	acclimation rate	0.3	yr^{-1}	assumed to take about 3 yrs to acclimate
*	Active tissue litter fall	295		Sollins et al. (1980 Fig 2)
a_A	Active biomass turnover rate	0.234126984	yr^{-1}	Claculated from Eq for LC
*	Woody litterfall	475		Sollins et al. (1980 Fig 2)
a_W	Woody biomass turnover rate	0.01123197	yr^{-1}	Claculated from Eq for LC
B_A	Active biomass	1260	$g\ C\ m^{-2}$	Sollins et al. (1980 Table 2)
B_{Amax}	Maximum active biomass	1596.575342	$g\ C\ m^{-2}$	calculated from Eq for BA
B_C	Plant C	43550	$g\ C\ m^{-2}$	Sollins et al. (1980 Table 2)
B_N	Plant N	73.616	$g\ N\ m^{-2}$	Sollins et al. (1980 Table 2)
B_{NF}	BA at canopy closure	630	$g\ C\ m^{-2}$	assumed 1/2 steady state
B_P	Plant P	11.1704	$g\ P\ m^{-2}$	Sollins et al. (1980 Table 2)
B_W	Woody biomass	42290	$g\ C\ m^{-2}$	calculated from Eq for BW
C_a	Atmospheric CO2	386	ppm	http://www.esrl.noaa.gov/gmd/ccgg/trends/
D_C	Detritus and microbe C	19960	$g\ C\ m^{-2}$	Sollins et al. (1980 Table 4)
D_N	Detritus and microbe N	419.5	$g\ N\ m^{-2}$	Sollins et al. (1980 Table 4)
D_P	Detritus and microbe P	41.95	$g\ P\ m^{-2}$	assumed 1/10 of DN; Sollins et al. (1980 Table 4) extractable only
E_N	Inorganic N	2.6	$g\ N\ m^{-2}$	Rastetter et al. (2001 Table 1)
E_P	Inorganic P	0.26	$g\ P\ m^{-2}$	assumed 1/10 of EN
F_{max}	Maximum symbiotic N fixation	0.00135	$g\ N\ g^{-1}\ C\ yr^{-1}$	adjusted to match Cleveland et al. (1999 Table 4b)
F_{NP}	N fixation potential	0	$g\ N\ m^{-2}\ yr^{-}_{1}$	calculated from Eq for FNP
G_{mC}	Microbial DC use	1287.5	$g\ C\ m^{-2}\ yr^{-}_{1}$	calculated from Eq for GmC
G_{mN}	Microbial DN use	102.6021145	$g\ N\ m^{-2}\ yr^{-}_{1}$	calculated from Eq for GmN

G_{mP}	Microbial DP growth	15.00968922	g P m^{-2} yr^{-}_{1}	calculated from Eq for GmP
I_{ND}	N deposition rate	0.2	g N m^{-2} yr^{-}_{1}	Sollins et al. (1980 Fig 3)
I_{NF}	Non-symbiotic N fixation	0.28	g N m^{-2} yr^{-}_{1}	Sollins et al. (1980 Fig 3)
I_P	P inputs to inorganic stock	0.05	g P m^{-2} yr^{-}_{1}	Sollins et al. (1980 Fig 3)
k_C	Plant CO2 half saturation constant	350	ppm	Rastetter et al. (2001)
k_{mN}	Microbial N half saturation constant	0.231	g N m^{-2}	Assumed 1/2 plant value
k_{mP}	Microbial P half saturation constant	0.57	g P m^{-2}	Assumed 1/2 plant value
k_N	Plant N half saturation constant	0.462	g N m^{-2}	Williams and Yanai 1996 assuming 0.45 m3 H2O
k_{NF}	N fix inhibition constant	0.02	m^2 g^{-1} C	adjusted so symbiotic N fixation peaks ~ year 90
k_P	Plant P half saturation constant	1.14	g P m^{-2}	Williams and Yanai 1996 assuming 0.45 m3 H2O
L_C	Litter C	770	g C m^{-2} yr^{-}_{1}	calculated from Eq for LC
L_N	Litter N	6.505214533	g N m^{-2} yr^{-}_{1}	calculated from Eq for LN
L_P	Litter P	1.240046367	g P m^{-2} yr^{-}_{1}	calculated from Eq for LP
M_N	Gross N mineralization	26.02085813	g N m^{-2} yr^{-}_{1}	assume 4 x net as implied by 15N data of Nadelhoffer et al. (1999 Fig 1 slope = 0.25)
M_P	Gross P mineralization	2.602085813	g P m^{-2} yr^{-}_{1}	assumed 1/10 of MN
P_{max}	Maximum Net primary production	1.165227404	g C m^{-2} yr^{-}_{1}	calculated from Eq for Pn

P_n	Net primary production	770	g C m^{-2}_{1} yr^{-}	calculated from steady state Eq for BC
q_{mN}	Immobilization C:N ratio	8	g C g^{-1} N	Brady (1974: p151)
q_{mP}	Immobilization C:P ratio	56	g C g^{-1} P	Assume molar N:P = 16:1
q_N	Plant optimal C:N ratio	591.5833514	g C g^{-1} N	calculated from Eq. for qN
Q_N	Inorganic N leaching	0.0144	g N m^{-2}_{1} yr^{-}	3% of total N losses Currie et al (1996 Table 7)
q_{NA}	Active tissue C:N ratio	58.74947545	g C g^{-1} N	Sollins et al. (1980 Table 2)
q_{NLA}	Active tissue litter C:N ratio	90.0704357	g C g^{-1} N	Sollins et al. (1980 Table 3)
q_{NLW}	Woody tissue litter C:N ratio	147.0588235	g C g^{-1} N	Sollins et al. (1980 Table 3)
q_{NW}	Woody tissue C:N ratio	810.6346681	g C g^{-1} N	Sollins et al. (1980 Table 2)
Q_{OC}	Organic C leaching	255	g C m^{-2}_{1} yr^{-}	calculated from steady state Eq for DC
Q_{ON}	Organic N leaching	0.4656	g N m^{-2}_{1} yr^{-}	calculated total inputs minus QN
Q_{OP}	Organic P leaching	0.025	g P m^{-2}_{1} yr^{-}	calculated total inputs minus QP
q_P	Plant optimal C:P ratio	3898.696555	g C g^{-1} P	calculated from Eq. for qP
Q_P	Inorganic P leaching	0.025	g P m^{-2}_{1} yr^{-}	assumed 1/2 inputs
q_{PA}	Active tissue C:P ratio	286.1035422	g C g^{-1} P	Sollins et al. (1980 Table 2)
q_{PLA}	Active tissue litter C:P ratio	363.0562046	g C g^{-1} P	Sollins et al. (1980 Table 3)
q_{PLW}	Woody tissue litter C:P ratio	1111.111111	g C g^{-1} P	Sollins et al. (1980 Table 3)
q_{PW}	Woody tissue C:P ratio	6250	g C g^{-1} P	Sollins et al. (1980 Table2)
Q_{10Pn}	Q10 NPP	1.4	none	assumed value

Q_{10UN}	Q10 plant N uptake	2	none	assumed value
Q_{10UP}	Q10 plant P uptake	2	none	assumed value
Q_{10Nfix}	Q10 Nfix	2	none	assumed value
Q_{10DC}	Q10 soil C turnover	2	none	assumed value
Q_{10DN}	Q10 soil N turnover	2	none	assumed value
Q_{10DP}	Q10 soil P turnover	2	none	assumed value
Q_{10mUN}	Q10 microbial N uptake	2	none	assumed value
Q_{10mUP}	Q10 microbial P uptake	2	none	assumed value
R_C	Plant C requirement	770	$g\ C\ m_1^{-2}\ yr^{-}$	calculated from Eq for RC
R_m	Microbial respiration	515	$g\ C\ m_1^{-2}\ yr^{-}$	Sollins et al. (1980 Fig 2)
r_{mC}	microbial DC use	0.064504008	yr^{-1}	calculated from Eq for Rm assuming maximum C efficiency
r_{mN}	microbial DN use	0.244581918	yr^{-1}	calculated from Eq for MN
r_{mP}	microbial DP use	0.357799505	yr^{-1}	calculated from Eq for MP
R_N	Plant N requirement	6.505214533	$g\ N\ m_1^{-2}\ yr^{-}$	calculated from Eq for RN
R_P	Plant P requirement	1.240046367	$g\ P\ m_1^{-2}\ yr^{-}$	calculated from Eq for RP
U_{mC}	Microbial C uptake	772.5	$g\ C\ m_1^{-2}\ yr^{-}$	calculated from Eq for UmC
U_{mN}	Microbial N uptake	19.9812436	$g\ N\ m_1^{-2}\ yr^{-}$	calculated from steady state Eq for EN
U_{mP}	Microbial P uptake	1.387039446	$g\ P\ m_1^{-2}\ yr^{-}$	calculated from steady state Eq for EP
U_N	Plant N uptake	6.505214533	$g\ N\ m_1^{-2}\ yr^{-}$	calculated from steady state Eq for BN
U_{nC}	Net C growth	0	$g\ C\ m_1^{-2}\ yr^{-}$	calculated from Eq for UnC

U_{Nfix}	Symbiotic N fixation	0	g N m^{-2} yr^{-} $_{1}$	assumed 0 in mature state
U_{Nmax}	Maximum plant N uptake	0.006080271	g N g^{-1} C yr^{-1}	calculated from Eq for UN
U_{nN}	Net N growth	0	g N m^{-2} yr^{-} $_{1}$	calculated from Eq for UnN
U_{nP}	Net P growth	0	g P m^{-2} yr^{-} $_{1}$	calculated from Eq for UnP
U_{P}	Plant P uptake	1.240046367	g P m^{-2} yr^{-} $_{1}$	calculated from steady state Eq for BP
U_{Pmax}	Maximum plant P uptake	0.005299343	g P g^{-1} C yr^{-1}	calculated from Eq for UP
V_C	Plant C uptake assets	0.333333333	fraction	assumed 1/3 total
V_N	Plant N uptake assets	0.333333333	fraction	assumed 1/3 total
V_P	Plant P uptake assets	0.333333333	fraction	assumed 1/3 total
α_N	Inorganic N leaching constant	0.005538462	yr^{-1}	calculated from Eq for QN
α_{OC}	Organic C leaching constant	0.012775551	yr^{-2}	calculated from Eq for QOC
α_{ON}	Organic N leaching constant	0.001109893	yr^{-3}	calculated from Eq for QON
α_{OP}	Organic P leaching constant	0.000595948	yr^{-4}	calculated from Eq for QOP
α_P	Inorganic P leaching constant	0.096153846	yr^{-1}	calculated from Eq for QP
β_N	N immobilization rate constant	0.000183269	g N g^{-1} C yr^{-1}	calculated from Eq for UmN
β_P	P immobilization rate constant	2.61091E-05	g P g-1 C yr-1	calculated from Eq for UmP
γ_B	Allometric constant	0.13724278	fraction	Fit todata from Sollins et al. 1980 and Bormann and Sidle 1990
γ_{NF}	Non-symbiotic N fixation constant	0.000230674	g N $g^{-2/3}$ C $m^{-2/3}$ yr^{-1}	calculated from Eq for INF

ε_{Cx}	Maximum microbial C efficiency	0.6	fraction	Rastetter et al. (2001)
ε_{mC}	Microbial C efficiency	0.6	fraction	calculated from Eq for emC
ε_{mN}	Microbial N efficiency	0.787729276	fraction	calculated from Eq for emN
ε_{mP}	Microbial P efficiency	0.841304576	fraction	calculated from Eq for emP
η_C	Microbial optimal C asset allocation	1	none	calculated from Eq for hC
η_N	Microbial optimal N asset allocation	1	none	calculated from Eq for hN
η_P	Microbial optimal P asset allocation	1	none	calculated from Eq for hP
ρ_M	Plant multiplicative scaling constant	7.389196499	$g\ C\ m^2\ yr^2\ g^{-1}\ N\ g^{-1}\ P$	calculated so P*n = Pn
ρ_{mM}	Microbial multiplicative scaling constant	0.000298513	$m^4\ yr^2\ g^{-1}\ N\ g^{-1}\ P$	calcualted so G*mC = GmC
ϕ_N	Growth-increment N:C	0.001329895	$g\ N\ g^{-1}\ C$	calculated from Eq for fN
ϕ_P	Growth-increment P:C	0.000180342	$g\ P\ g^{-1}\ C$	calculated from Eq for fP
Ψ	Weighted requirement	1	none	calculated from Eq for Y
Ψ_N	Stoichiometric net N growth	0	$g\ N\ m^{-2}\ yr^{-}_{1}$	calculated from Eq for YN

Citations:

Bormann, B.T., and R.C. Sidle. 1990. Changes in productivity and distribution of nutrients in a chronosequence at Glacier Bay National Park, Alaska. J Ecol 78:561-578.

Brady, N.C. 1974. The Nature and Properties of Soils, 8th Edition. MacMillan Publishing Co. New York. 639 pp.

Currie, W.S., J.D. Aber, W.H. McDowell, R.D. Boone, and A.H. Magill. 1996. Vertical transport of dissolved organic C and N under long-term N amendments in pine and hardwood forests. Biogeochemistry 35:471-505.

Nadelhoffer, K.J., B.A. Emmett, P. Gundersen, O.J. Kjønaas, C.J. Koopmans, P. Schleppi, A. Tietema, and R.F. Wright. 1999. Nitrogen deposition makes a minor contribution to carbon sequestration in temperate forests. Nature 398:145-148.

Rastetter, E.B., P.M. Vitousek, C. Field, G.R. Shaver, D. Herbert, G.I. Ågren. 2001. Resource Optimization and Symbiotic N Fixation. Ecosystems 4:369-388.

Sollins, P., C.C. Grier, F.M. McCorison, K. Cromack Jr, R. Fogel, and R.L. Fredricksen. 1980. The internal element cycles of an old-growth Douglas-fir ecosystem in Western Oregon. Ecol. Monogr. 50:261-285.

Willimas, M, and R.D. Yanai. 1996. Multi-dimensional sensitivity analysis and ecological implications of a nutrient uptake model. Plant and Soil 180:311-324.