$$\frac{dx(t)}{dt} = \dot{x(t)} = I(t) \cdot b + x(t) \cdot re(t) \cdot A$$

Name

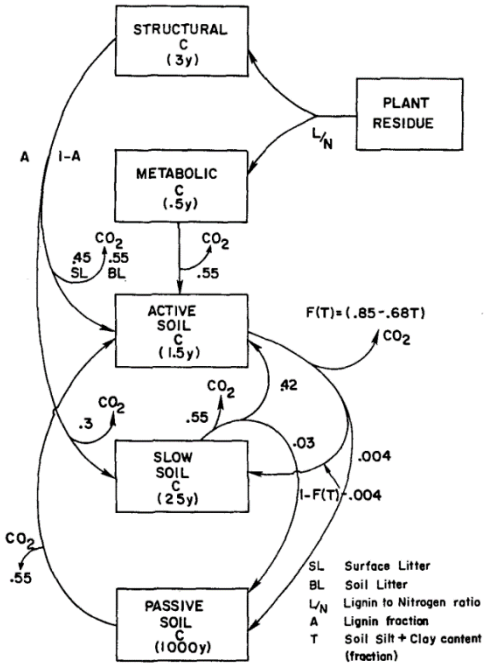
Century (SOM)

Important publications

(Parton et al., 1994, 1987)

Special features

- The decay rate of the structural pool is dependent on the lignin fraction
- Mixture of FOM distribution and FOM decay parameters
- The complete model has also surface litter pools, totalling in 9 pools (we model only the SOM pools)



SOM pool concept of Century (from Parton et al., 1984)

Input distribution: b

Incoming plant material gets distributed between metabolic and structural by the following equation:

I_met = 0.85 – 0.018 * L/N, I_struc = (1-I_met) L/N: Lignine-to –Nitrogen-ratio

b = (I_struc, I_met)^T

Initialisation: x(t_0)

After (Falloon and Smith, 2006), Century is initialized the following way:

The Passive fraction (P) is dependent on the clay content:

$P = -4 * e^{(-5*clay\%*clay\%)} + (0.0079 * clay\%) + 0.244.$

The Active fraction (A) is 3%, and the Slow fraction (S) is the minimum of (1-A-P, 55%).

If still something remains, we assign it to the metabolic pool.

Environmental response: re(t)

re(t) = rT(t) * rW(t)

$$rT(t) = \left(\frac{45-T}{45-35}\right)^{0.2} * e^{0.2/2.63} \cdot \left(1 - \left(\frac{45-T}{45-35}\right)^{2.63}\right)$$

$$rW(t) = \frac{1}{1 + 30 * e^{\left(-8.5 * \frac{P}{E}\right)}}$$

with

T = monthly air Temperature [°C]

P = monthly sum of Precipitation [mm]

E = monthly Evapotranspiration [mm]

Mass flow Matrix: A

Flow rates are in [a^{-1}] from Parton et al., 1994. Rows are flows into each pool; columns are flows from each pool. Shown values are for pure sand and no Lignine.

	CO_2	struc	met	active	slow	passive
CO_2		2.64*	10.175	6.205**	0.11	0.002475
struc		**-4.8***				
met			**-18.5**			
active		2.16*	8.325	**-7.3****	0.0894**	0.002025
slow		0*		1.0731**	**-0.2**	
passive				0.0219**	0.0006**	**-0.0045**

* dependent on Lignine content, ** dependent on texture (see additional info)

References

Falloon, P., Smith, P., 2006. Simulating SOC changes in long-term experiments with RothC and CENTURY: model evaluation for a regional scale application. Soil Use Manag. 18, 101–111. https://doi.org/10.1111/j.1475-2743.2002.tb00227.x

Parton, W.J., Ojima, D.S., Cole, C.V., Schimel, D.S., 1994. A General Model for Soil Organic Matter Dynamics: Sensitivity to Litter Chemistry, Texture and Management, in: Bryant, R.B., Arnold, R.W. (Eds.), SSSA Special Publication. Soil Science Society of America. https://doi.org/10.2136/sssaspecpub39.c9

Parton, W.J., Schimel, D.S., Cole, C.V., Ojima, D.S., 1987. Analysis of Factors Controlling Soil Organic Matter Levels in Great Plains Grasslands1. Soil Sci. Soc. Am. J. 51, 1173. https://doi.org/10.2136/sssaj1987.03615995005100050015x

Additional info

* Liginine-content dependencies:

K_f1 = -4.8 * exp(-3 * A) A =Lignin fraction in structural pool

K_f3 = K_f1 * 0.45 * (1-A)

K_f4 = K_f1 * 0.7 * A

K_f0 = K_f1 * (0.3*A + 0.55*(1-A)

** texture dependencies:

K_22 = -7.3 * (1-0.75 * ABT) ABT = silt and clay fraction (US system)

K_24 = K_22 * (0.003 + 0.032 * C) C = clay fraction

K_20 = K_22 * (0.85 – 0.68 * ABT)

K_23 = K_22 * (1 – K_20 –K_24)

K_35 = -0.2*(0.003 + 0.009*C) # different from Fig. 1 (+ insetad of -)

K_32 = -0.2 * (0.45 – K_35)

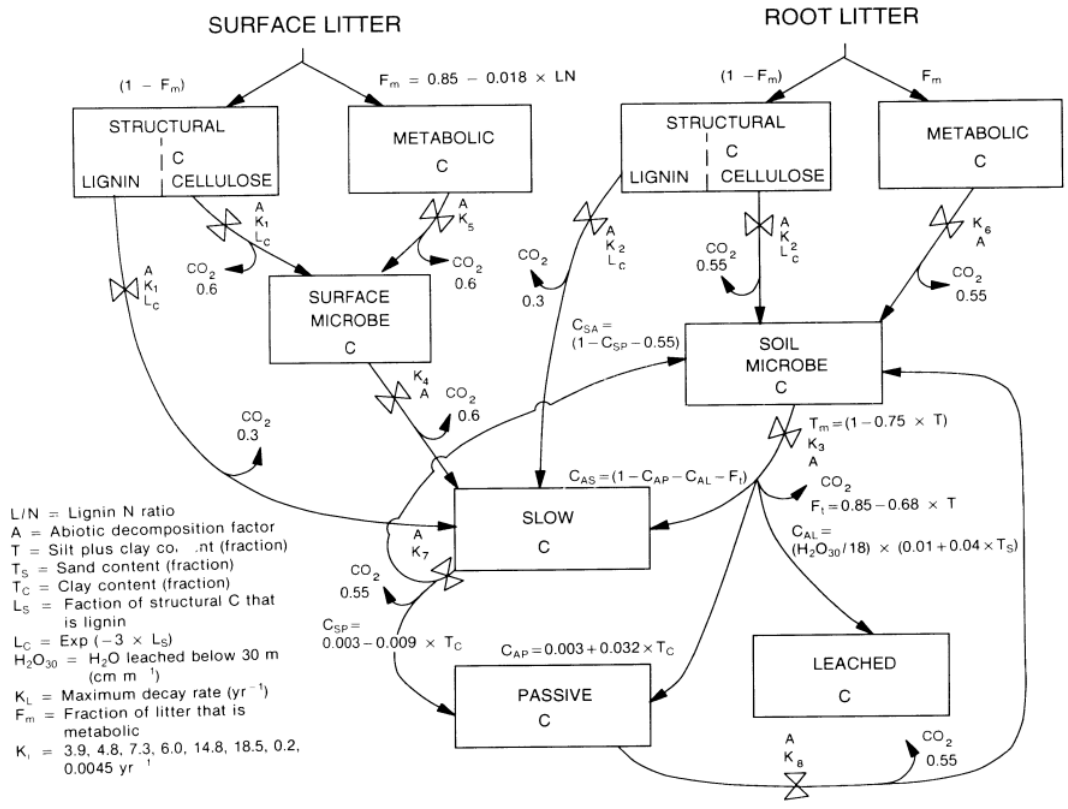


Fig. 9–1. Carbon flow diagram for the CENTURY model.

complete SOMC-Submodel of CENTURY (from Parton et al., 1994)