

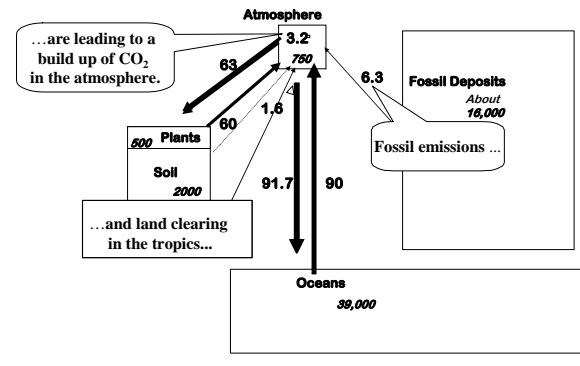
Decomposition

(Ch. 19: 424-429)

- I. What is it?
- II. Who does it?
- III. What controls it?
- IV. How does it fit into the big picture?

The Global Carbon Cycle - 1990s

Units Gt C and Gt C y⁻¹



Fate of tundra and boreal soil C?

5. Carbon Cycle of Terrestrial Ecosystems

Table 5.3 Distribution of Soil Organic Matter by Ecosystem Type

Ecosystem type	Mean soil organic matter (kg C m ⁻²)	World area (ha × 10 ⁶)	Total world soil organic carbon (mt C × 10 ⁶)
Tropical forest	10.4	24.5	255
Temperate forest	11.8	12	142
Boreal forest	14.9	12	179
Woodland and shrubland	6.9	8.5	59
Tropical savanna	3.7	15	56
Temperate grassland	19.2	9	173
Tundra and alpine	21.6	8	178
Desert scrub	3.6	18	101
Extreme desert, rock, and ice	0.1	24	3
Calibrated	12.7	14	178
Swamp and marsh	68.6	2	137
Totals		147	1456

¹From Schlesinger (1977).



I. What is it?

Respiration of dead organic matter: litter & SOM

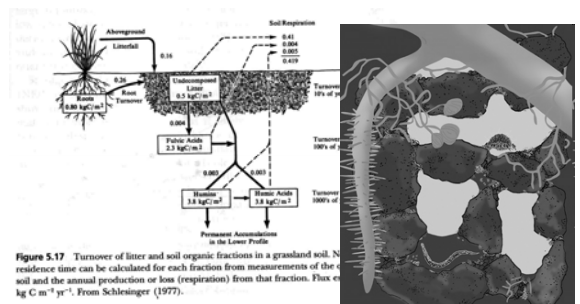


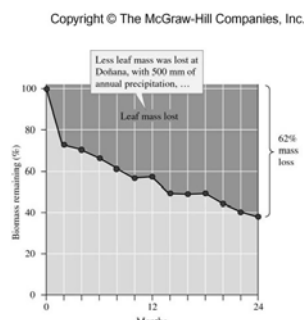
Figure 5.17 Turnover of litter and soil organic fractions in a grassland soil. Residence time can be calculated for each fraction from measurements of the soil and the annual production or loss (respiration) from that fraction. Fluxes in kg C m⁻² yr⁻¹. From Schlesinger (1977).

<http://www.actagro.com/art/maincontentpix/soldiagram.jpg>

I. What is it?

- Consumption of dead organic matter
- Mass loss → release of CO₂
- Release of organically bound nutrients
- Link between C and N cycles

19.5

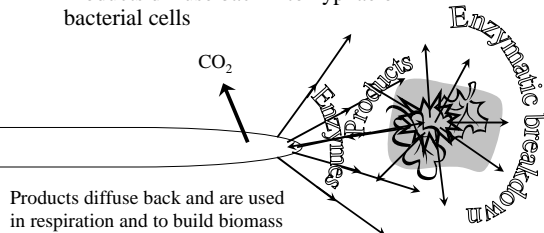


II. Who does it?

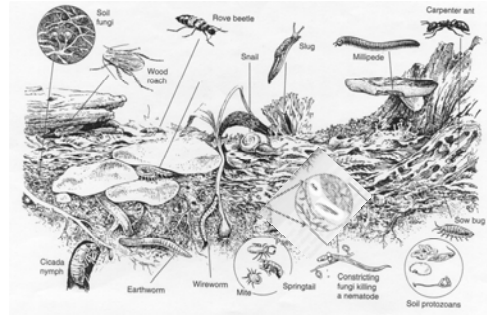
- Primary decomposers: bacteria & fungi
 - Extracellular enzymes for degrading complex organic molecules
- Conditioners
 - Mechanical: increased surface area
 - Biological: gut passage

Primary decomposers: Bacteria and Fungi

- Get carbon and energy from organic sources
- Release enzymes
- Enzymatic breakdown of substrate
- Products diffuse back into hyphae or bacterial cells



Conditioners

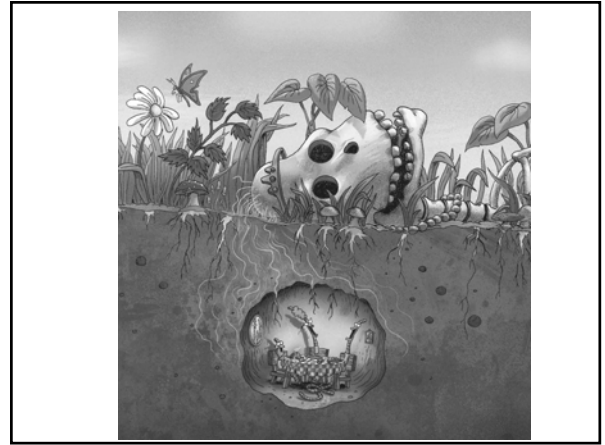


Worms: conditioners

"You see," Father Worm began, "Harriet loved Nature. But loving Nature is not the same as understanding it. And Harriet not only misunderstood the things she as- vilifying some creatures while romanticizing others—but also her own connection to them." Father Worm paused, his eyes narrowing. "Ah, connections, Son. That's the fateful key that Harriet missed, the key to understanding the natural world."

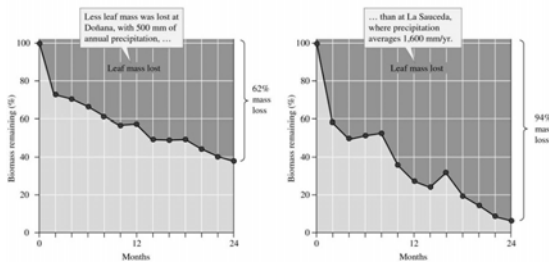
Father Worm sat back, stretching himself out to his full, glorious three and a half inches. "Take us worms, for example. We till, aerate, and enrich the earth's soil, making it suitable for plants. No worms, no plants; and no plants, no so-called higher animals running around with their oh-so-precious backbones!"

He was really getting into it now. "Heck, we're invertebrates, my boy! As a whole, we're the movers and shakers on this planet! Spineless superheroes, that's what we are!" And since Father Worm didn't have a flat to bring down on the table, he just yelled, "RANG!"



III. What controls it? A. Climate - precipitation

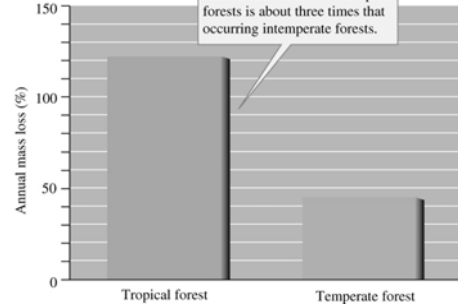
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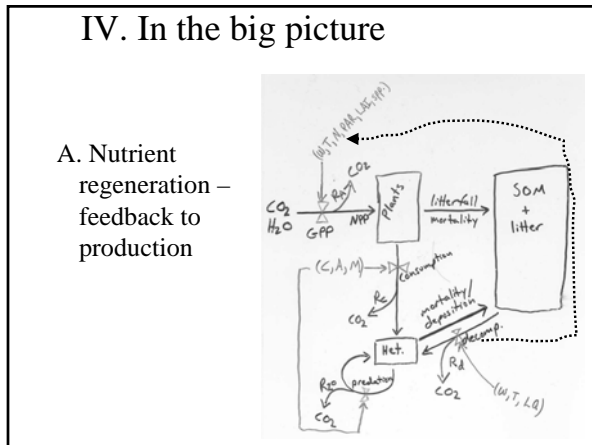
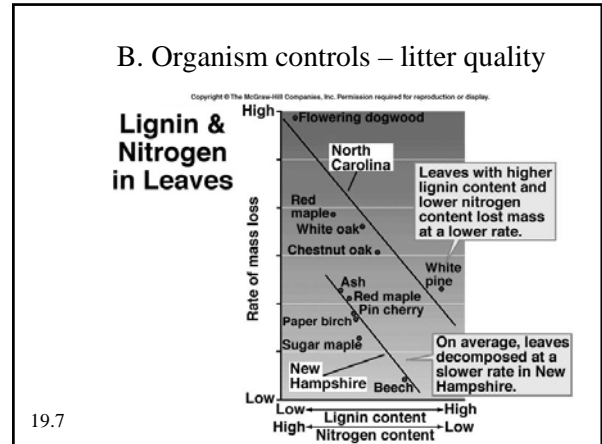
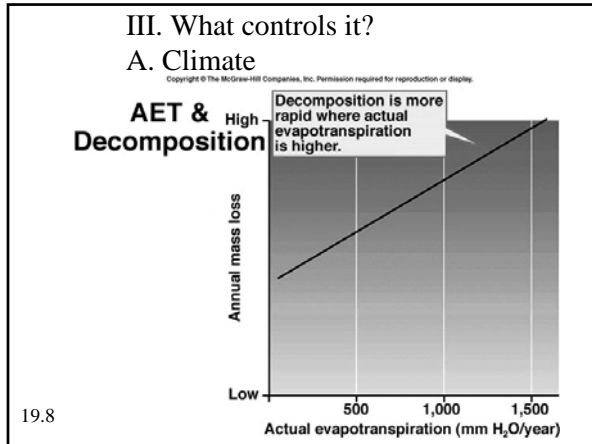
19.5 Same MAT ~16.5 °C

III. What controls it? A. Climate - temperature

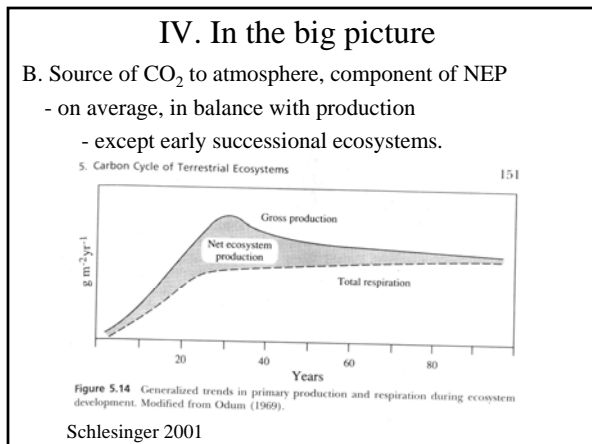
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19.9

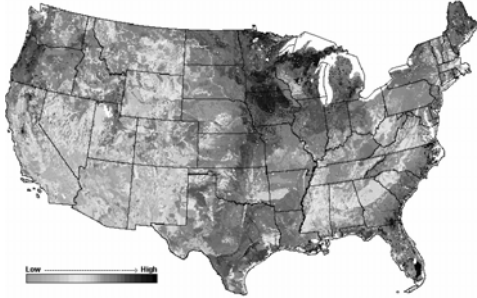


- ### Brief Nitrogen Cycle
- Emphasize: inputs, recycling, outputs
 - Inputs: lots in atmosphere, but little available.
 - N-fixation, importance in early succession
 - Recycling - Mineralization: N regeneration in plant available form → plant uptake
 - Losses:
 - denitrification (Fertilizer inputs → N₂O (greenhouse gas))
 - Leaching → eutrophication



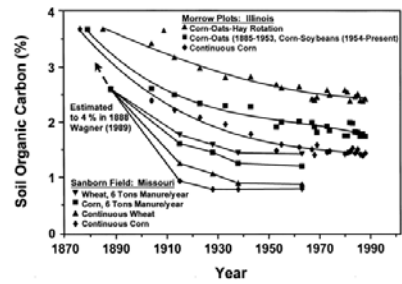
- ### C. Balance of Prod and Decomp leads to large diffs in C pools among ecosystems
- Implications –
 - C feedback in tundra
 - C loss with ag in grasslands
 - Soil fertility in tropics

Soil Organic Matter Content
Source: W. W. Hargrove and R. J. Luxmoore



http://www.unl.edu/nac/atlas/Map_Html/Stable_and_Productive_Soils/National/Soil_Organic_Matter_Content/Soil_Organic_Matter_Content.htm

Loss of SOM with tillage



<http://www.ipm.iastate.edu/ipm/1cm/2002/3-18-2002/croproationgraph.gif>



Andy Rogers / P-1 1/22/08
John Aeschliman shows a spot where rain has washed soil from a neighboring farmer's property onto the road. Aeschliman says his method of farming, in which plants are seeded directly into the remains of the previous crop without tilling, gives stability to the soil, enabling it to retain water and preserve the organic matter within it.
http://www.seattlepi.com/local/348200_dirt22.html

Low soil organic matter in tropical soils



Tropical forest in Panama
<http://www.lancs.ac.uk/staff/bardgett/Research.html>

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