

Soil organic matter and carbon transformation

Soil organic Matter

All materials of either **plants, animal,** or **microbial origin** produced in the soil or added to it regardless of their degree of decomposition.

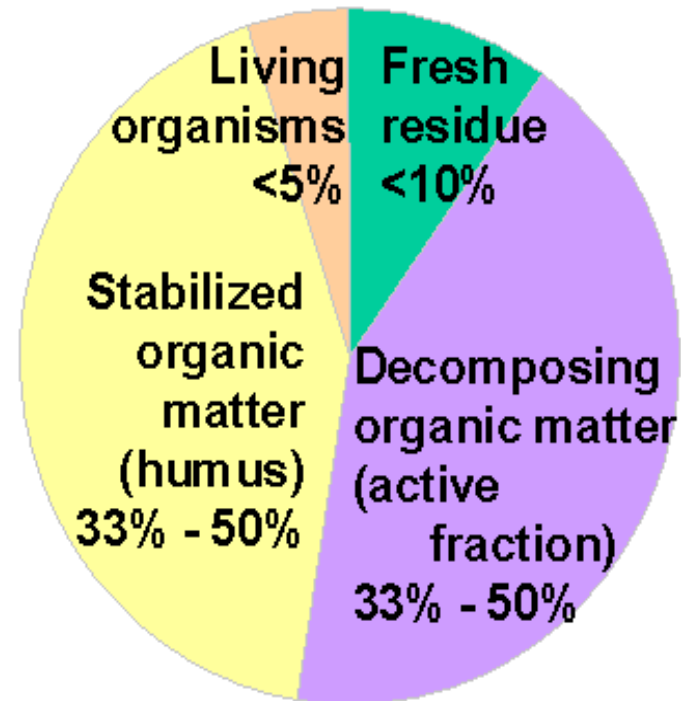
Organic Matter

The key to healthy soils

SOM (Soil Organic matter)

• Encompasses all *organic components* of a soil:

- Fresh residues
- Decomposing organic matter
- Stable organic matter
- Living organisms

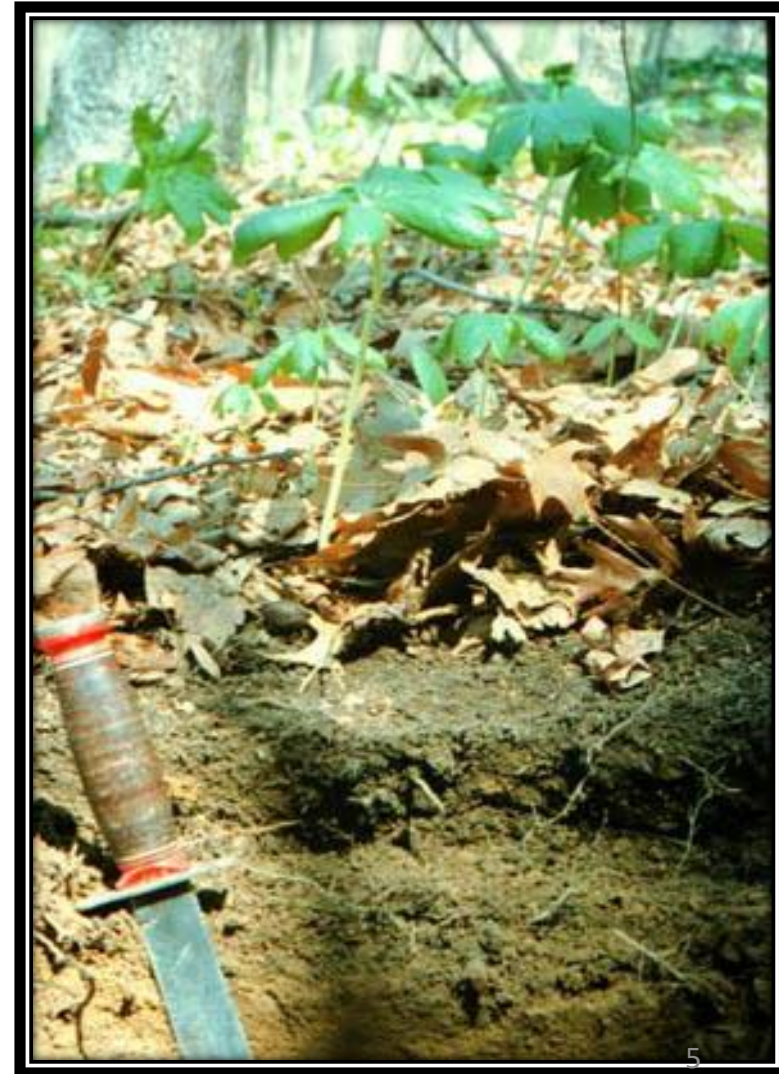


Soil Organic Matter

- All living organisms (microorganisms, earthworms, etc),
- Fresh residues (old plant roots, crop residues, recently added manures),
- Well-decomposed residues (humus).
- The SOM content of agricultural topsoil is usually in the range of 1 to 6%.
- This amount is the result of all additions and losses of SOM that have occurred over the years.
- Non-cultivated soils will have SOM ranges between 3-10%

Fresh Residues

- Up to 15% of organic matter is fresh residue (usually <10)
- Comprised mainly of litter fall
- Many of the different types of plant litter can be recognized.

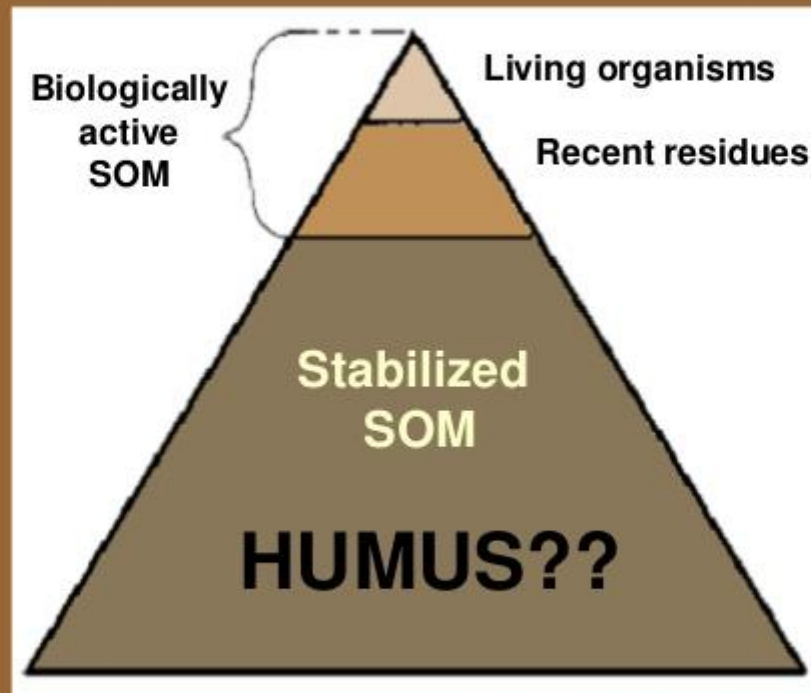


Decomposing Organic Matter

- Plant material is transformed from one organic compound to another mainly by organisms in the soil
- Organisms create by-products, wastes, and cell tissue
- Compounds released as waste by one organisms can often be used as food by another



SOM is a complex mixture



Adapted from Magdoff and Weil (2003)

HUMUS

- It refers to decomposed organic residues which have undergone a series of degradation.
- The humic substances consist of a series of highly acidic, **yellow to black**, high molecular weight compounds: humic acid, fulvic acid, and humatmelanic acid.

Humus

slowly decomposing residue of soil organic matter

- chiefly fibrous vegetation, decomposed gradually by active micro-organisms into a black, colloidal material that coats soil particles.
- it has a high CEC.

Stable Organic Matter -Humus

Newly-formed humus=

- a) combination of resistant materials from the original plant tissue,
- b) compounds synthesized as part of the microorganisms' tissue which remain as the organisms die. (Fulvic and Humic Acid)
humus is mostly resistant to further microbial attack- N and P are protected from ready solubility

Function of Humus

1. Holds water and nutrients
2. Sticks together
3. Strong crumb structure & thus reduce soil erosion
4. Provides some nutrients (N & P)
5. Buffers effects of pesticides
6. Humus decomposes at the rate of 2.5% per year
7. Creates good soil "Tilth"
8. Coates the sand, silt, clay particles making them dark and the darker the color, the greater the amount of soil humus present.

How does Organic Matter Improve Soil?

By:

- ❖ increase water holding capacity
 - ❖ nutrients attach to O.M.
 - ❖ O.M. improves tilth (aggregate)
-
- The amount of humus in soil is directly proportional to the amount of nitrogen in soil
 - Soils high in O.M. are easily worked and may be described as having good tilth.

Benefits of Organic Matter

- Promotes granulation of soil by binding soil particles into granules.
- Makes clay soils less sticky and improve tilth.
- Deeper root growth, water entry and storage are improved as well as aeration of the soil.

Carbon transformation




What Is Carbon?

- An element
- The basis of life of earth
- Found in rocks, oceans, atmosphere

Carbon Cycle

- The same carbon atoms are used repeatedly on earth.

Earth  Atmosphere.



Plants Use Carbon Dioxide



- Plants pull carbon dioxide from the atmosphere and use it to make food photosynthesis.
- The carbon becomes part of the plant (stored food).

Animal Eats Plants

- When organisms eat plants, they take in the carbon and some of it becomes part of their own bodies.



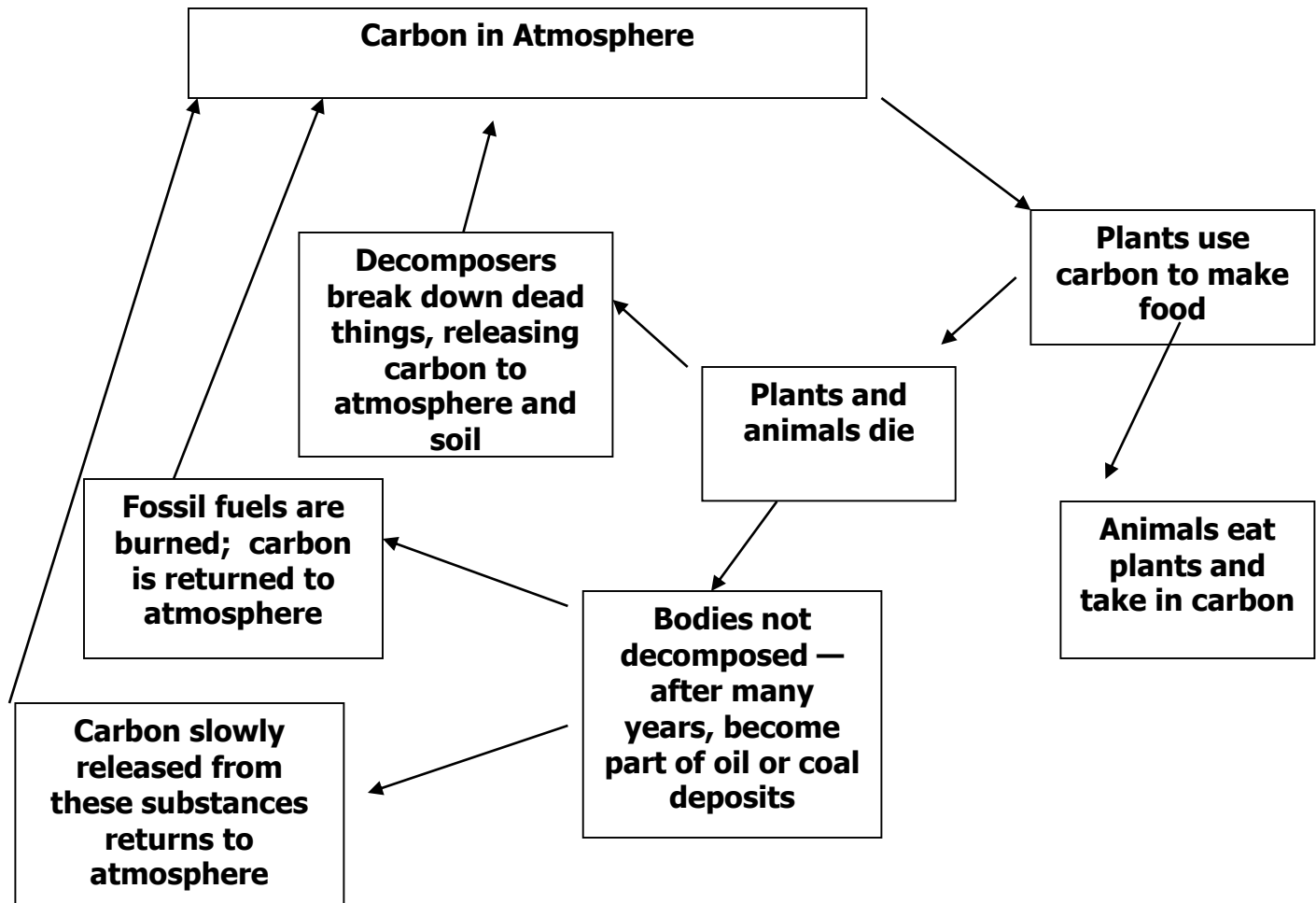
Plants and Animal Die

- When plants and animals die, most of their bodies are decomposed and carbon atoms are returned to the atmosphere.
- Some are not decomposed fully and end up in deposits underground (oil, coal, etc.).

Carbon Slowly Returns to Atmosphere

- ❖ Carbon in rocks and underground deposits is released very slowly into the atmosphere.

This process takes many **years**.



Carbon Cycle Diagram

Thanks for BEARING