



*What is Compost?*  
*Composting Biology and Core*  
*Principals*

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# *Compost: definition*

- ✦ “An accumulation of decaying or decayed organic matter, as from leaves and manure, used to improve soil structure and to provide nutrients.”
  - Decay is a biological process (not a chemical process)

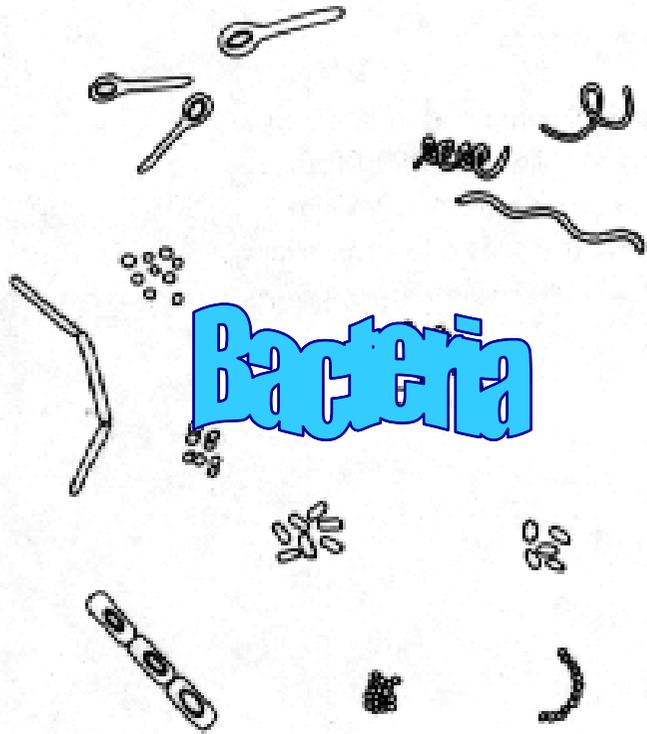
- 
- Backyard Composting
  - Vermicomposting
  - Thermophilic Composting

*Not all composts are created equal.*

# *Thermophilic composting*



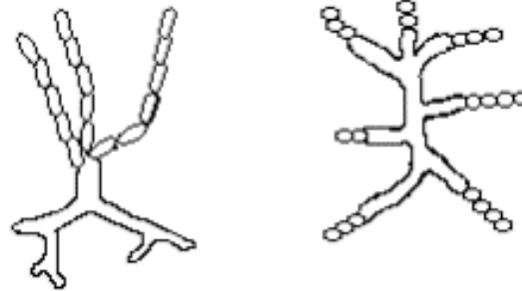
# *Compost microorganisms*



**Bacteria**



**Actinomycetes**



**Fungi**

# *Aerobic processes*

**Microbes,  
Carbon, &  
Oxygen**

**Carbon  
Dioxide,  
Water,  
Compost,  
& *Heat***

**Respiration**



# *Thermophilic composting*

- ✦ Microbes tend to specialize in the temperatures they prefer.
- ✦ In California soils and in our bodies mesophiles are most abundant. Pathogens are mesophiles.
- ✦ Between 110°F and 155°F, thermophiles dominate.
- ✦ Above about 160°F die off begins.
- ✦ Reliable pathogen kill occurs above 131°F.
- ✦ Heat greatly accelerates microbial efficiency.

# *Thermophilic composting*



# *Why compost?*

# Active Composting

- ✦ **To eliminate disease organisms**  
*Animal • Plant • Human*
- ✦ **To produce a stable and safe soil amendment**  
*Nutrients • Odors • Phytotoxins*



# *Carbon*

- ✱ **Source of energy for microbes**
- ✱ **Not all forms are equally available**
  - **lignin (less available)**
  - **cellulose**
  - **fats, waxes, proteins**
  - **sugars (more available)**

C



C

# *Nitrogen*

- ✦ **Vital nutrient for microbes**
- ✦ **Needed for protein synthesis**
- ✦ **Excess may volatilize as ammonia (NH<sub>3</sub>)**
- ✦ **Other nitrogenous compounds can be odiferous**
- ✦ **Also important for plants**
- ✦ **C:N ratio**
  - **initially about 35:1**
  - **about 10:1 to 20:1 in cured product**

N

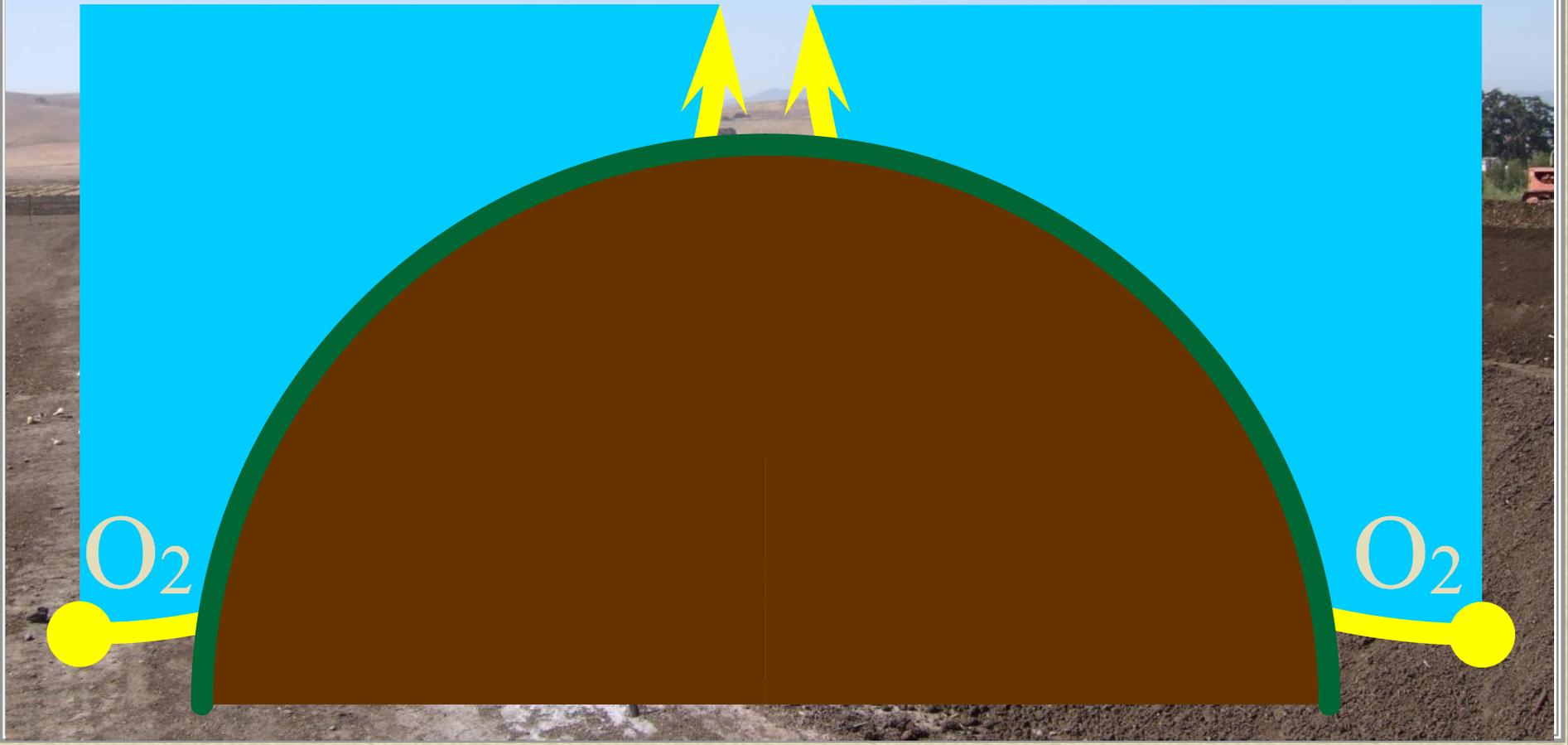


# *Oxygen*

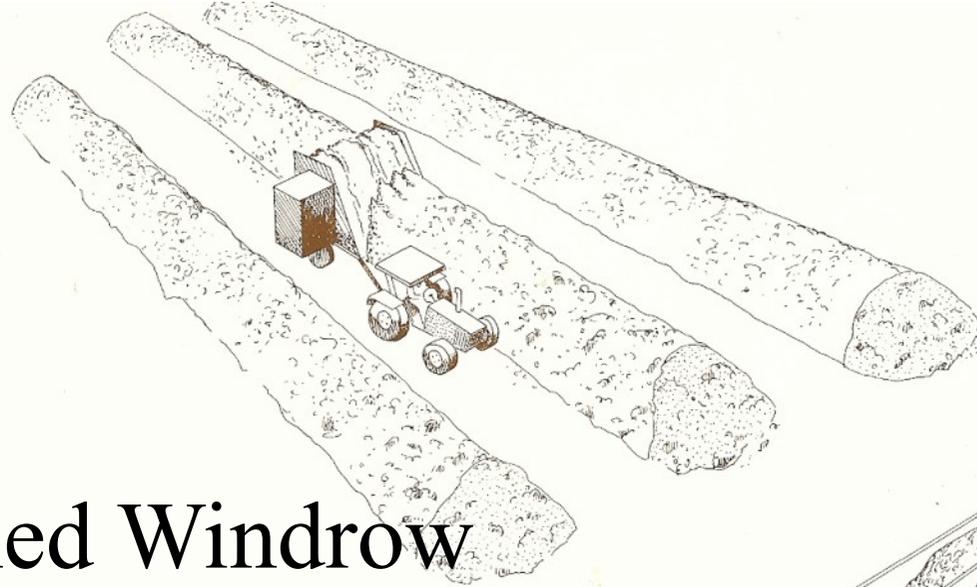
- ✦ **Acts as an electron acceptor**
- ✦ **Permits efficient liberation of *energy* from carbon**
- ✦ **Energy is used by microbes to grow and reproduce**



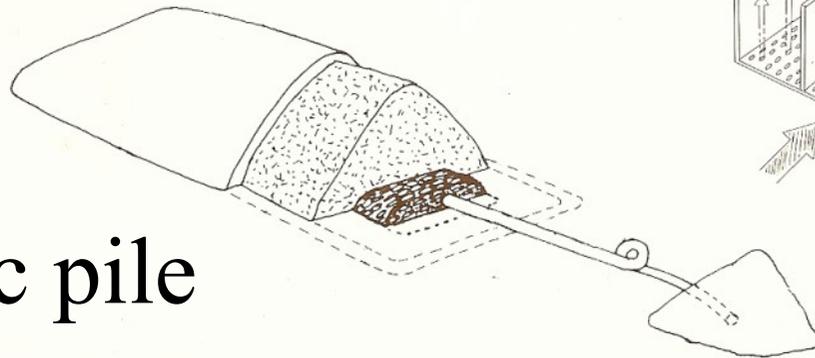
# *Oxygen: turned windrow*



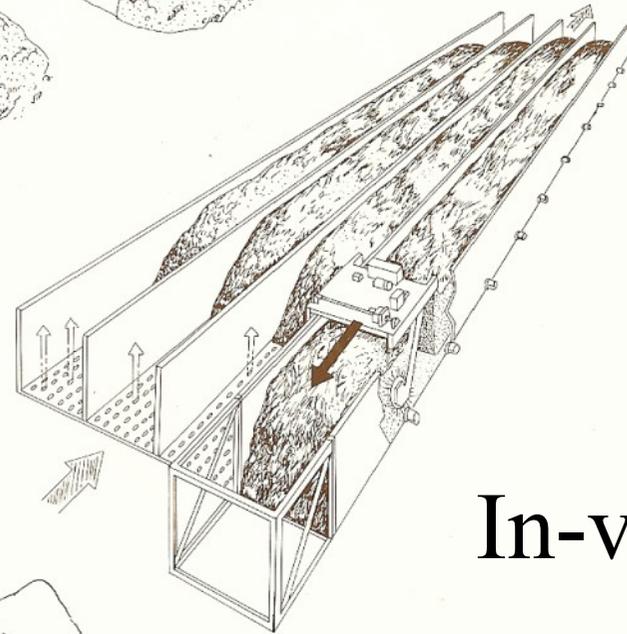
# *Composting alternatives*



Turned Windrow



Static pile



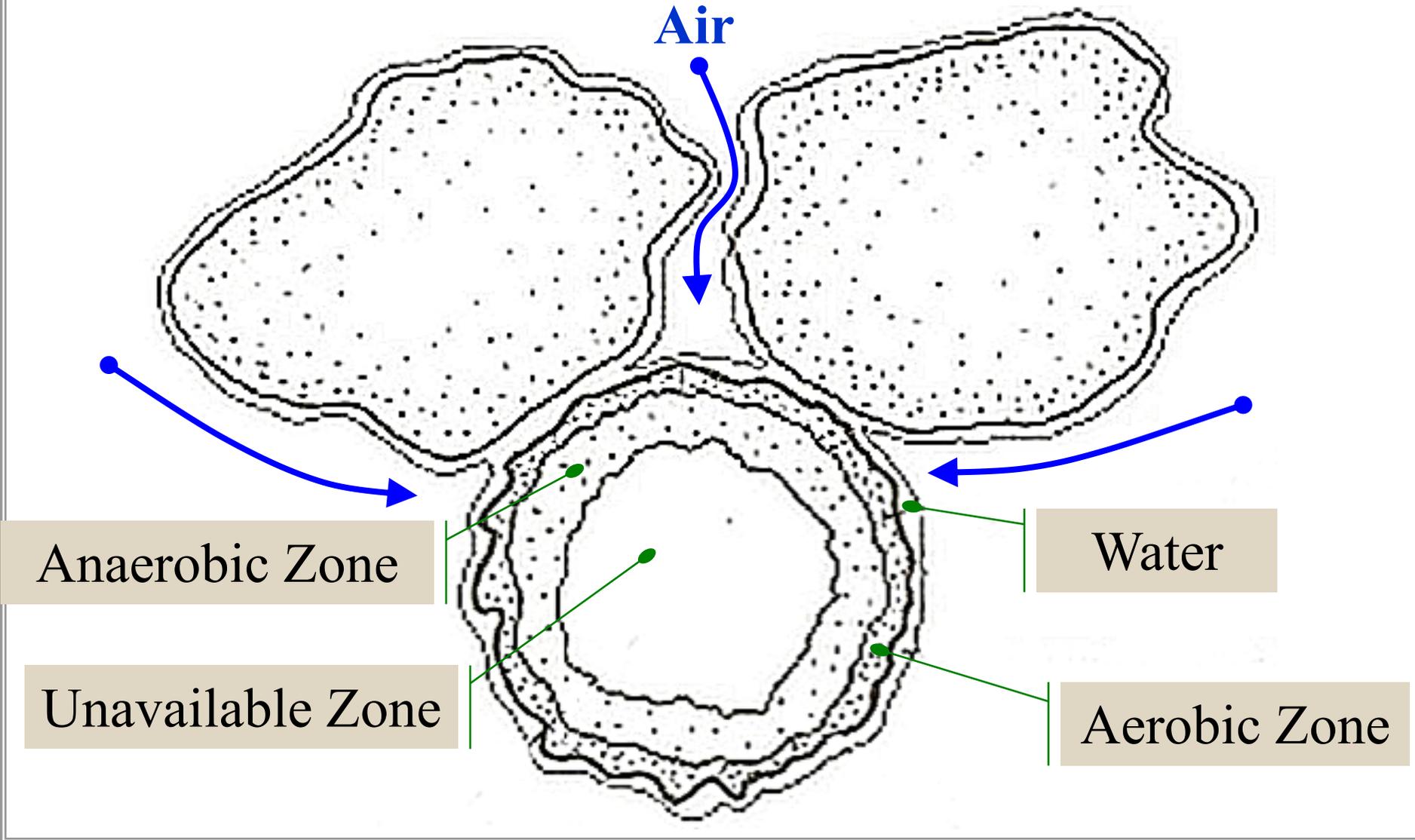
In-vessel

# *Water*

- ✦ **Clings to compost particles**
- ✦ **The bath within which microbes grow**
- ✦ **Too much fills pores**
- ✦ **Oxygen moves slowly into water**

H<sub>2</sub>O

# *Compost particle environment*



## *The previous slide shows anaerobic and aerobic soil particles*

- ✦ The illustration shows air and water flowing easily through the uppermost compost particles.
- ✦ The bottom particle is noted to be water logged.
  - The outer layer is noted to be aerobic
  - The inner layer is noted to be anaerobic
  - The center is noted as the “unavailable zone.”

# *Management parameters*

✧ **Particle  
Size**

✧ **H<sub>2</sub>O**

✧ **O<sub>2</sub>**

✧ **Porosity**

✧ **C:N ratio**

# Soil fauna

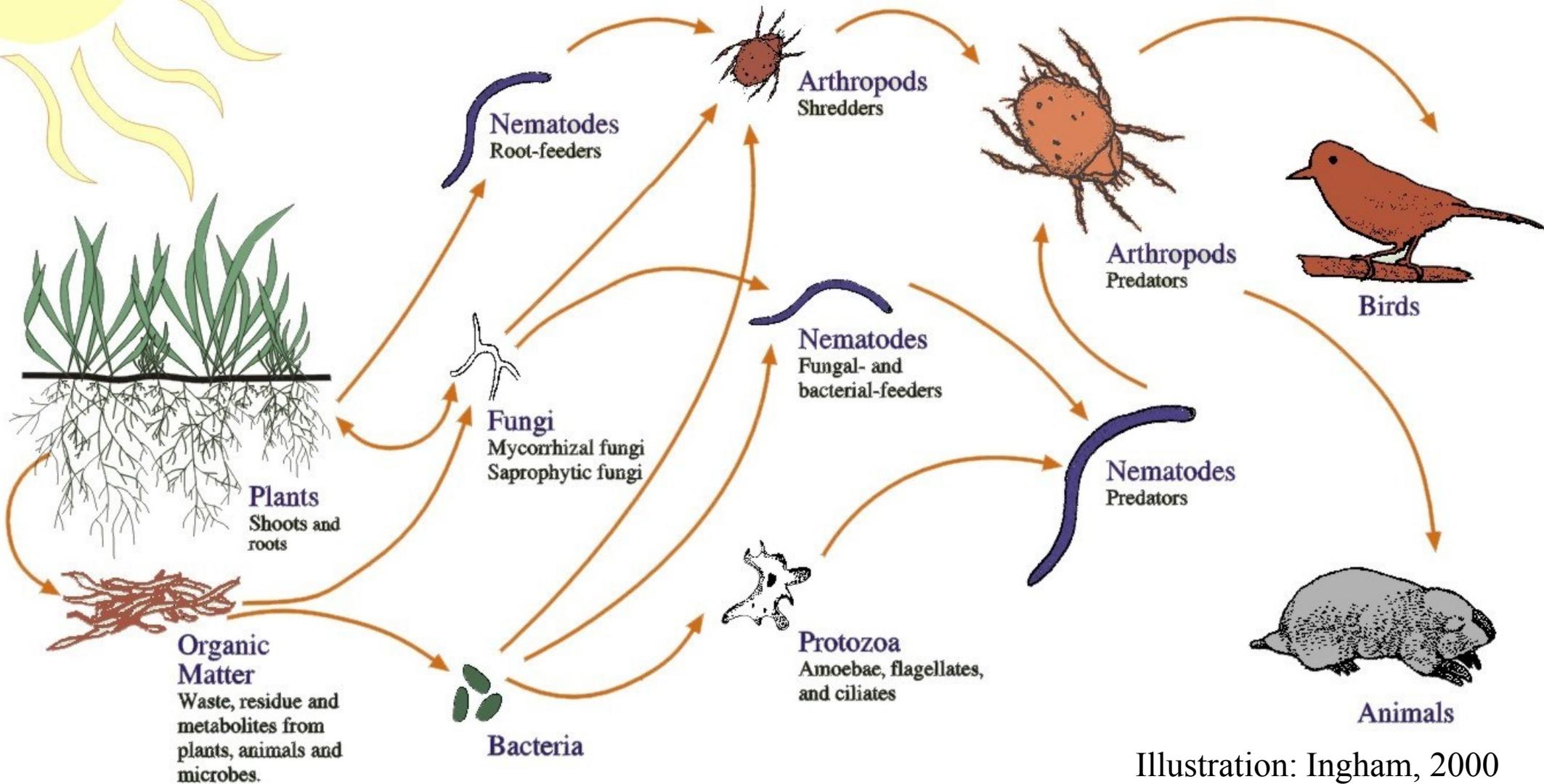


Illustration: Ingham, 2000

## *The previous slide presents an illustration of soil fauna components*

- Plants – shoots and roots
- Organic matter – waste, residue and metabolites from plants, animals and microbes.
- Fungi – Mycorrhizal and Saprophytic fungi
- Bacteria
- Protozoa – amoebae, flagellates, and ciliates
- Nematodes – root feeders
- Arthropods – shredders
- Nematodes – fungal and bacterial feeders
- Nematodes – predators
- Arthropods – predators
- Birds
- Animals

Illustration – Ingham, 2000

# *Bacteria and fungi*

- ✦ Bacteria are much smaller than fungi
- ✦ Both decompose composts in the soil

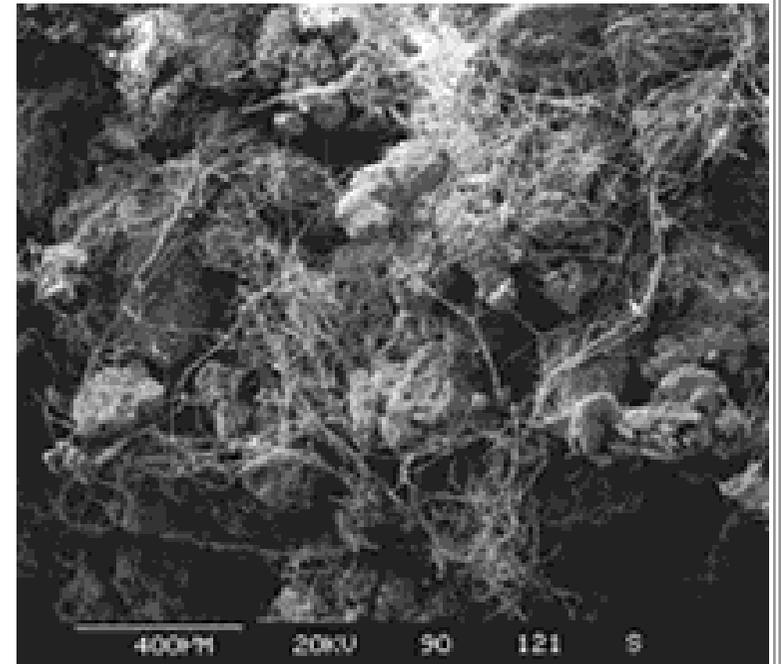
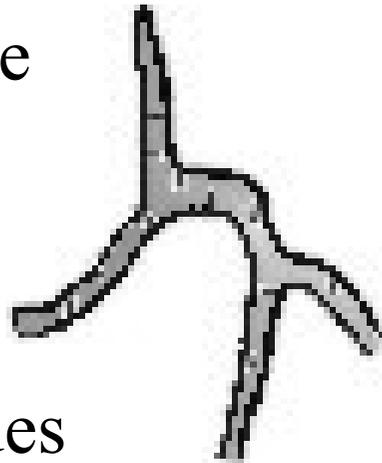




# *Compost in soil*

- ✦ Encourages the formation of soil aggregates
- ✦ Aggregates are soil clusters held together as a result of compost decomposition

- Fungal hyphae bind particles together
- Bacterial polysaccharides serve as glue



# *Aggregates*

- ✦ Aggregates soils are said to have “good structure”
- ✦ Aggregated soils
  - Hold water while allowing air to penetrate
  - Facilitate drainage and salt removal
  - Allow roots to penetrate
  - Are more stable, resisting erosion
    - Sheet
    - Rill



# *Conclusions*

- ✦ The composter's success in managing the process will determine
  - Product quality
  - Product consistency
- ✦ Consistent quality increases demand for composts
- ✦ Composts improve soils



Questions?





*Compost*  
*types and uses*

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*Mulches:  
cover the soil*

✦ Higher C:N ratios

✦ Larger particles sizes

✦ Low trash levels

✦ Maturity less important

# *Soil amendments: modify soil properties*

- ✦ Changes take time
- ✦ Soil properties are changes by
  - Compost particles
  - Formation of soil aggregates
- ✦ Salinity more likely to be a concern
- ✦ Maturity may be more important

# *Organic fertilizers: slow release*

- ✦ Compost nutrient content is usually not available immediately
- ✦ Important in long-term nutrient budgeting
- ✦ Low C:N ratios are better fertilizers

# *Conclusions*

- ✦ Mulches, soil amendments and organic fertilizers are uses, not products.
- ✦ Composts may serve any of these.
- ✦ Different composts have different properties, and will therefore be more suitable for some uses than for others.