What is Compost?

Composting Biology and Core Principals

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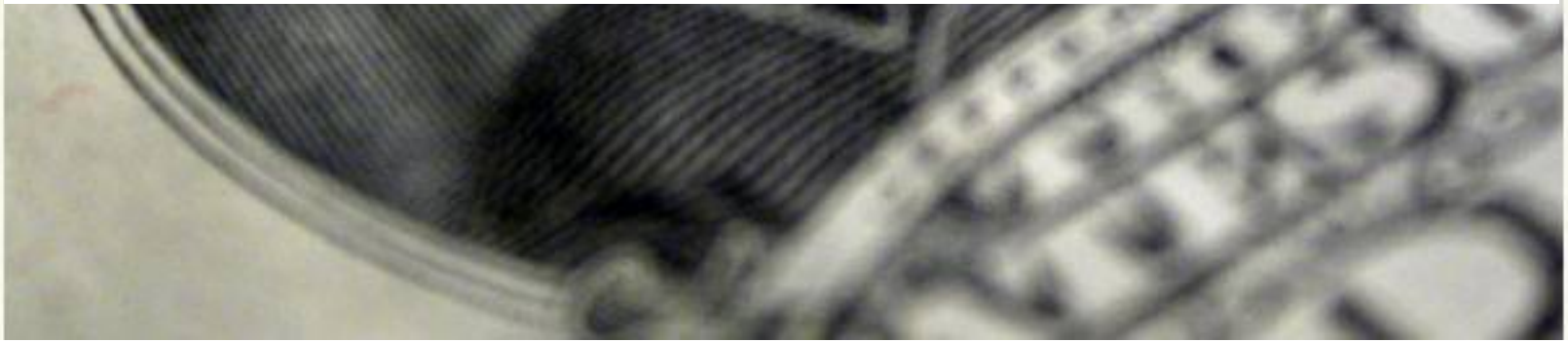
Compost: definition

- "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)
  - Properties determine what is a compost (not the production method)

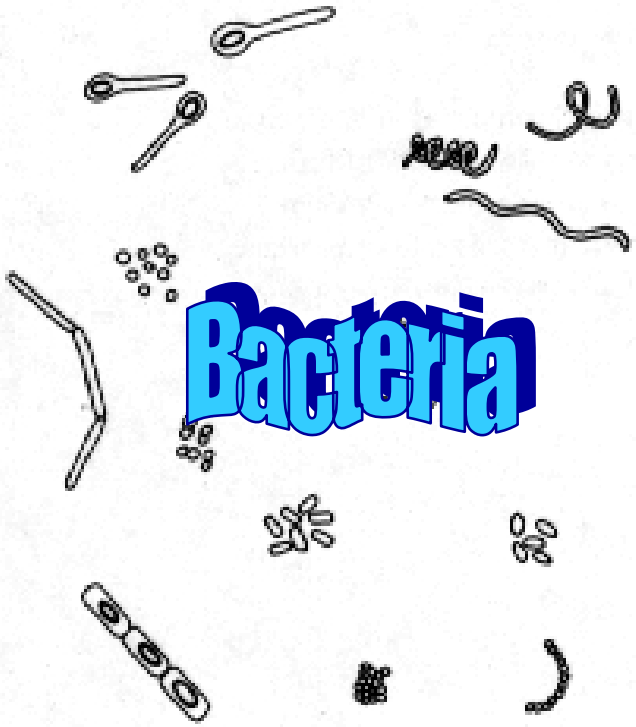
- Backyard Composting
- Vermicomposting
- Thermophilic Composting

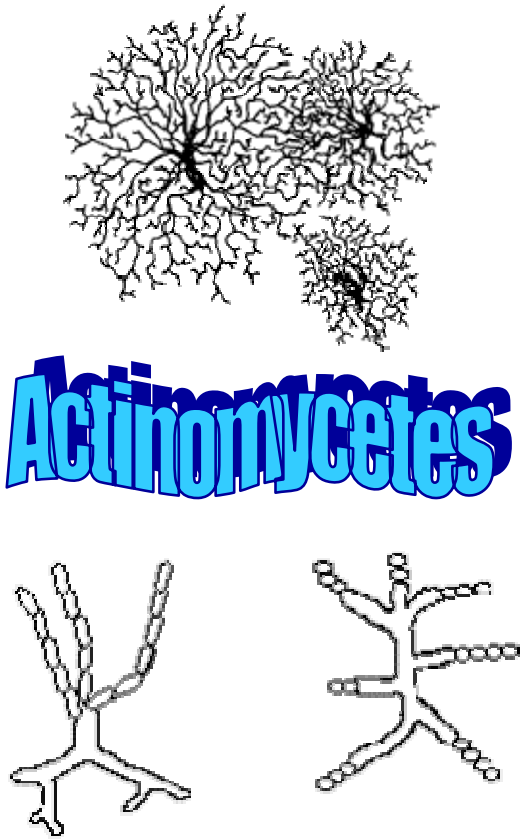


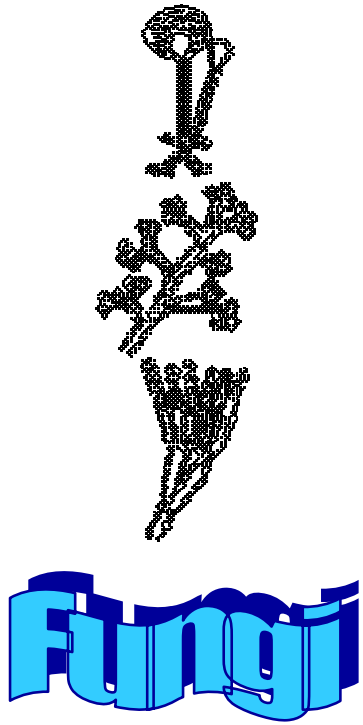
Not all composts are created equal.

Thermophilic composting

Compost microorganisms

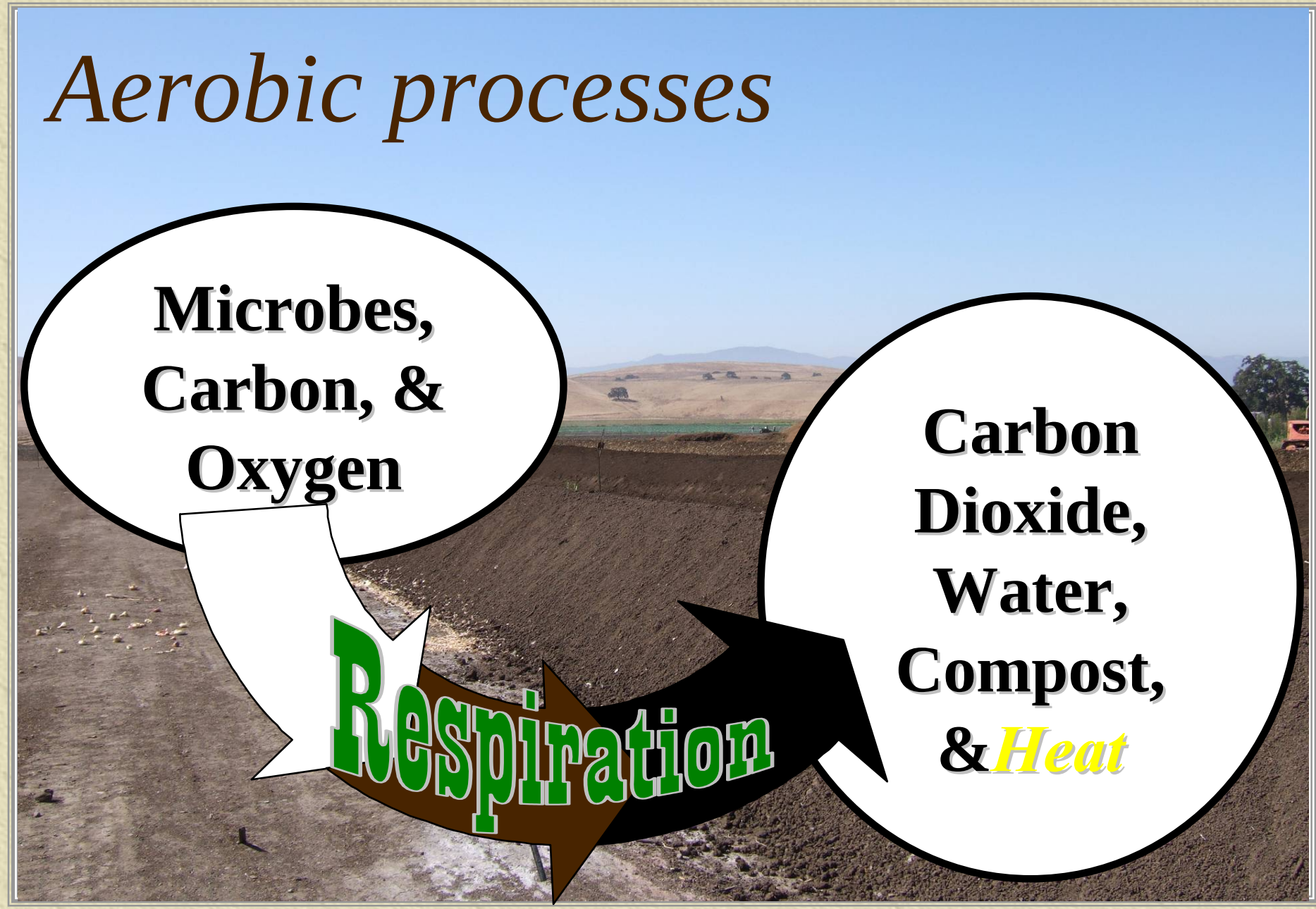






Illustrations: www.Digitalseed.com

Aerobic processes



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 dieoff begins.
- Reliable pathogen kill occurs above 131°F.
- Heat greatly accelerates microbial efficiency.

Thermophilic composting

Why compost?

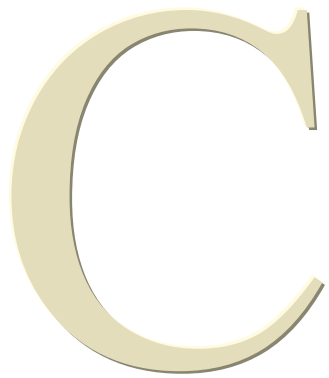
Active Composting

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

Curing

Carbon

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




C

Nitrogen

- **Vital nutrient for microbes**
- **Needed for protein synthesis**
- **Excess may volatilize as ammonia (NH_3)**
- **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**

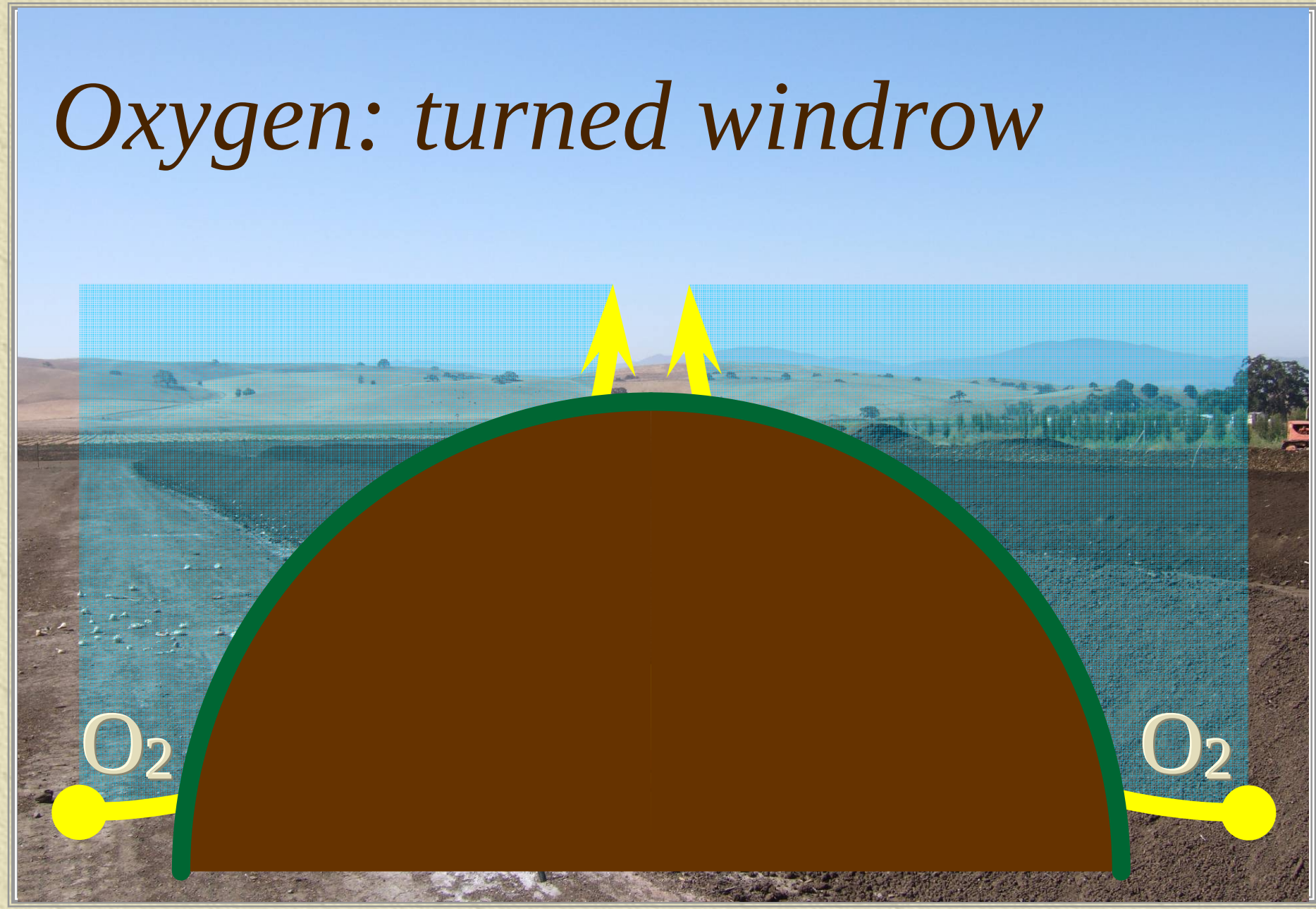
N


N

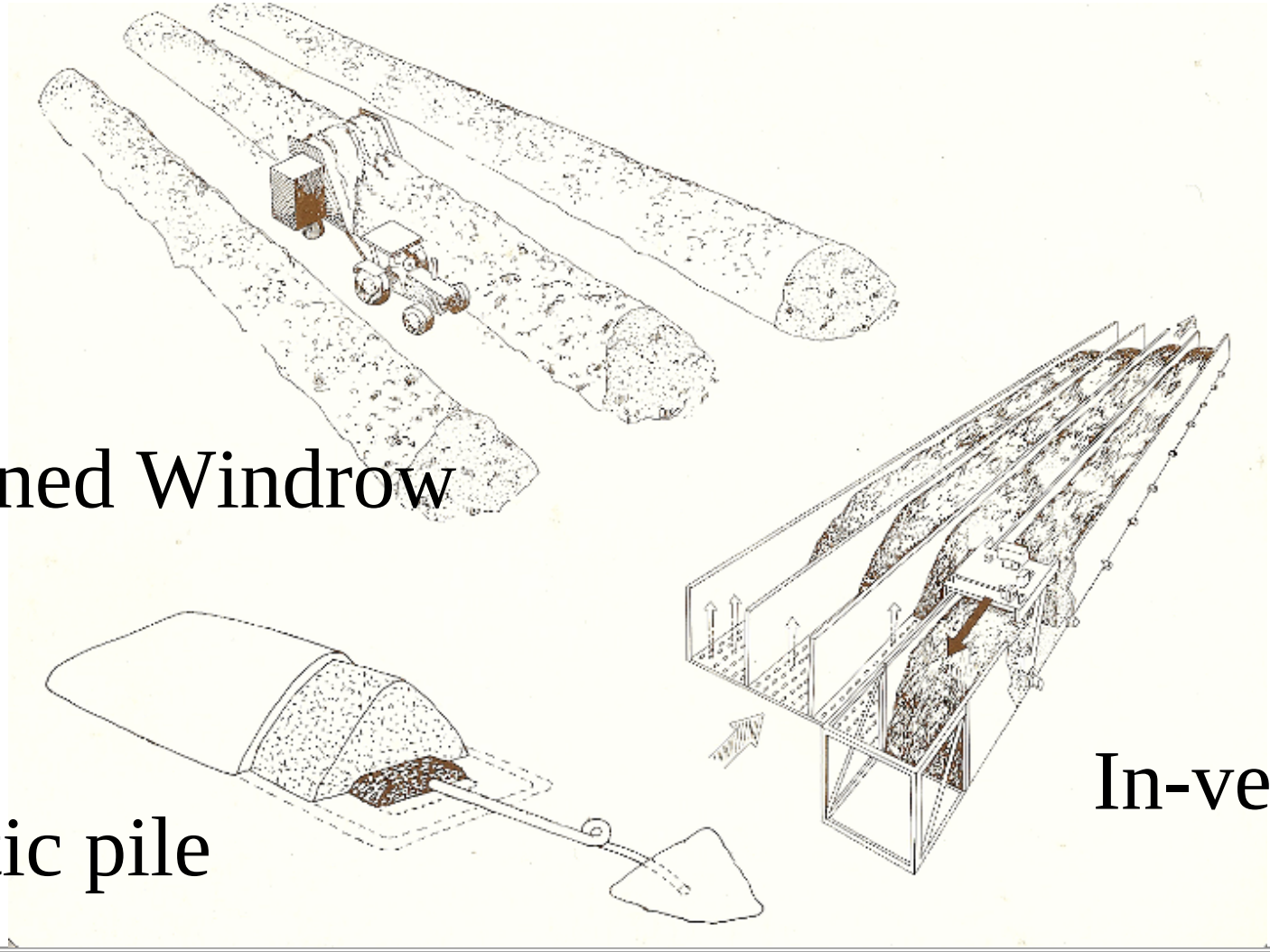
Oxygen

- **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

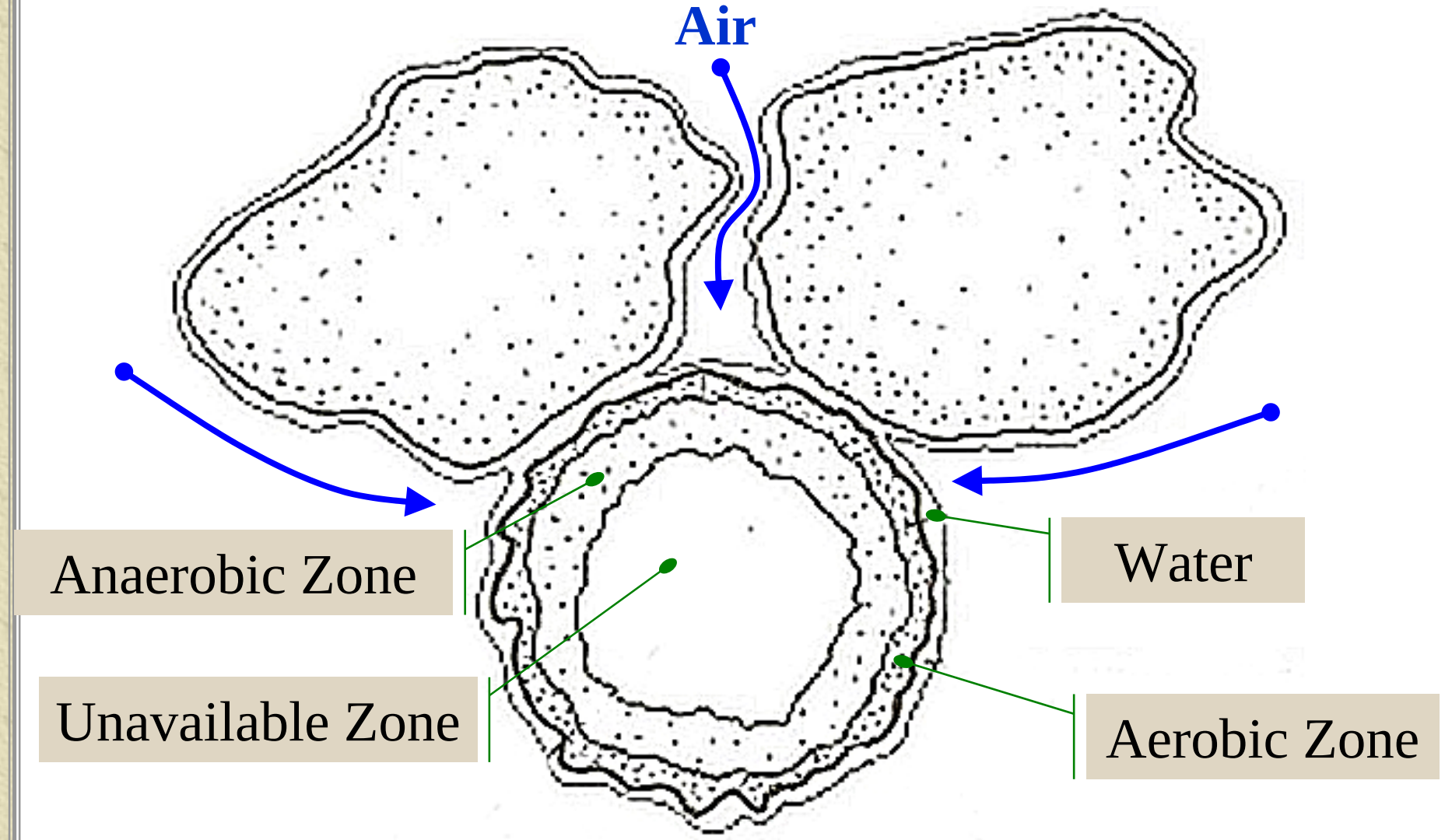
In-vessel

Illustration: Rynk et al. 1992

Water

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

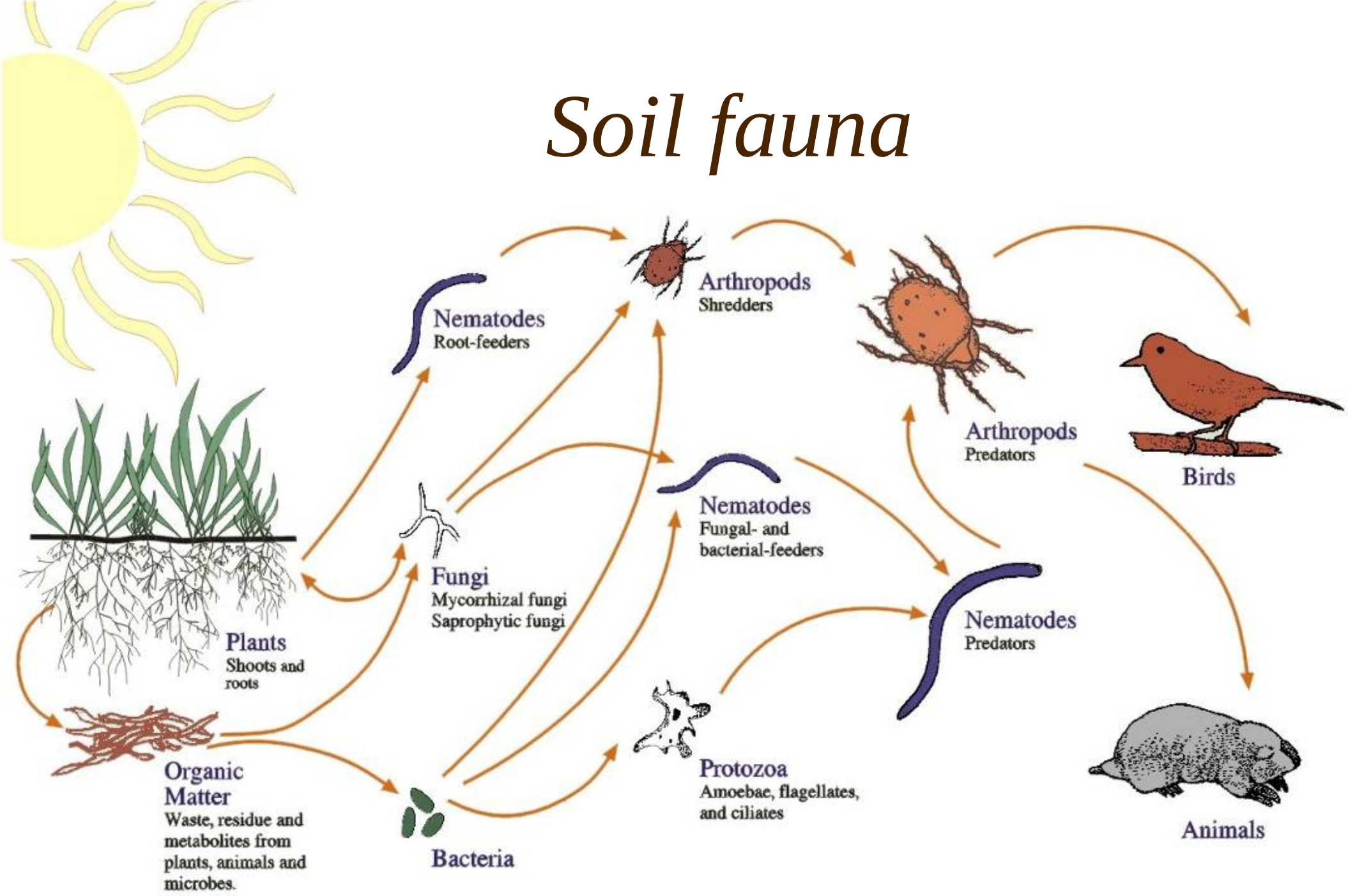
Compost particle environment



Management parameters

- **Particle Size**
- **Porosity**
- **C:N ratio**
- **H_2O**
- **O_2**

Soil fauna

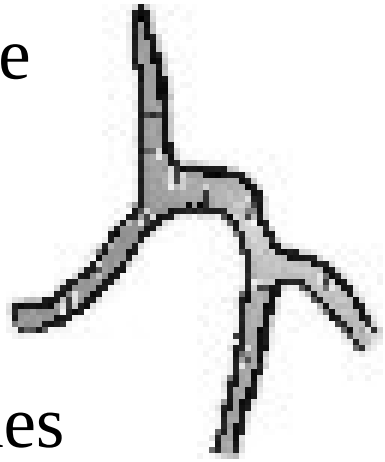

Nematodes
Root-feeders
Arthropods
Shredders
Arthropods
Predators
Birds
Nematodes
Fungal- and
bacterial-feeders
Fungi
Mycorrhizal fungi
Saprophytic fungi
Plants
Shoots and
roots
Nematodes
Predators
Organic
Matter
Waste, residue and
metabolites from
plants, animals and
microbes.
Protozoa
Amoebae, flagellates,
and ciliates
Bacteria
Animals

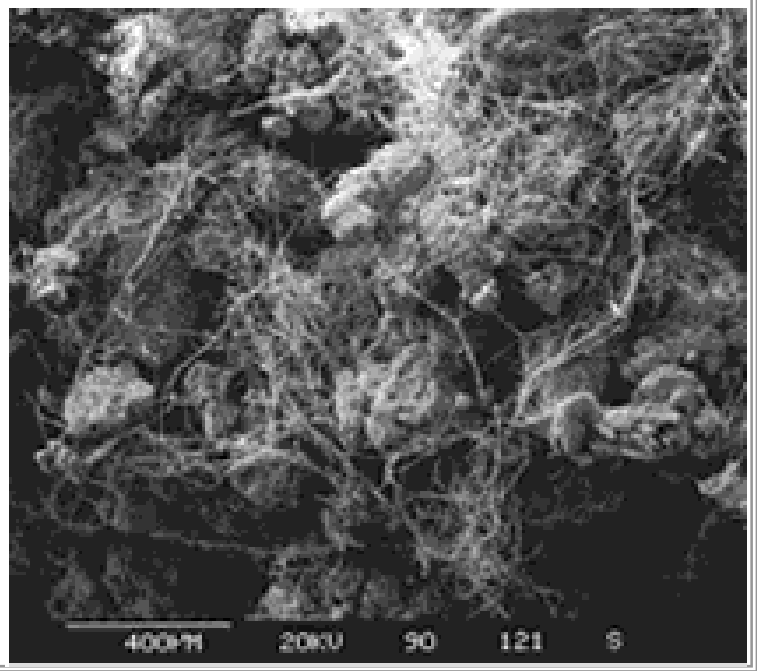
Bacteria and fungi

- 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

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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.