

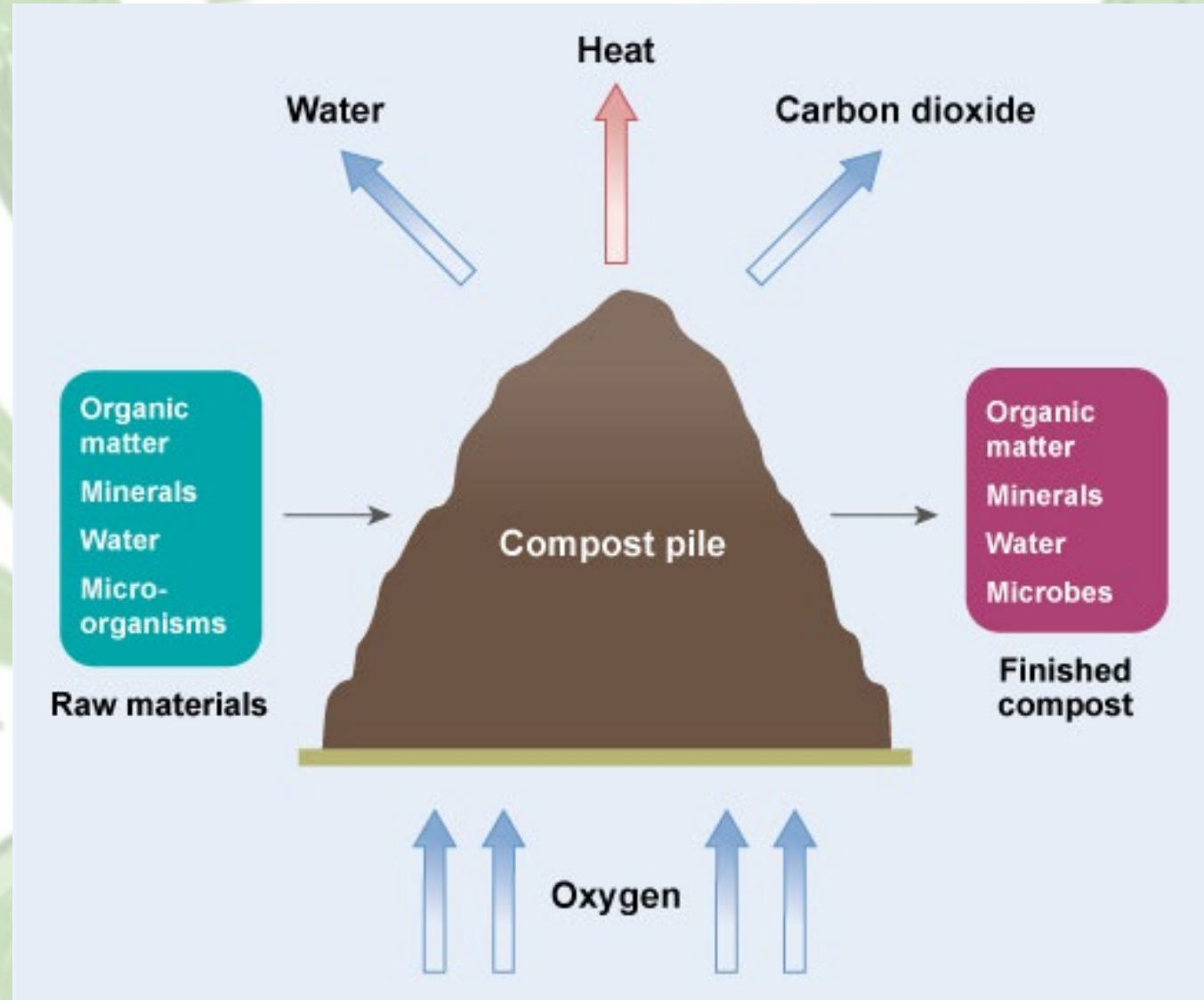
Module 03: What Happens in a Compost Pile



LSU AgCenter Home Composting Certificate Course

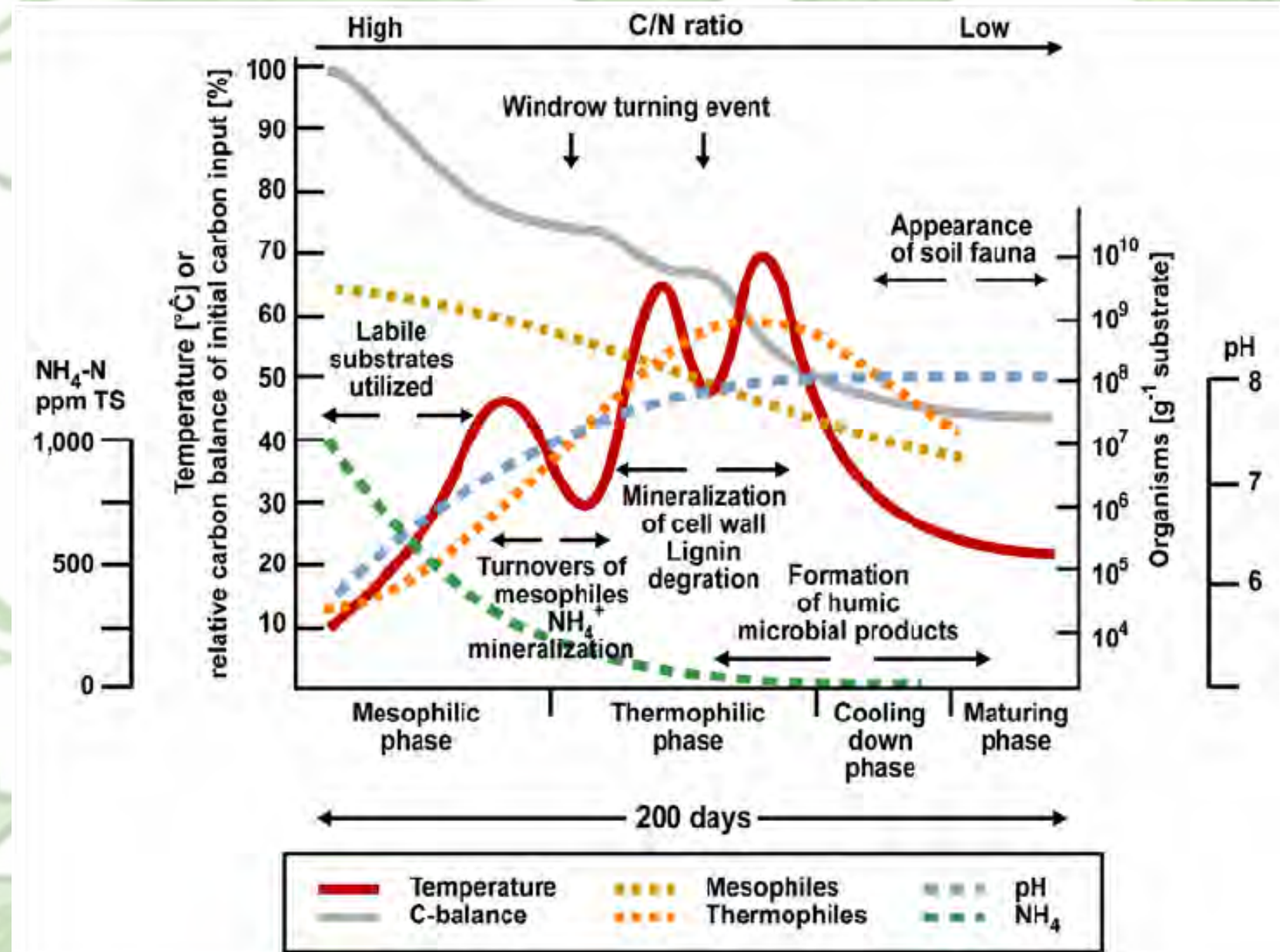
Dr. Joe Willis, Anna Timmerman & Chris Dunaway

Our Focus Will Be on Hot Composting



The Four Phases of Composting

1. Mesophilic phase
2. Thermophilic phase
3. Cooling phase or 2nd Mesophilic
4. Curing/Maturing phase



Phase One – Mesophilic Phase

- Prepared raw materials are combined
- Aerobic mesophilic organisms (such as bacteria, actinomycetes, fungi and protozoa) on the raw material or colonizers begin breakdown
- Mesophilic means medium-temperature loving organisms which will grow the best at temperatures between 68 and 113°F.
- Labile substrates like sugars and starch are oxidized first
- Thermal energy generated by microbes causes the pile to heat up to about 105°F

Phase Two – Thermophilic Phase

- As the temperature rises, mesophilic organisms die or form survival units
- Aerobic thermophilic organisms become active
- Thermophilic means heat-loving organisms which will grow best at temperatures between 110-176°F.
- Breakdown of proteins, fats, and complex carbohydrates like cellulose and hemicellulose
- Temperature rises to 130-150°F quickly (1-3 days)
- Decomposition is most rapid, can last for several days to several weeks
- At temperatures of >131°F, human and plant pathogens are killed as well as most seeds.

Phase Three – Cooling Phase

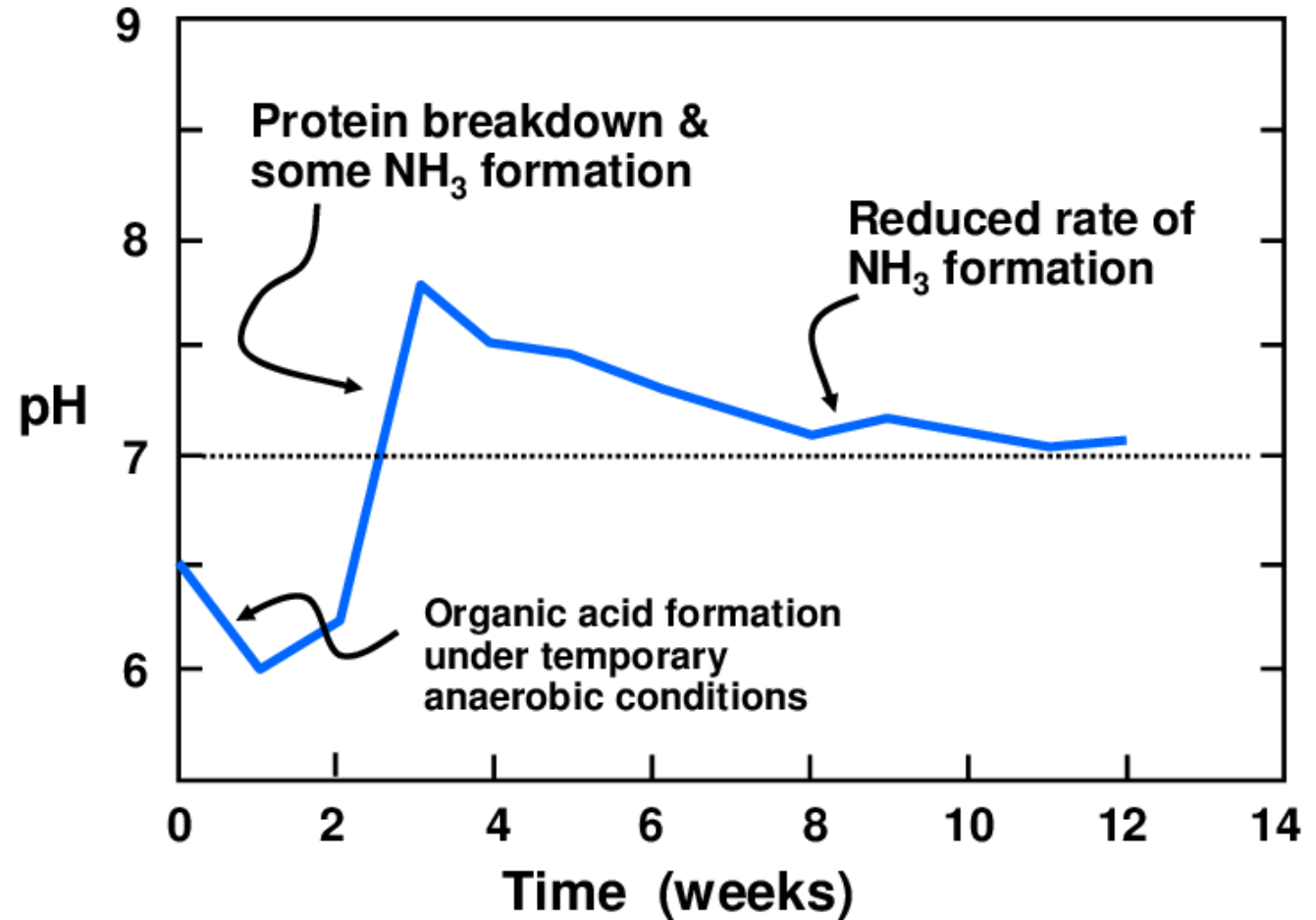
- Substrates are being depleted
- Activity decreases and therefore temperature drops
- Mesophilic organisms come to life or colonize the pile and get back to work digesting the more resistant organic materials.
- Fungi and macroorganisms such as earthworms and sowbugs that break the coarser elements down into humus also move back in

Phase Four – Curing/Maturing Phase

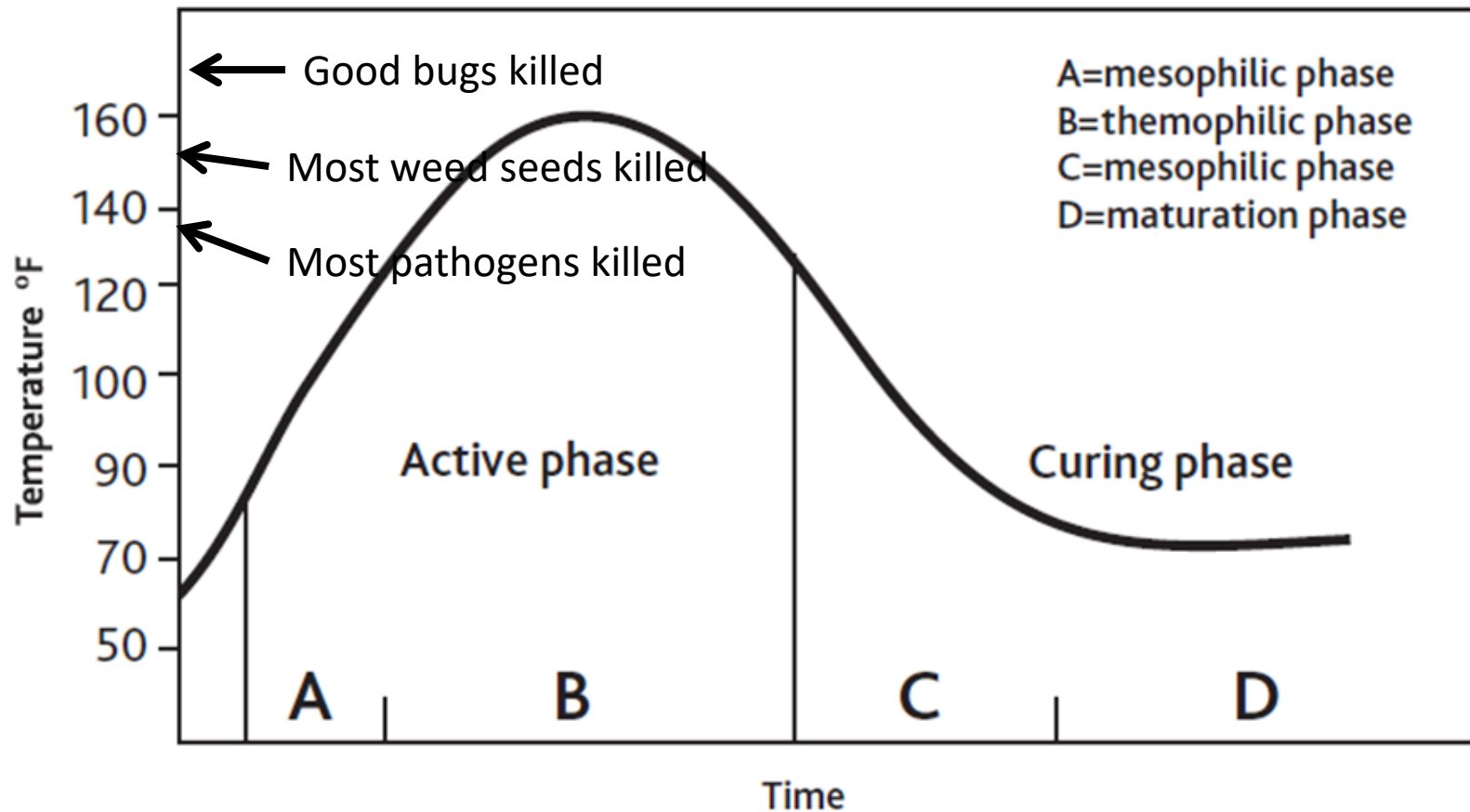
- Remaining materials continue to decompose at a much slower rate.
- Immature composts can contain high levels of organic acids, extreme pH values or high salts. With time, organisms in the pile are able to alleviate these conditions
- The longer the curing phase, the greater the number and diversity of organisms that the compost will contain
- There's still a lot of food in the pile. It takes months to break down some of the more resistant organic material in compost such as lignin.

Variation of pH During a Typical Composting Operation

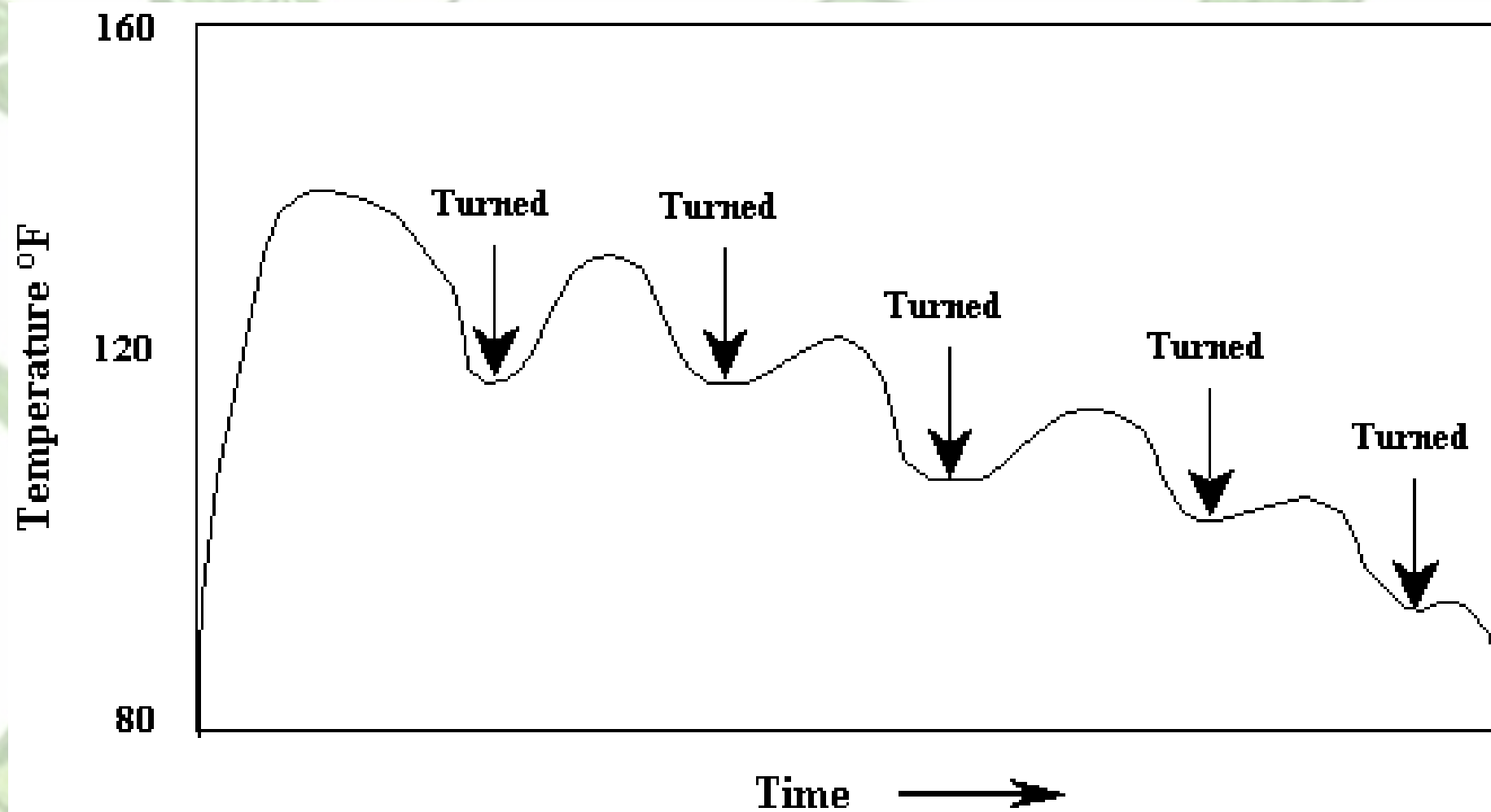
- Can initially drop to 4.0-4.5.
- Rises during thermophilic phase.
- Drops to 7.0-7.2 upon finish.



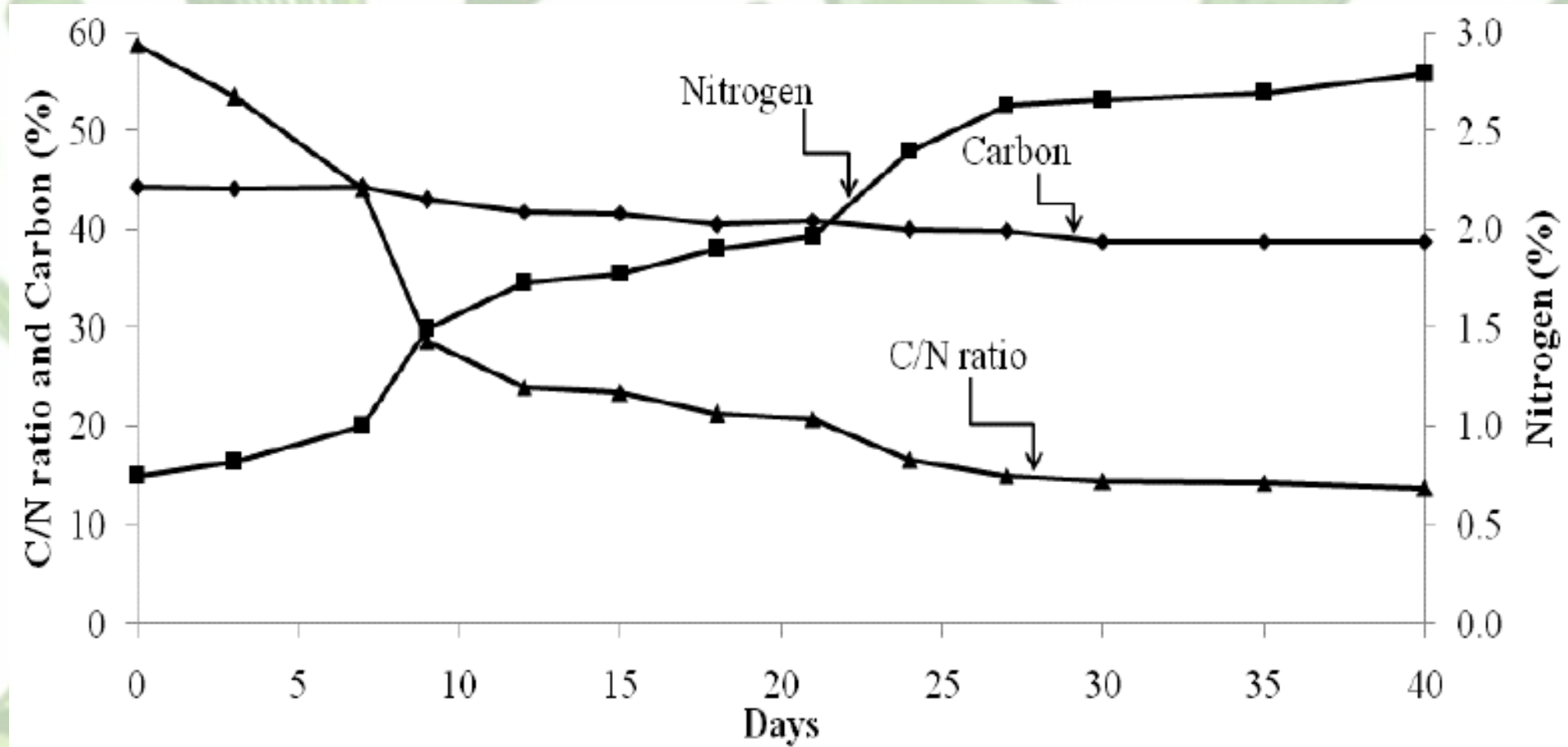
Variation of Temperature During a Typical Composting Operation



Typical Temperature Pattern in a Turned Compost Pile



Variation of C/N Ratio During a Typical Composting Operation





The Players

Bacteria

- Smallest living organisms
- 250,000 – 500,000 fit inside a period!
- 1 teaspoon soil has 100 million – 1 billion
- Consume simple carbon compounds
- 80-90% of microbes in compost pile
- Responsible for most of decomposition and heat generation in compost



Fungi

- Molds, yeasts, mushrooms
- Numerous during mesophilic phases
- When temperatures are high, most fungi live in outer layer of compost
- Break down tough organic debris
- Cellulose, hemicellulose, lignin
- Can decompose materials too dry, acidic, or low in nitrogen for bacterial activity



Actinomycetes

- Cause earthy smell
- Bacteria with filaments (resemble fungi)
- Look like gray spider webs
- Degrade cellulose, lignin, chitin, proteins
- Bark, woody stems, paper
- Live in wider range of pH than other bacteria
- Some species in thermophilic phase, others in curing phase



Protozoa

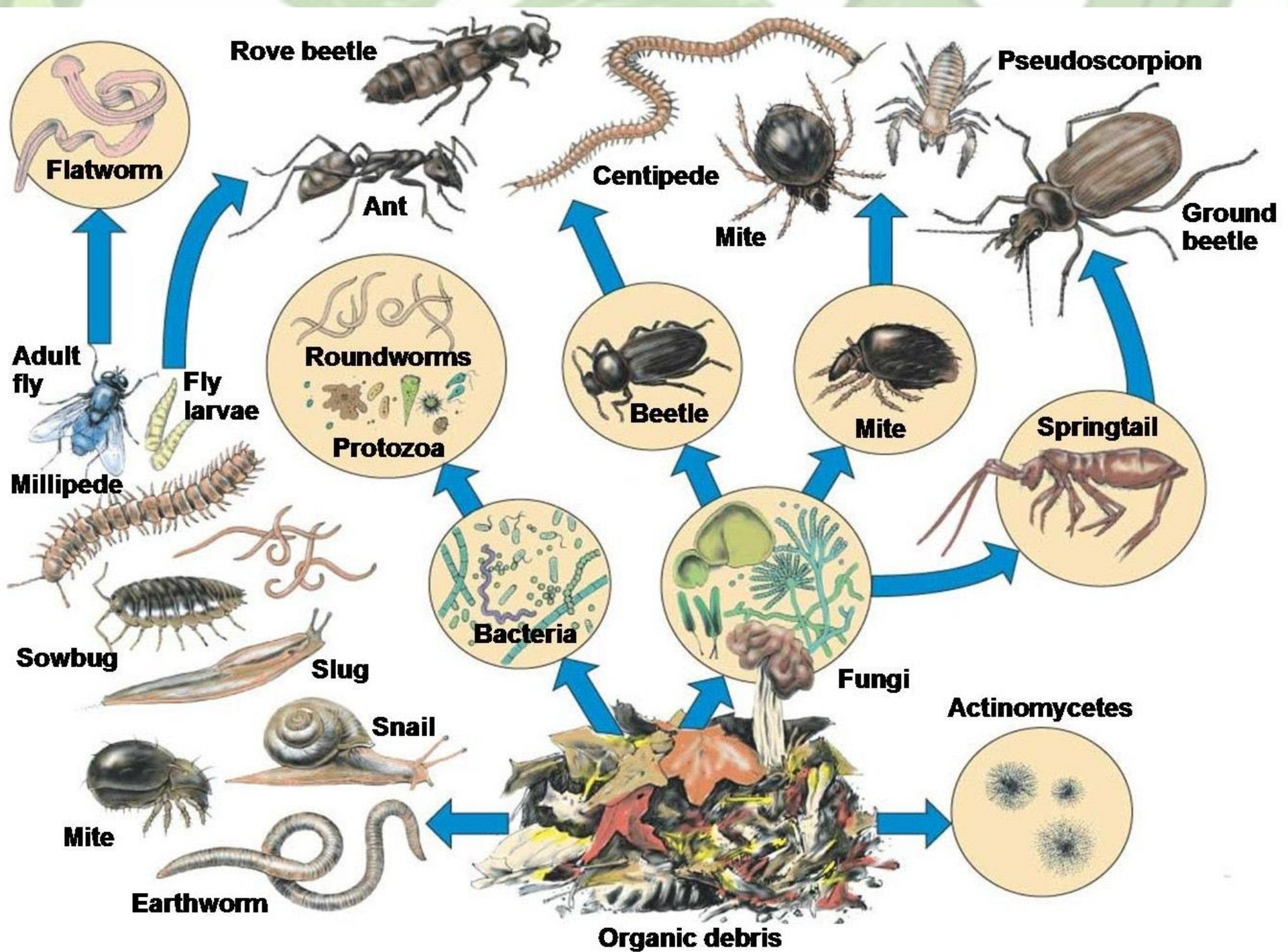
- One-celled microscopic animals
- Live in water droplets in compost
- Play minor role in decomposition
- Feed on organic matter, bacteria and fungi



Rotifers

- Microscopic multicellular organisms
- Also found in water drops in compost
- Also eat organic matter, bacteria and fungi







Please post all your questions and results to the message board .