

Maximizing the Value of Compost

How to build and maintain a healthy soil food web through the making and application of biologically robust compost.



Compost for Good

May 2, 2023



We
Compost
for
Good

Compost for Good

- Three individuals, John, Jen, and Katie, who are passionate about organics recycling on the community scale
- A project of AdkAction, a partner of ANCA (Adirondack North Country Association), a collaborator with many
- We work with individuals, businesses, and communities to turn waste into a resource
- While our focus is in NYS, we work with others throughout the US and other countries





Compost for Good

Our vision is a world in which humans positively impact the earth and its communities by valuing organic waste as a resource. Our mission is to support communities to adopt economically viable and ecologically resilient composting systems and processes through education, outreach, technical support, peer to peer connections, and research.

A different kind of farming

- Organic?
- Regenerative?
- Permaculture?
- Biological?

They all have one thing in common: they look to indigenous processes and knowledge for solutions.





How to know what's in the soil

With experience, you can tell a lot by the smell, feel, and look of soil. But to really know what's going on under our feet, soil testing is important.

- Traditional testing
 - Provides information about physical characteristics of soil
 - ex: pH, soluble salts, nutrient levels, % organic matter
- Testing under the microscope
 - Provides information about the life in the soil, and therefore a more accurate understanding at the health of the soil and the ability of the soil to grow crops, retain water, etc.



A Look Underground

- There is a greater amount of biomass underground than above ground
- Plants produce sugars and other compounds through photosynthesis
 - This is a very energy intensive process
- In some cases up to 50% of the sugars produced by a plant will be pumped through the roots and into the soil
 - Why would a plant do this?



Emerging Research

- We've learned about the importance of of microbes to human health
- We are now learning about the importance of microbes to plant health

There is a great deal that we still don't know.



The power of microbes

- One gram of soil is equivalent to approximately one teaspoon
- One gram of soil contains approximately **10^{12}** bacteria and miles of fungal hypha
- **10^{12}** is: 1,000,000,000,000
 - Or put another way: one trillion billion
- One gram of soil can contain tens of thousands of species of bacteria



Benefits of a robust soil microbiome

- Farmer prosperity
 - Decreased inputs as soils are better able to cycle nutrients
 - Increased outputs, as healthy soils support increased yields
- Water holding capacity
 - 1% increase in soil organic matter holds 17-25,000 gallons of water more per acre
- Carbon Sequestration
 - Carbon absorbed from the atmosphere and released to fungi can store a tremendous amount of long-term carbon
- Biodiversity and ecosystem health
 - Diverse and intact soil life is the foundation for all other life
- Human health
 - Healthy soils inhibit pests and disease, decreasing reliance on harmful pesticides and herbicides
- Community impact







Leaders in the field of biological farming

There are many, but here are two:

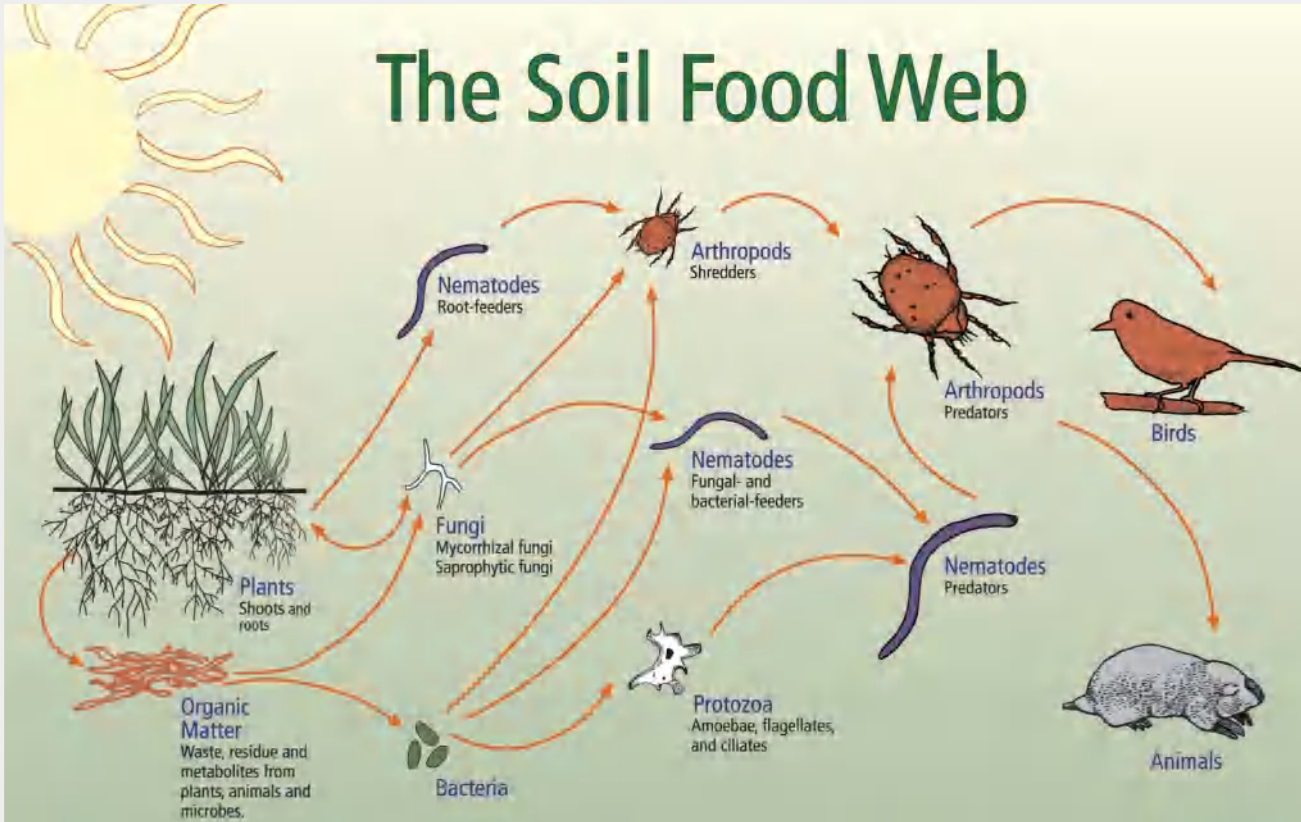


Dr. Elaine Ingham

- The Soil Food Web School
- Teaches people how to produce biologically complete compost
- And the importance of the the microbe/plant interactions



The Soil Food Web



First trophic level:
Photosynthesizers

Second trophic level:
Decomposers
Mutualists
Pathogens, Parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators

The Soil Food Web

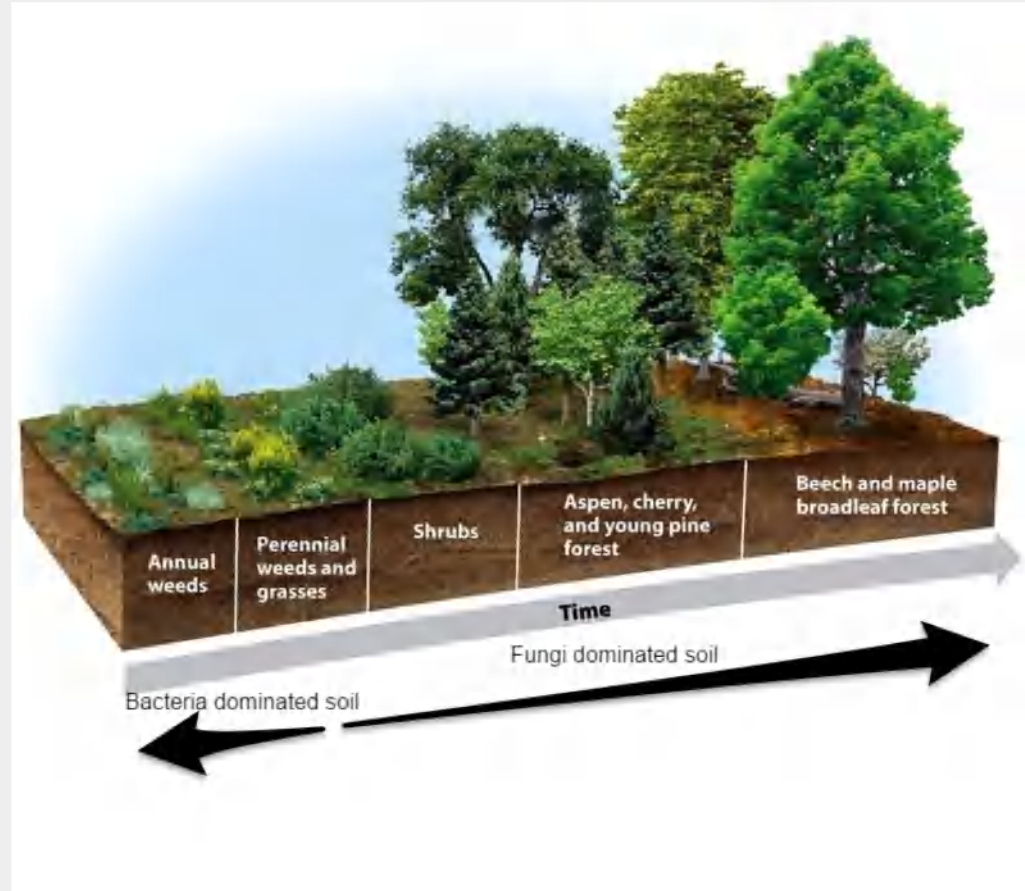
simplified

- Bacteria break down organic matter and minerals
- Fungi do the same
- Both produce glues that bind together soil particles
- Protozoa and nematodes eat each other and bacteria/fungi.
In the process, they release nutrients in a plant available form



Plant Succession

What about the difference in the soil microbiome in each of these cases, and how does that match your cropping systems?



Dr. David Johnson

- BEAM
 - Biologically Enhanced Agricultural Management





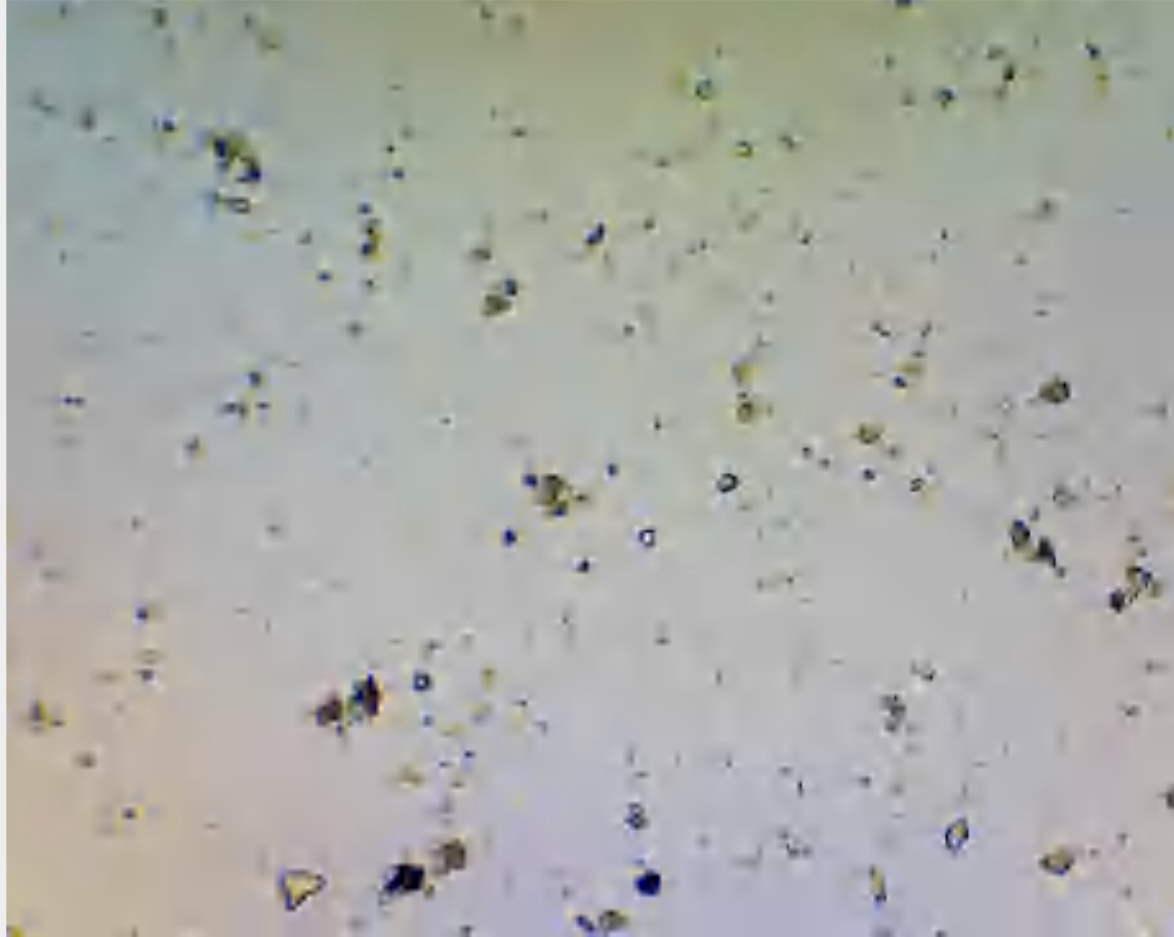
Bioreactor
Johnson-Su
Composteo

Soil Microbiology

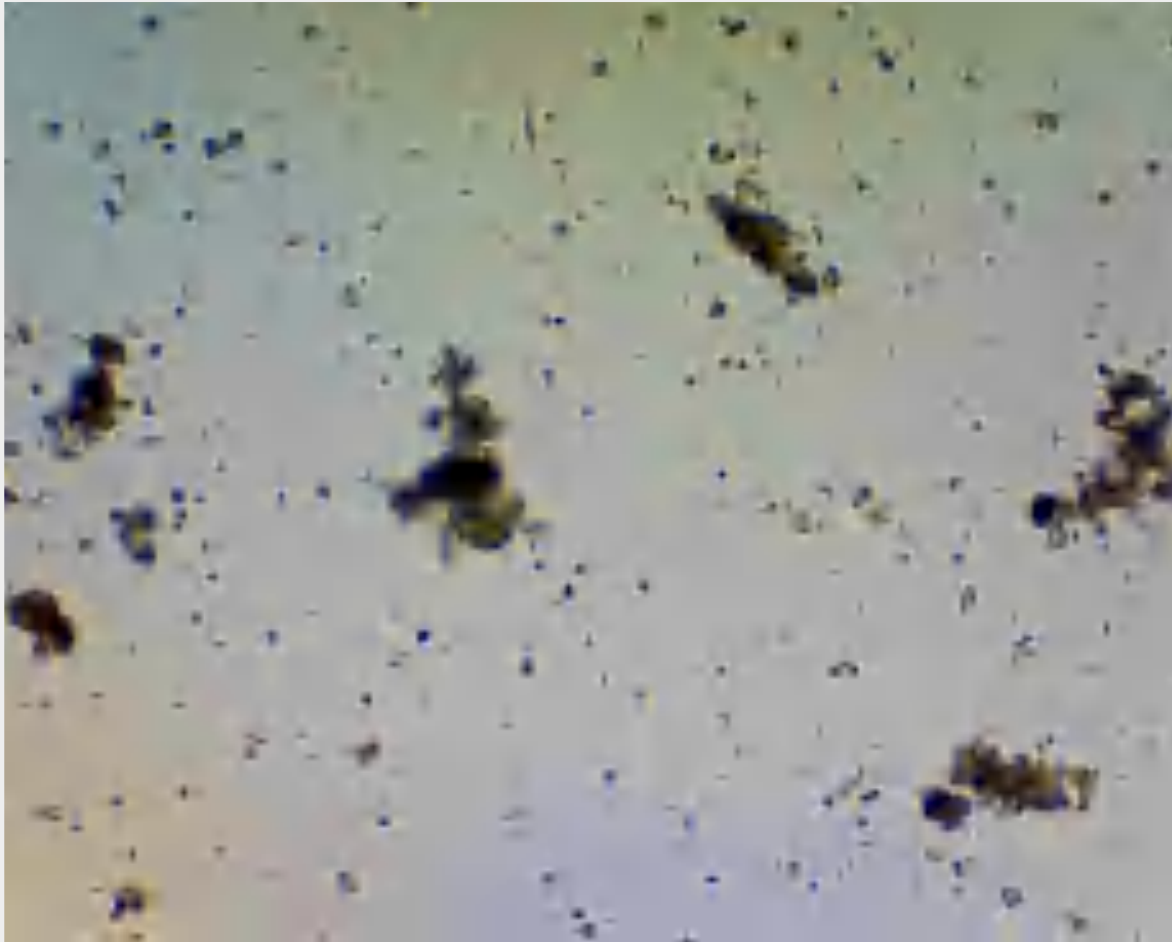
The stars in the process: bacteria, fungi, protozoa, nematodes,
and microarthropods



Bacteria



Bacteria in motion



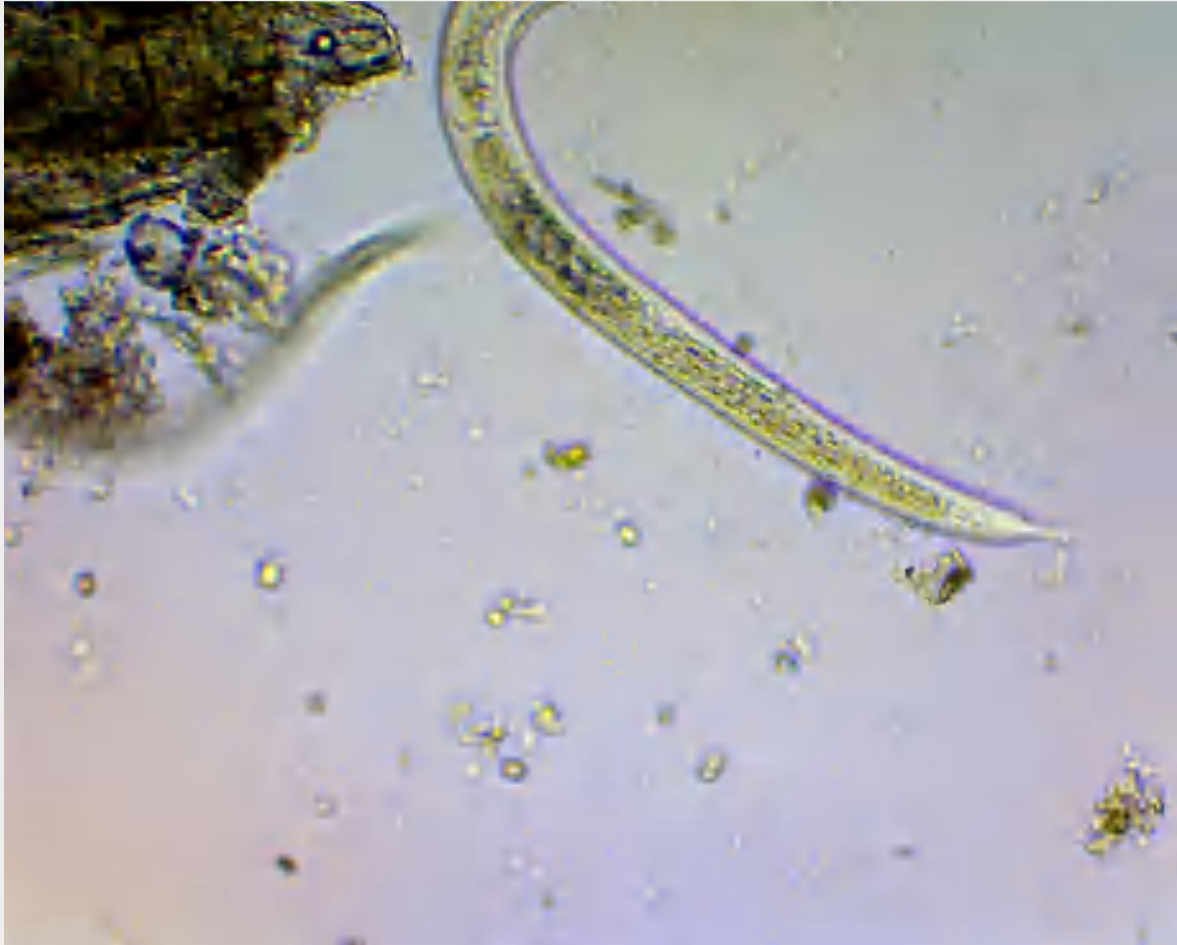
Fungi and Fungal Spores



Protozoa



Nematodes



Nematode in motion



Micro arthropod



Soil aggregation

how it works

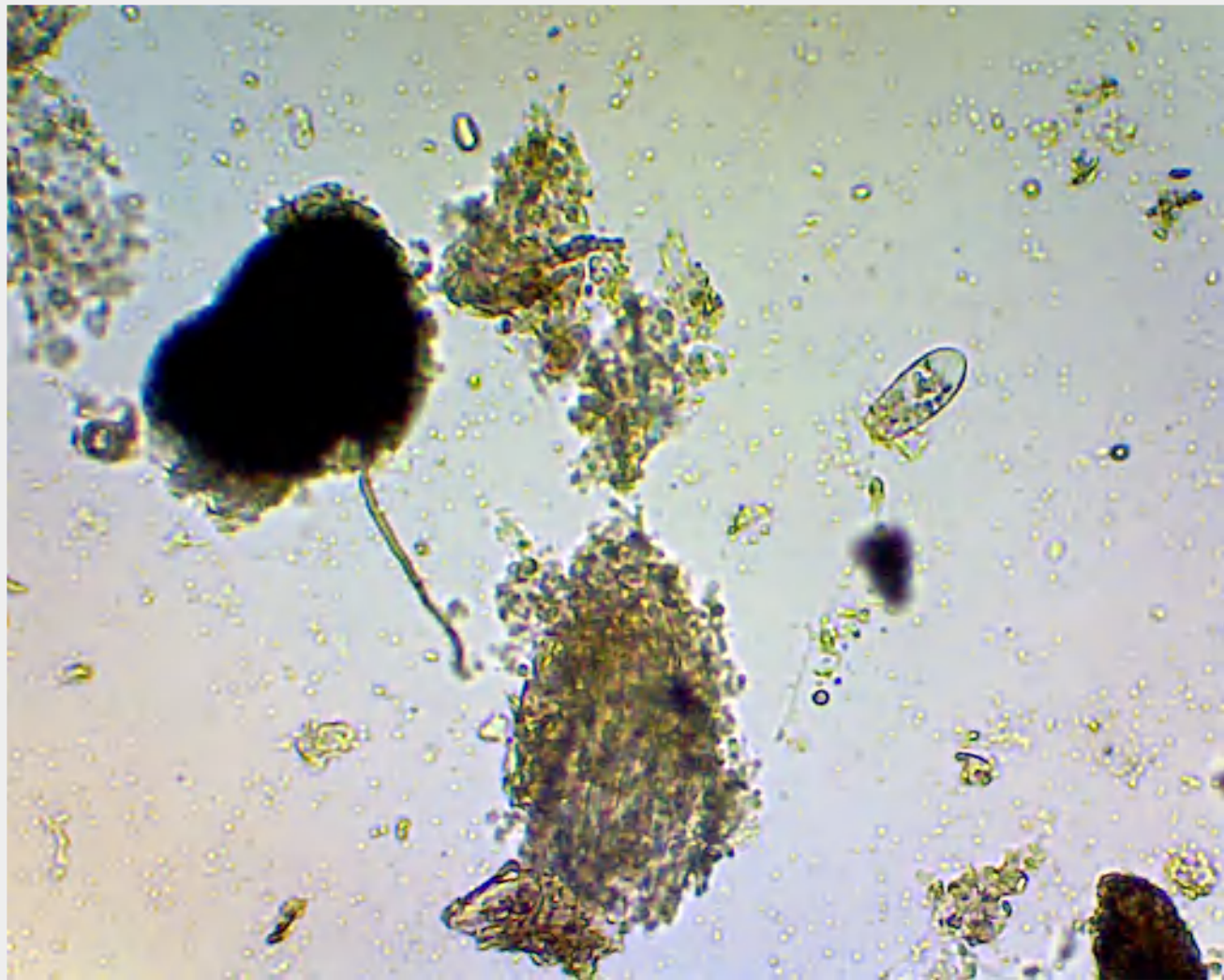
- Bacteria and fungi produce organic compounds that act as glues
- These glues bind organic matter, mineral particles, and themselves into clumps called micro aggregates
- Under the right conditions these microaggregates combine to form macroaggregates, creating lots of pore spaces for air and water



Micro-aggregates
just forming



Macro-aggregates
forming



Biologically robust compost with good aggregation



Nutrient cycling

how it works

- Bacteria and fungi consume organic matter, minerals, and each other, concentrating nitrogen and other plant foods in their bodies
- Once consumed, the excess nitrogen is released into the surrounding soil in a plant available form
- Plants then are able to uptake these plant foods into their roots



How do we establish that biology in our soils, then
how do we keep that biology in our soil?



Compost

- For the purpose of this talk, think about compost as a way to grow a wide variety of microbes to inoculate your soil
- While there are lots of methods of breaking down organic material, we focus on aerobic decomposition, where the presence of oxygen produces beneficial aerobic microbes
- High quality compost = a wide variety of microbes
 - Test under a microscope to confirm biology



Examples of organics that can be composted

- Food waste
- Yard debris
- Slaughterhouse offal
- Animal mortalities
- Soiled paper
- Natural Organic Reduction
(composting human remains)
- Human waste
 - CfG is working on human urine composting



Three bay system

- Made From Wooden Pallets
- See YouTube Videos on how to build one
 - [Video #1](#)
 - [Video #2](#)



A simple and inexpensive static bay system built from straw



Aerated Static Piles



In-Vessel Designs

- CfG has developed a relatively inexpensive community-scale, in-vessel composter
- The design is on our [website](#)—and is free and available to anyone.

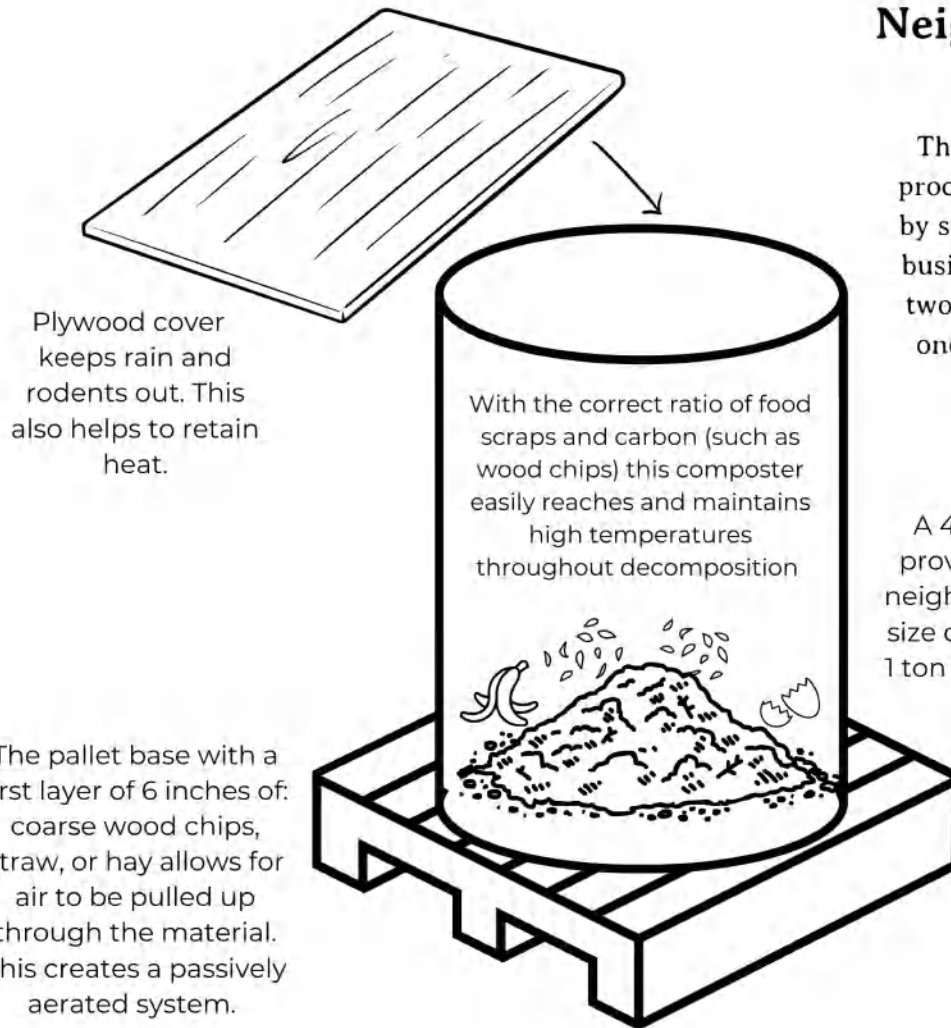




Neighborhood-scale Composter

This composter is capable of processing food waste generated by several households, farms, or businesses. Best to have at least two in order to give compost in one time to break down while filling the second.

A 4' diameter, 4' tall culvert provides the perfect space for neighborhood composting. This size drum can fit approximately 1 ton (2 cubic yards) of material!



Plywood cover keeps rain and rodents out. This also helps to retain heat.

With the correct ratio of food scraps and carbon (such as wood chips) this composter easily reaches and maintains high temperatures throughout decomposition

The pallet base with a first layer of 6 inches of coarse wood chips, straw, or hay allows for air to be pulled up through the material. This creates a passively aerated system.



compost for good
reimagining waste



How compost builds healthy soils

When biologically complete compost is added to soil, the soil comes alive. Bacteria, protozoa, fungi, nematodes and microarthropods from the compost inoculate the soil, and are the building blocks of a complex and interconnected soil food web.



How to apply compost to soils

No matter how compost is applied, when it is biologically robust, small amounts go a long way. Think of compost as an inoculant for the soil.

Traditional application:

- Compost can be spread with a conventional manure spreader, or spreading by hand is fine for applying the compost. It is important to try to apply the compost evenly.

Liquid application:

- Compost extract
 - Compost is submerged in aerated water to extract the existing biology.
- Compost tea
 - Compost is submerged in aerated water, with the addition of food for the existing microbes, like molasses and kelp, to stimulate the reproduction of microbial life in the compost.

Key to successful composting programs

- The power of one
 - That person does not necessarily have to be the operator, but does need to be interested in, and excited about composting



Keeping biology in our soil to maintain long-term soil health

1. Maintain continuous living roots
 - a. Cover crops or interplanting with perennials. The roots supply sugars for the microbes.
1. Reduce soil disturbance
 - a. Maintains microbial communities—especially fungi
1. Value biodiversity
 - a. There is a direct correlation between the soil biodiversity and the diversity of plants growing above
1. Keep soil covered
 - a. Mulch, crop residue, etc.

How do you know if you have good biology in your soil?
Test with a microscope.



Composting and Climate Change Mitigation

Climate change threatens food systems all over the world. By including composting into our food systems, we can:

- Increase the amount of fungal biomass in our soils, thereby pulling more carbon from the atmosphere and have healthier soils
 - Both the living portion and the decomposing portion of all of that underground life can store a tremendous amount of carbon. Soils are the second largest carbon sink on the planet. The first are the world's oceans.



Primary takeaways

- Nature-based solutions
- Compost is the fastest, and perhaps the best way to add biology to your soil
 - Have your compost/soil tested for biology under a microscope
- Composting is resource management, rather than waste management
- Continuous living roots
- Minimize soil disturbance
- Feed the microbes with organic matter

Thank You

Email us at: compostforgood@adkaction.org

Visit our website for more information and resources:
adkaction.org/compost

Please join our growing community on [Facebook](#)



Reimagine Waste!