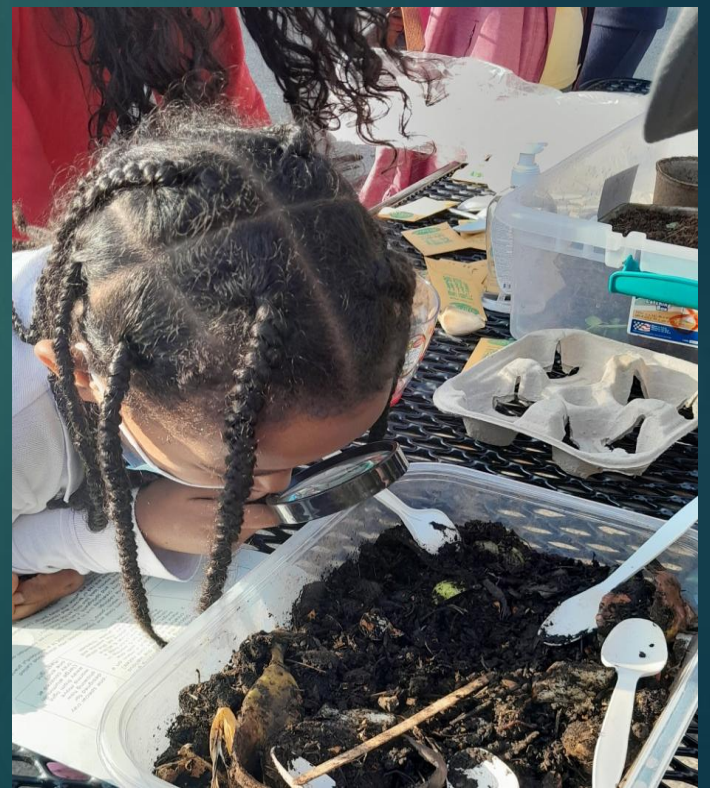
SOIL ORGANISMS AND THE WORLD BENEATH OUR FEET

WORKSHOP #2 - YORK REGION COMMUNITY COMPOST CHAMPIONS TRAINING PROGRAM

YORK REGION
COMPOST CHAMPIONS TRAINING PROGRAM

- Funded by the Region's **Circular Economy Fund**
- **Goal:** to promote and support effective participation in organics recycling, compost use on lawns and gardens, and adoption of soil-health best management practices on lawns and gardens in York Region, through the establishment of a *neighbourhood champions program*.
- **Stages:** Recruitment, Training, Practical Experience
- **Key Concept: The Soil Safari**



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Choose Your Level of Commitment and Participation

Passive Involvement

I am just here because I am interested and want to learn

Engaged Contribution

I want to get fully involved without a commitment to becoming a certified Compost Champion

Active Leadership

I want to become a Certified Community Compost Champion and a Soil Safari leader


WELCOME to your
SOIL SAFARI
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Hamilton Watershed Stewardship Program
Hamilton Conservation Authority
A Healthy Watershed for Everyone
TD
TD Friends of the Environment Foundation
Communities in Bloom
Collectivités en fleurs
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1. *Minerals – Soil's Foundation*

2. *Soil Organic Matter* (SOM)

3. *Soil Organisms*

4. *Stable Soil Aggregates*

5. *Soil and Climate*

6. *Soil Health (6Cs)*

7. *Composting and Compost Use*

8. *Make Great Compost* at Home

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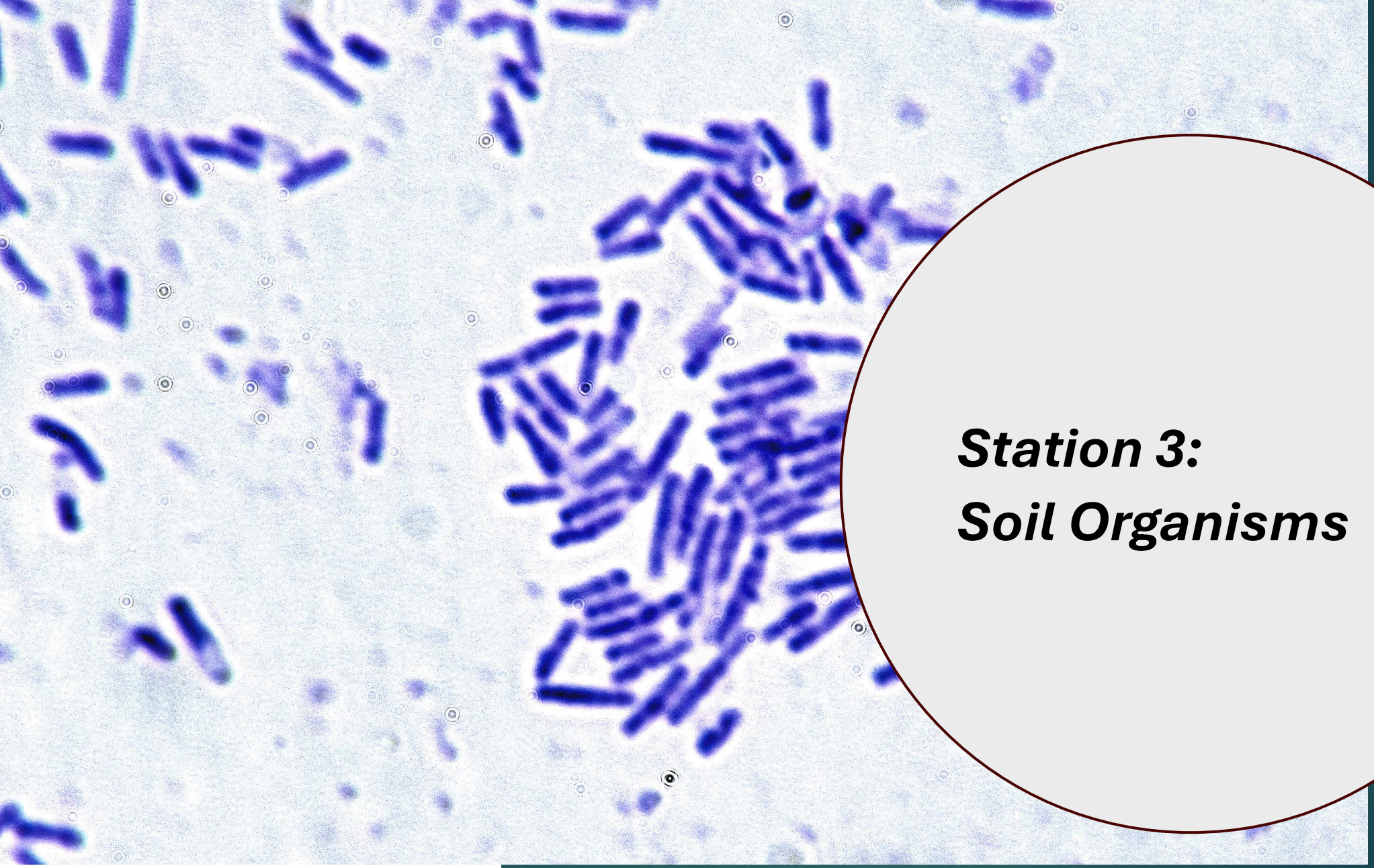
Today's Topics

3. Soil Organisms

4. Stable Soil Aggregates



Station 3: Soil Organisms

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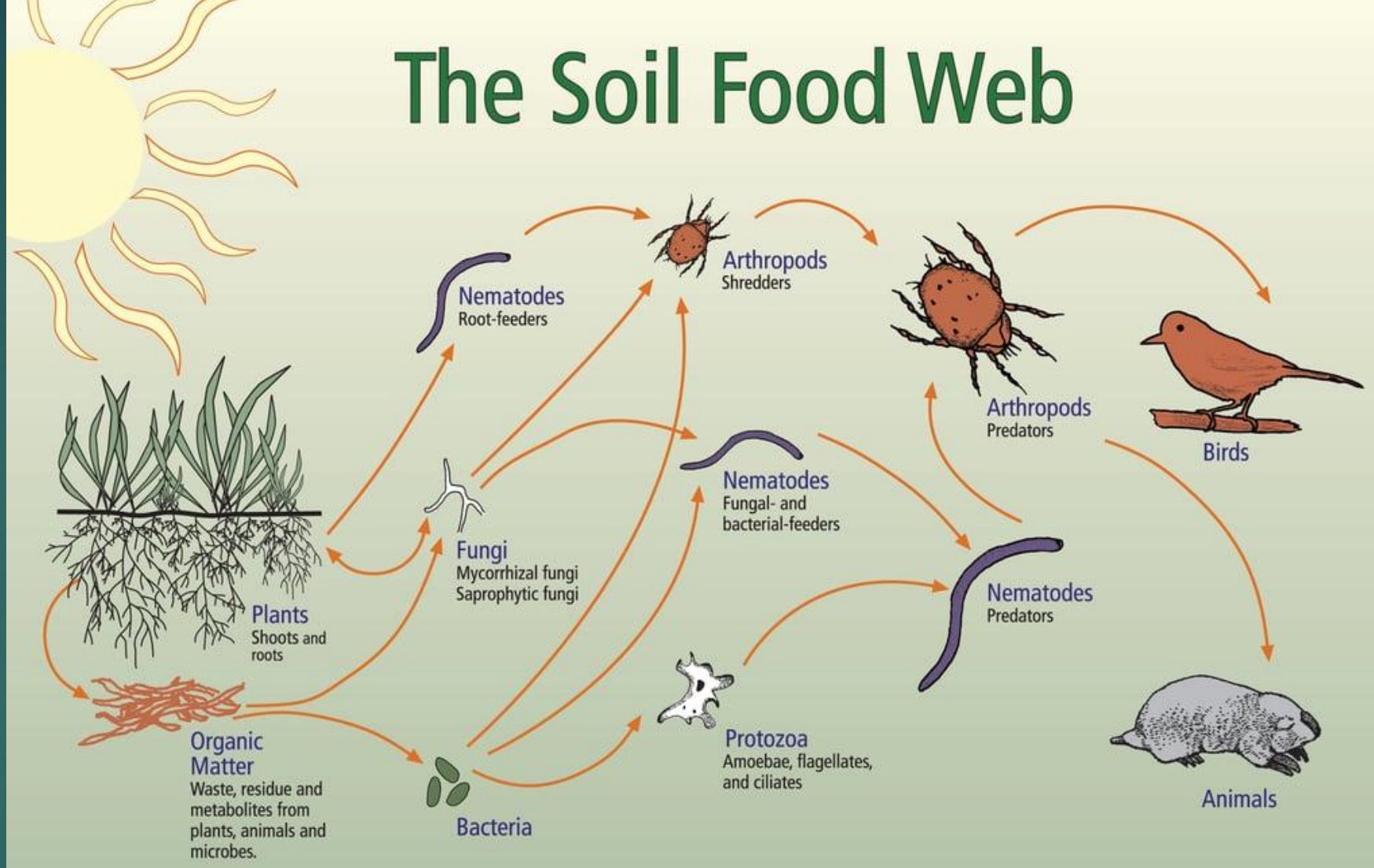
The Soil Food Web



First trophic level:	Second trophic level:	Third trophic level:	Fourth trophic level:	Fifth and higher trophic levels:
Photosynthesizers	Decomposers Mutualists Pathogens, Parasites Root-feeders	Shredders Predators Grazers	Higher level predators	Higher level predators

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Bacteria: The Glue Guys

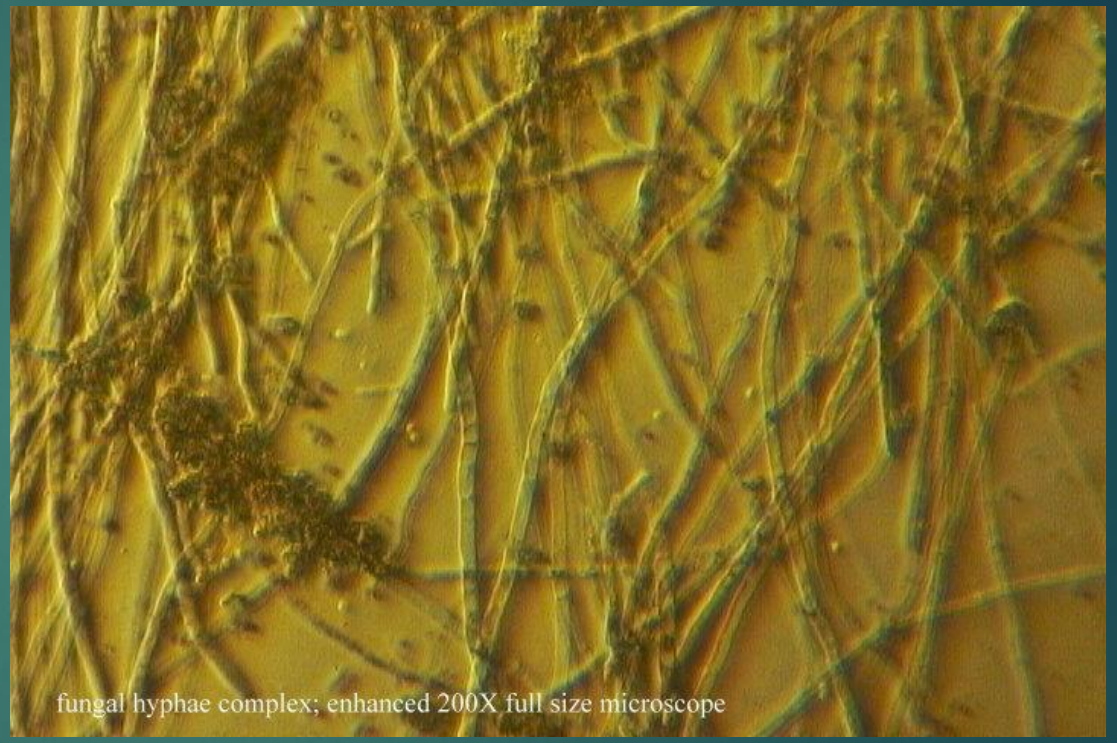
Microscopic: fraction of a micron diameter; a few microns in length (micron = one millionth of a meter)

Between 100 million and a billion in a teaspoon of healthy soil

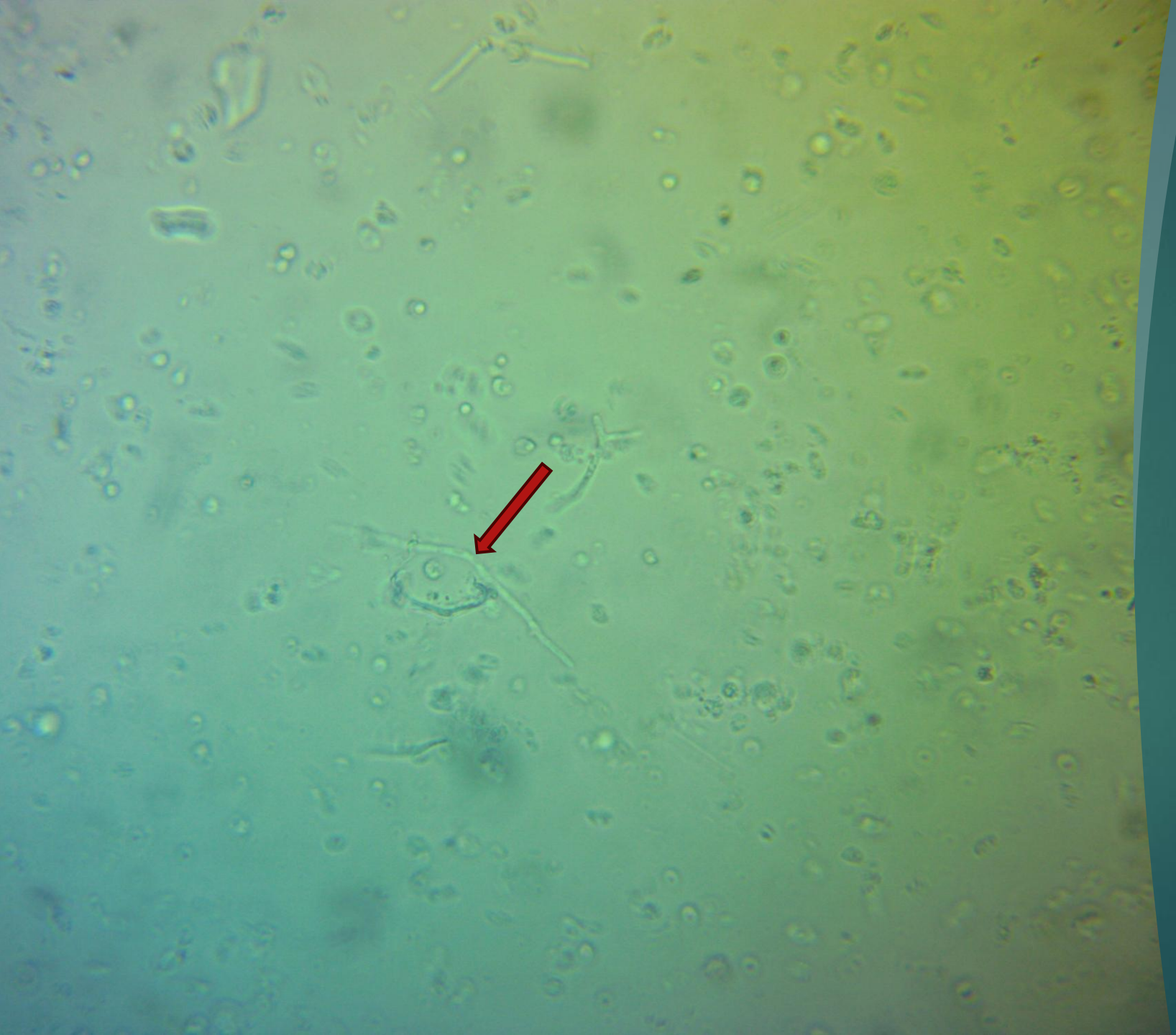
Photo credit: Soil and Water Conservation Society. SWCS. 2000. Soil Biology Primer

Fungi – Pulling it all together

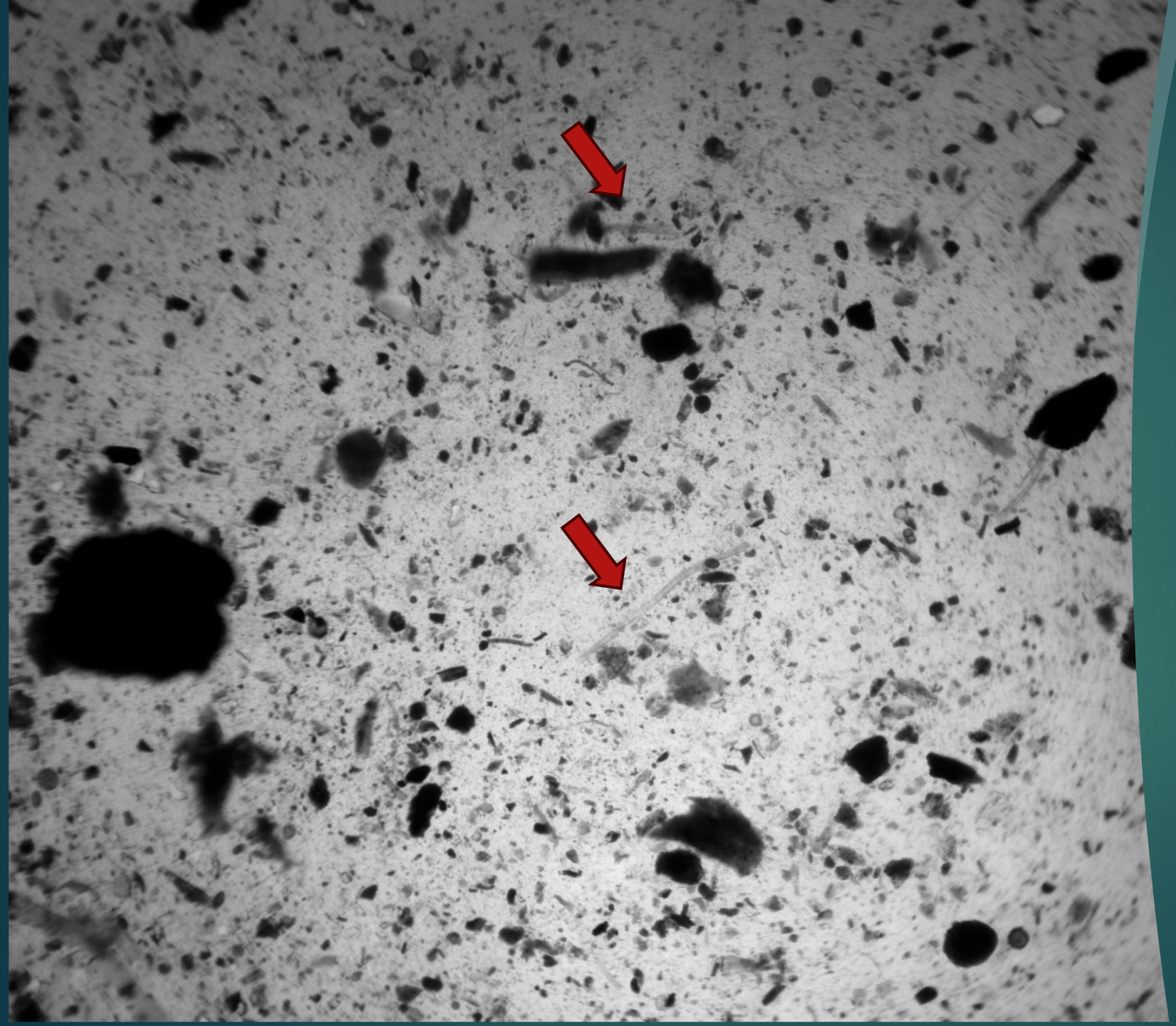
- Important decomposers, breaking down tough materials, such as lignin
- Grow as long threads, known as "hyphae", which are just a few microns in width



"mycelia" are groups of hyphae massed together (these are often visible)



Fungal Hyphae under the Microscope



Fungal Hyphae under the Microscope

Kahnawake Composting Facility

3 general types of fungi, based on where they get their food

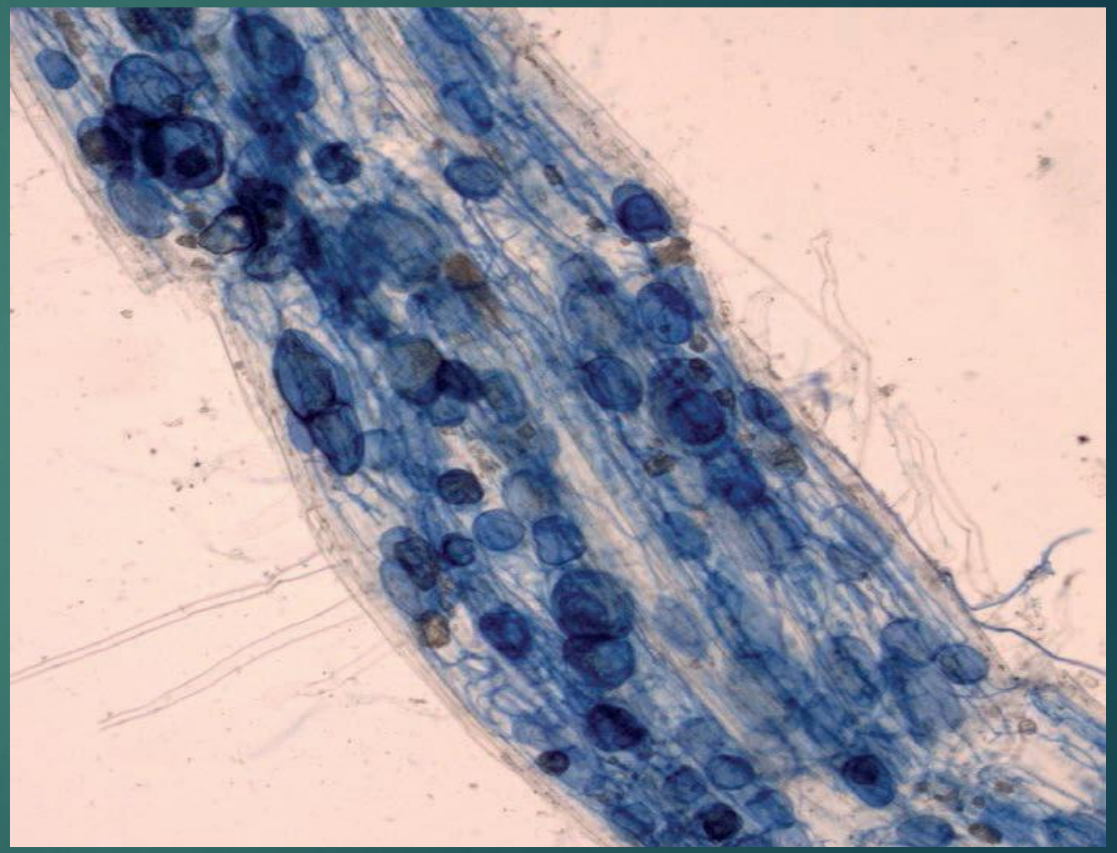
Decomposers (Saprophytic)

Parasitic/pathogenic

Mutualists

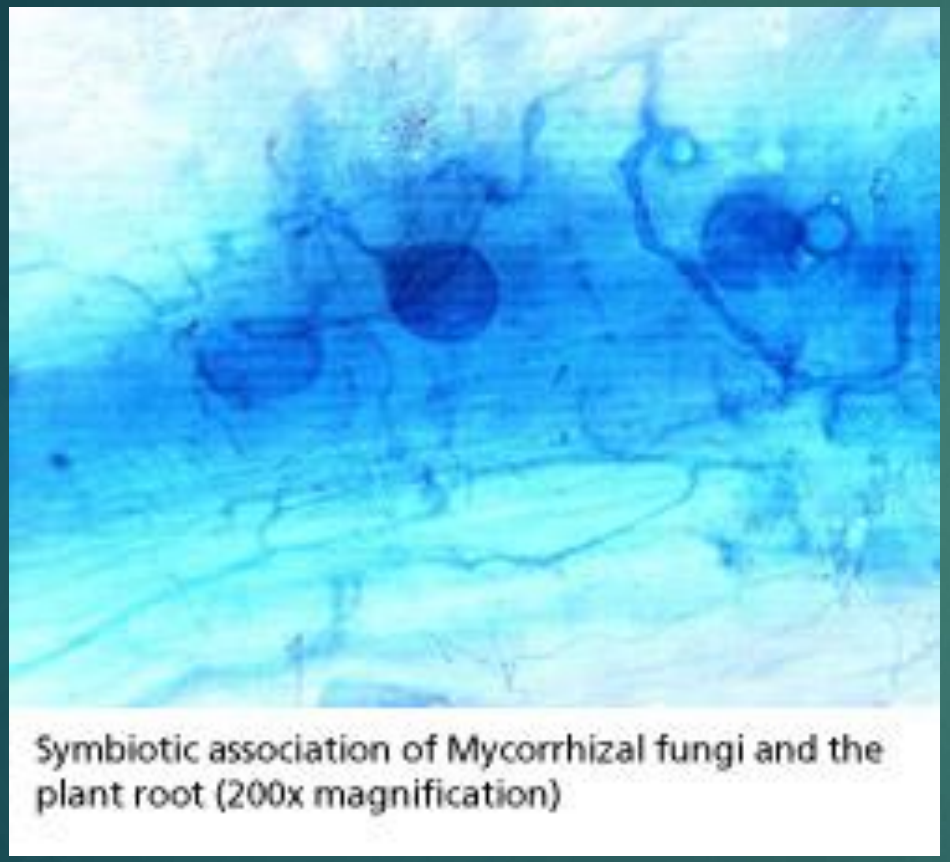
AM: Arbuscular Mycorrhizae

- Most common mycorrhizae in farm fields
- Many different species
- Confer many benefits, including: water and nutrients, disease suppression, soil structure, increased C levels
- Suppressed by high levels of fertility, especially P
- Damaged by tillage, inappropriate chemical use

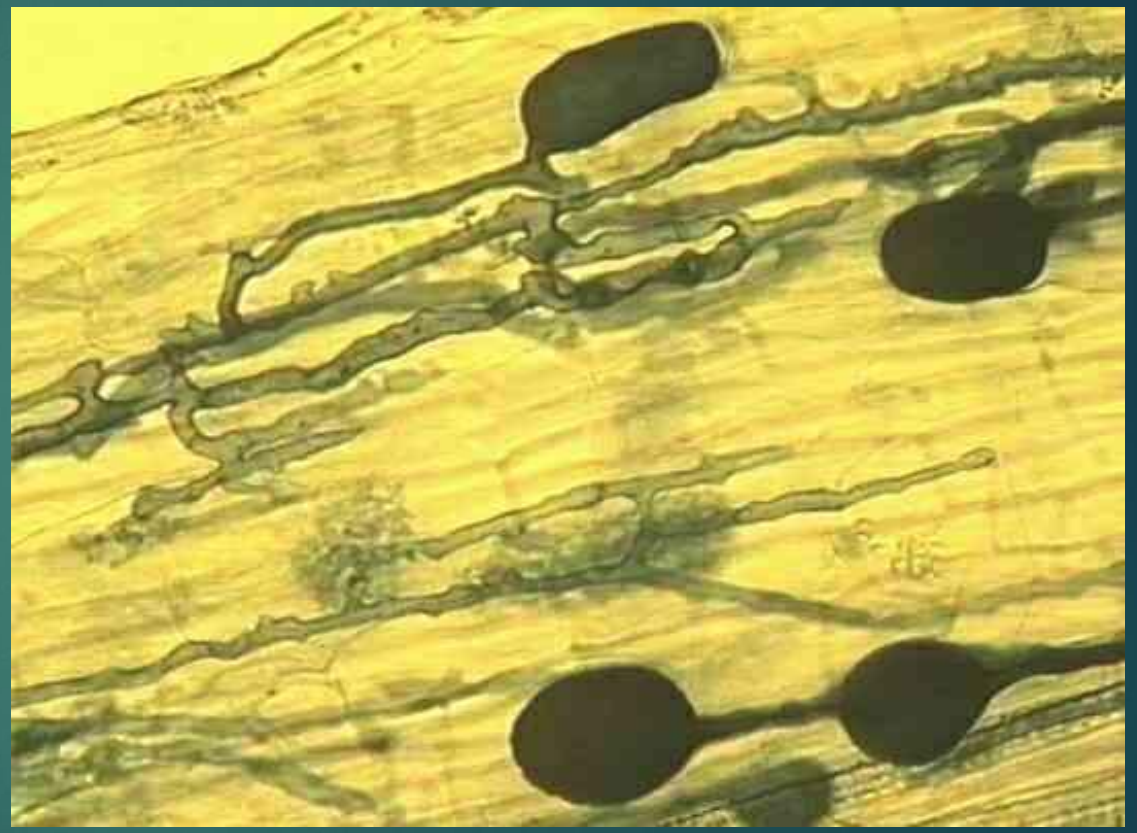


Source: Soil and Water Conservation Society

Mycorrhizal connections to roots



Symbiotic association of Mycorrhizal fungi and the plant root (200x magnification)



The Soil Food Web and Soil Functions

The organisms in the SFW are responsible for most of the soil's beneficial functions, including:

- Natural fertility
- Water management
- Disease suppression
- Pest Suppression
- Climate stability

Natural Fertility

What we are used to thinking of as the full story:

- Weathering & decomposition
- Mass flow of nutrients
- Diffusion

What were we missing in this story?

The extensive and vital role of microbes in the following:

- making **nutrients** plant-available in the right place, at the right time
- **Trading nutrients for carbon**, then sequestering that C in soil

Action in the root zone…

The rhizosphere fertility story requires an expanded cast of characters:

The Predators!

Like this?

No, more like this….

Or this….

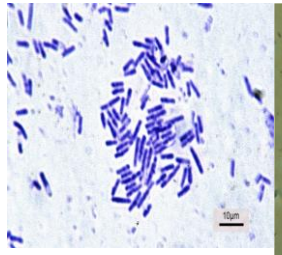
Protozoa and nematodes

Nutrient Cycling

Residues (full of nutrients)

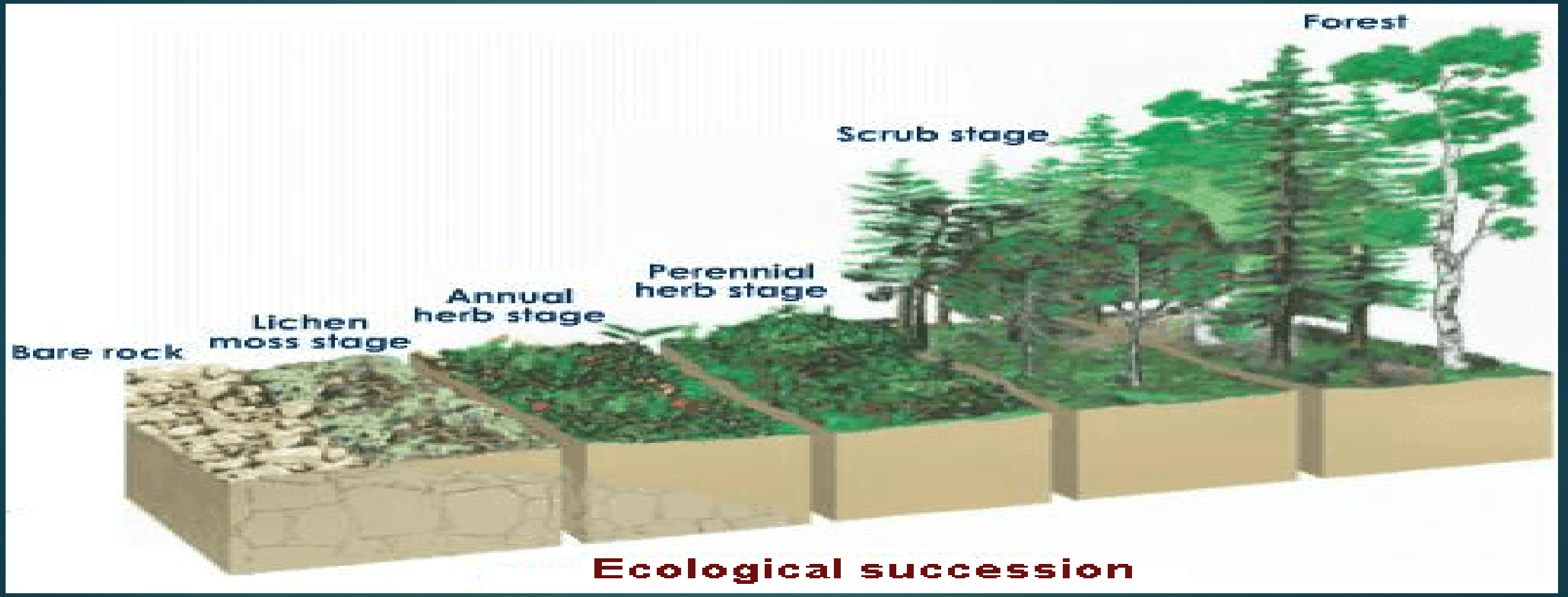
Facilitators (the big guys)

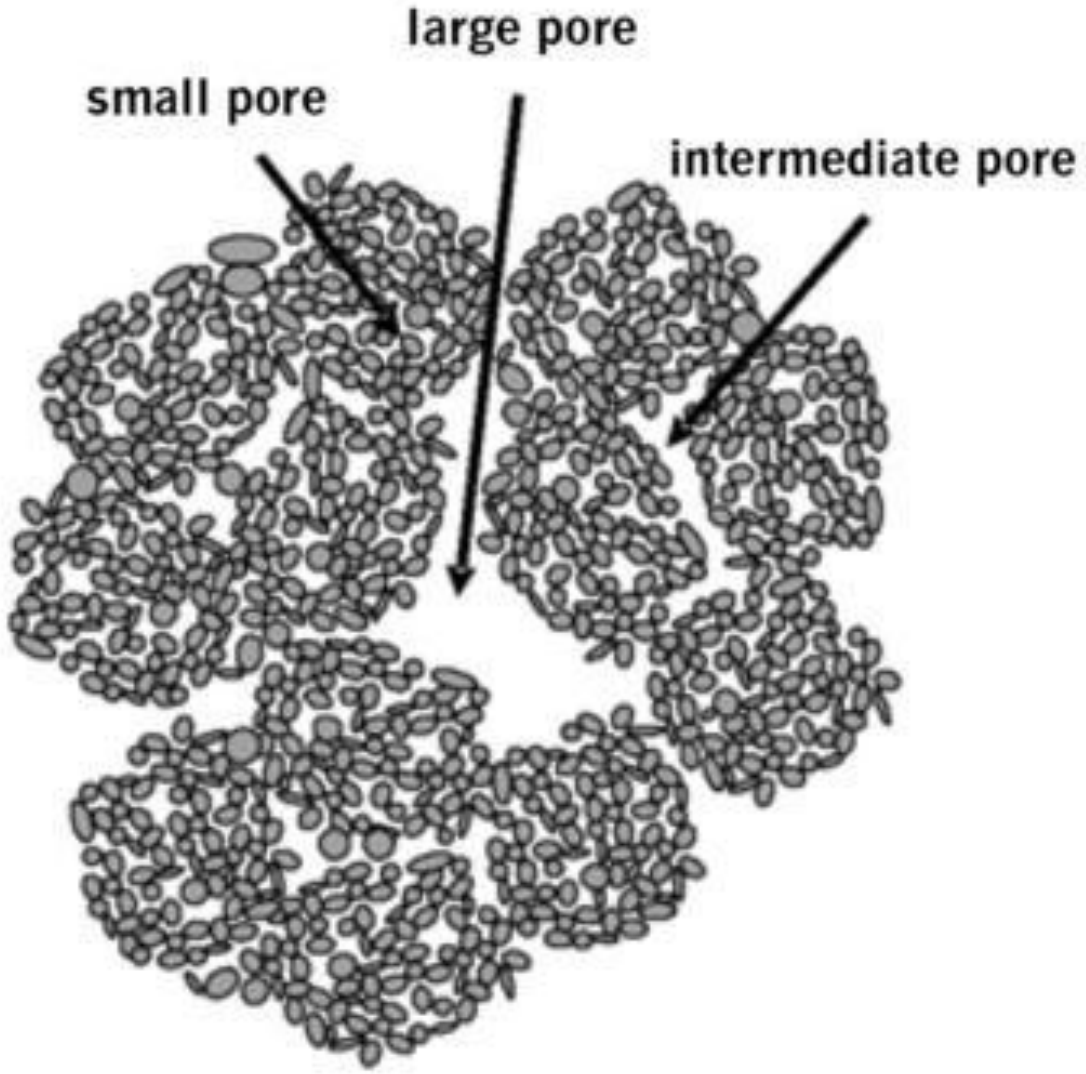
Decomposers (the little guys, both fast & slow)



Predators (the nutrient liberators)

Important Changes During Ecological Succession





Station 4: Soil Structure

Regolith vs Soil

Regolith (Moon, Mars)

- Mineral particles created by physical forces (cold/heat, impacts, "weather"

Soil (Planet Earth)

- Mineral particles created by physical forces (cold/heat, impacts, water movement, weather)
- Organic matter (OM) created by life
- Soil organisms (microbes, worms, etc.)

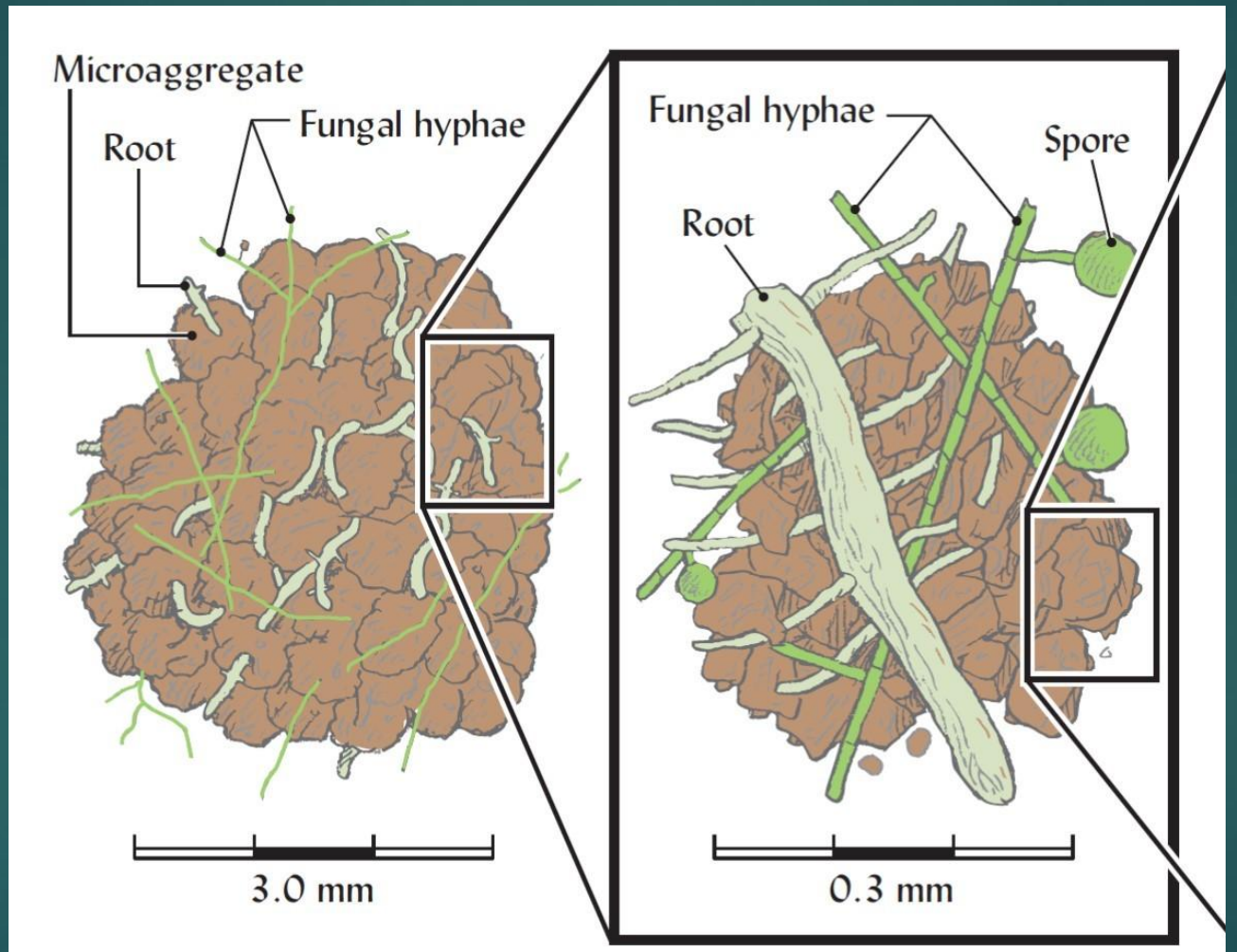
Good soil structure – crumbly, well aggregated

Crumbly texture, macro-aggregates

Platy, blocky, no aggregates

Photo credit: Mel Luymes and Adam Ireland

Soil Aggregation



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What is a healthy soil?

- A healthy soil is one that hosts a thriving soil food web (SFW)

- Thriving means that the soil organisms are plentiful, diverse, and active

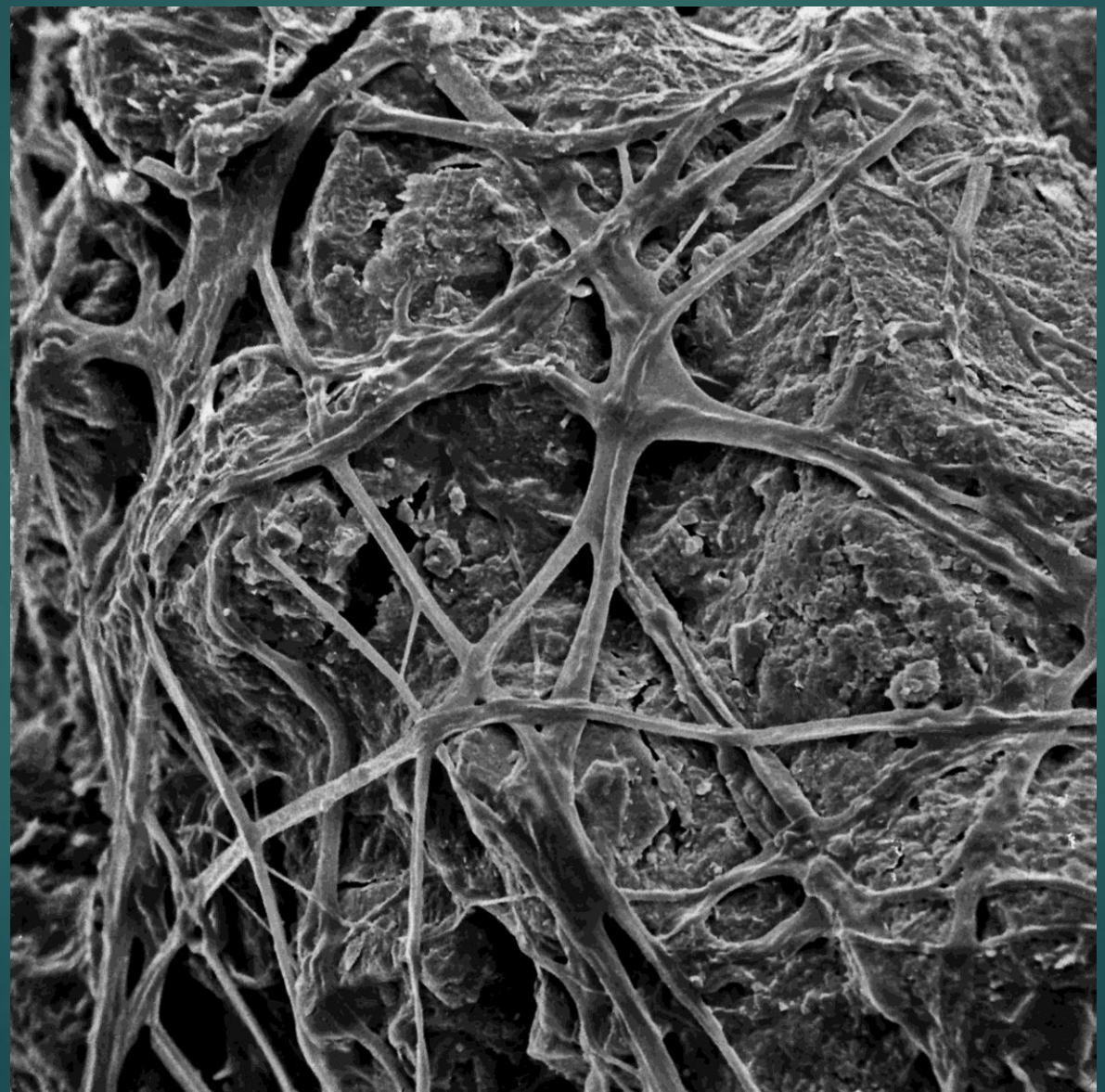
To better understand why a thriving population of soil critters is important, think of a human community. What makes a human community thrive?

- **A good environment, with lots of available resources**

- **A stable or growing population with the skills to convert the resources into goods and services**

- **An infrastructure to support the members of the community in their work and play**

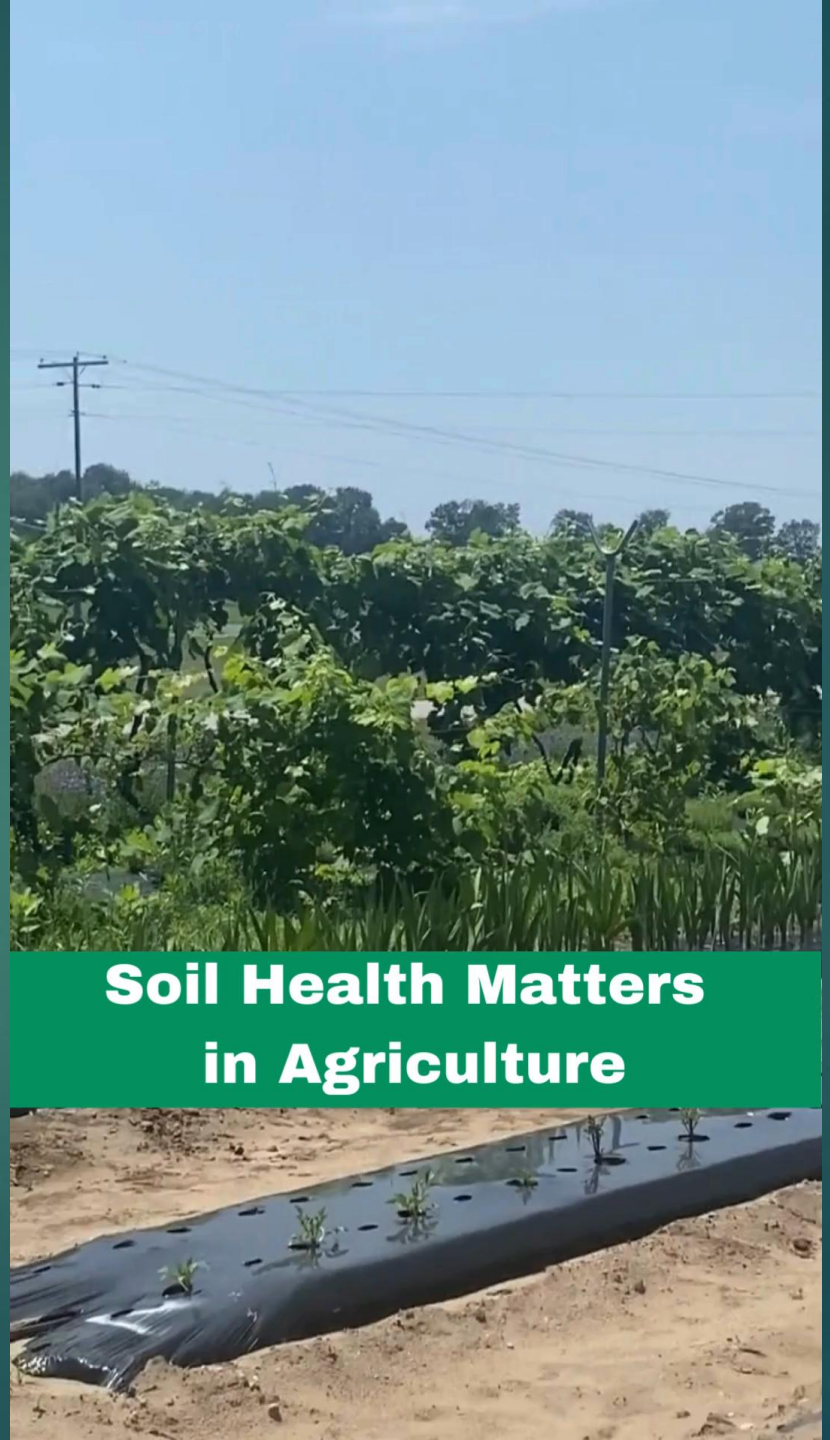
Network of fungal hyphae stabilizing an aggregate



Benefits of Good Aggregation in Soils

Benefit	Notes
Better infiltration of rainfall	Aggregates create pore spaces
Better water retention and drought resistance	**Pore spaces retain air and water**
Better environment for soil foodweb organisms (air, water, space)	Beneficial organisms require water and oxygen, as well as living space
Better environment for roots	**Better able to penetrate soil and increase range**
Higher levels of carbon sequestration	Aggregates are sequestration “engines”

Kevin Howe, Howe Farms, Ontario



Quiz Time

Fungi are most closely related to: a. bacteria, b. plants, c. animals

Mycorrhizal fungi receive photosynthate from plants in return for: a. nutrients b. water c. both

What are the spaces between soil aggregates called?

Which of the following microbes looks like a tiny worm? a. protozoa b. nematode c. yeast

Which of the following is NOT a benefit of good soil structure? a. water holding capacity b. disease suppression c. root nematodes

Thank you!


For Healthier Soil,
Healthier Food ...
ORGANICS ONLY PLEASE
We are feeding our soils.
It all starts with you !
Your thoughtful act of recycling organics does so much.
Recycling organics means less greenhouse gas
in the atmosphere. And using compost feeds the soil.
Our soils then return this kindness with healthier food,
cleaner water, richer biodiversity and a calmer climate.
Thank you for doing your best.
COMPOST !
Special recognition to the inspiring Soil Health advocacy work of the Food and Agriculture Organization of the United Nations (FAO).

Barnyard Organics, PEI