

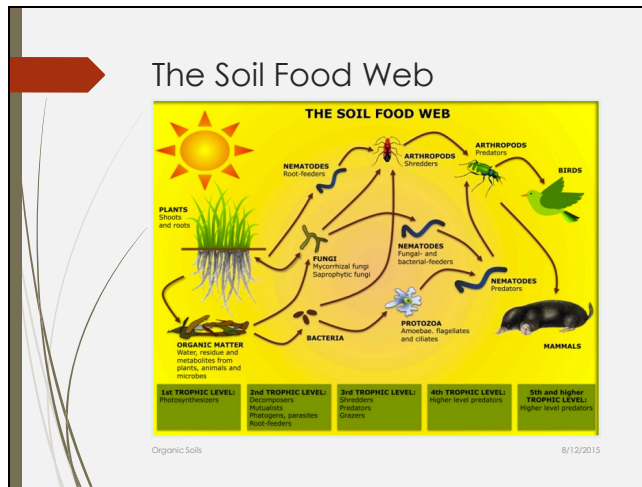
Slide 1

# The Soil Food Web

Understanding the Five Trophic Level

These slides are from the USDA Web Soil Survey with my commentary added.

Slide 2



Slide 3

## 1st Level - Photosynthesizers

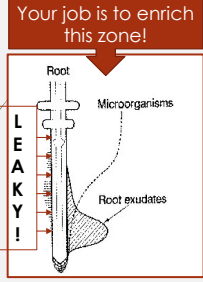
The diagram shows the 1st trophic level, which includes plants (shoots and roots) and organic matter (water, residue, and metabolites from plants, animals, and microbes). The sun is shown providing energy to the plants.

- Plants, roots, shoots
- Organic matter; "waste"
- Some bacteria; algae

Organic Soils 8/12/2015

## 1<sup>st</sup> Level - Photosynthesizers

Your job is to enrich this zone!



Organic Soils

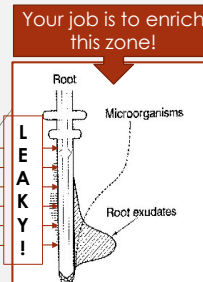
### Rhizosphere

- Roots = Rhizo; fibrous and tap
- Microbes
- Exudates - candy for bacteria and fungi
  - $H_2CO_3$  carbonic acid; dissolves minerals
  - pectins
  - sugars
  - alcohols
  - aldehydes
  - Weak acids – acetic, formic, oxalic

8/12/2015

## 1<sup>st</sup> Level - Photosynthesizers

Your job is to enrich this zone!




Organic Soils

### Roots (cont.)

- Decayed roots provide channels for water and worms
- Roots are lazy
  - Do not grow toward water
  - Grow where there is water; decay and die back where there is no water

8/12/2015

## 2<sup>nd</sup> Level – Decomposers, Mutualists, Pathogens, Parasites, Root Feeders



Organic Soils


### Organisms that eat photosynthesizers.

- Decomposers: bacteria, saprophytic fungi; break down residue
- Mutualists: mycorrhizal fungi, bacteria; enhance plant growth
- Pathogens: fungi, bacteria; disease markers
- Parasites: bacteria, fungi, nematodes, microarthropods

8/12/2015

Slide 7

## 2<sup>nd</sup> Level – Decomposers, Mutualists, Pathogens, Parasites, Root Feeders




**Bacteria**

- Characteristics:
  - Single celled
  - Microscopic
  - Sometimes form chains or colonies
  - Mostly good guys with bad reputations
- Numbers:
  - 4 million species in a ton of soil
  - 300 million – 50 billion individuals in a handful of soil
  - 25K species in a gram of soil

Organic Soils 8/12/2015

Slide 8

## 2<sup>nd</sup> Level – Decomposers, Mutualists, Pathogens, Parasites, Root Feeders




**Bacteria**

- Role:
  - Decomposers of dead organic material
  - Their exudates and body fluids help bind soil into aggregates
  - Specialized groups are involved in the nitrogen cycle
  - Good bacteria far outnumber the bad
  - Actinomycetes – chains; good

Organic Soils 8/12/2015

Slide 9

## 2<sup>nd</sup> Level – Decomposers, Mutualists, Pathogens, Parasites, Root Feeders




**Fungi**

- Characteristics:
  - Multi-cellular; form chains or hyphae
  - Single celled - yeasts
  - Neither plant nor animal
  - Mushroom is the fruiting body, as is mold
  - They cannot photosynthesize
  - They must live off of other life forms

Organic Soils 8/12/2015

Slide 10

## 2<sup>nd</sup> Level – Decomposers, Mutualists, Pathogens, Parasites, Root Feeders




**Fungi**

- Role:
  - They are the most important decomposers in the world
  - Saprophytic – decompose already dead organic matter
  - Mycorrhizal – fungi that form associations with plant roots
  - They get energy from plant sugars
  - They help “fetch” nutrients to the plant roots

Organic Soils 8/12/2015

Slide 11

## 2<sup>nd</sup> Level – Decomposers, Mutualists, Pathogens, Parasites, Root Feeders




**Nematodes**

- Characteristics:
  - Non-segmented worms
  - Tiny
  - Feed at several trophic levels
  - There are many beneficial nematodes

Organic Soils 8/12/2015

Slide 12

## 2<sup>nd</sup> Level – Decomposers, Mutualists, Pathogens, Parasites, Root Feeders




**Nematodes**

- Role:
  - They eat bacteria or fungi and release extra nitrogen to plants
  - They 'accidentally' move bacteria and fungi
  - They are food sources

Organic Soils 8/12/2015

Slide 13

### 3rd Level – Shredders, Predators, Grazers




**Arthropods**

- Characteristics:
  - Jointed appendages
  - Segmented body
  - Exoskeleton that is shed during molting
- Grouped as:
  - Shredders – millipedes, sowbugs, dung beetles
  - Predators – spiders, scorpions, mites, millipedes, ants
  - Herbivores - crickets
  - Fungal feeders – springtails, mites

Organic Soils 8/12/2015

Slide 14

### 3rd Level – Shredders, Predators, Grazers




**Arthropods**

- Role:
  - Largest phylum in the animal kingdom; there are more types of arthropods than all other types of animals combined
  - They are important in the pollination of flowering plants.
  - Some play an important role in soil aeration and water infiltration
  - Found in all consumer roles of an ecosystem, whether they eat plants or animals,
  - Some are important decomposers

Organic Soils 8/12/2015

Slide 15

### 3rd Level – Shredders, Predators, Grazers



**Protozoa**

- Characteristics:
  - “pre” “animal”
  - Single celled animals
    - Amoebas
    - Ciliates
    - Flagellates

Organic Soils 8/12/2015

Slide 16

**3rd Level – Shredders, Predators, Grazers**

**Protozoa**

- Role:
  - They eat bacteria and recycle them
  - The release excess N as  $\text{NH}_4^+$  for plants

Organic Soils 8/12/2015

Slide 17

**4<sup>th</sup> Level**

**Higher Level Predators**

- Arthropods, Nematodes, Birds, Mammals
- More complex life forms
- Tend to spend more time at or above the surface of the soil



*This product was developed by the Sustainable Agriculture Research and Education (SARE) program with funding from the National Institute of Food and Agriculture, U.S. Department of Agriculture (NIFA-USDA). Any opinions, findings, conclusions or recommendations expressed within do not necessarily reflect the view of the U.S. Department of Agriculture. U.S.D. A. is an equal opportunity provider and employer.*

