Soil Quality in Grazing Systems

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Definition of Soil Quality

Soil Fertility

Physical Properties

Biological Activity

“The ability of soil to function; to supply plants with adequate nutrients, have good drainage and aeration, promote root growth and biological activity.”

Six guidelines for soil quality:

WI Soil Quality Team, 2006:

- **Add/conserve organic matter**
- **Avoid excessive tillage**
- **Prevent soil compaction**
- **Keep the ground covered**
- **Diversify cropping systems**
- **Carefully manage fertilizer and pesticide use**

NRCS, 2013:

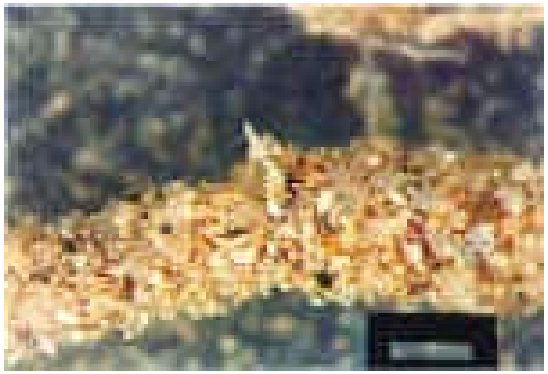
- **Enhance organic matter**
- **Avoid excessive tillage**
- **Manage pests and nutrient efficiently**
- **Prevent soil compaction**
- **Keep the ground covered**
- **Diversify cropping systems**

1. Physical Properties

- **Texture (% sand, silt, clay)**
- **Structure (aggregation and aggregate stability)**
- **Color (humus, drainage)**
- **Organic matter content (macro and decomposing)**
- **Infiltration/ aeration**
- **Compaction/bulk density**
- **Water holding capacity**
- **(Rooting patterns)**
- **Tilth**
- **Bearing strength**

Water Stable Aggregates

- Formed by the aggregation of clay (smallest particles), followed by gluing together of macro-aggregates with mycorrhyzal and bacterial secretions, fungal hyphae, and root hair bonding.



Five Ways to Improve Infiltration:

- Adding organic matter
- Reducing compaction
- Improving crop vigor
- Keeping the ground covered
- Don’t work the soil when wet!!!

Chemical Properties

- **pH**
- **Fertility (available nutrients)**
- **Salinity/ sodicity/ EC**
- **Humus content**
- **(Texture and mineralogy effect nutrient supply)**

"Banking" on Soil Nutrient Levels

Your Savings Account

-- Organic matter content, total N, total P, *clay* release of K.

-- These are slowly available, but can accumulate over time to be available later.

-- This is sometimes called nutrient "buffering."

Your Checking Account

-- Mineral N, available P and K

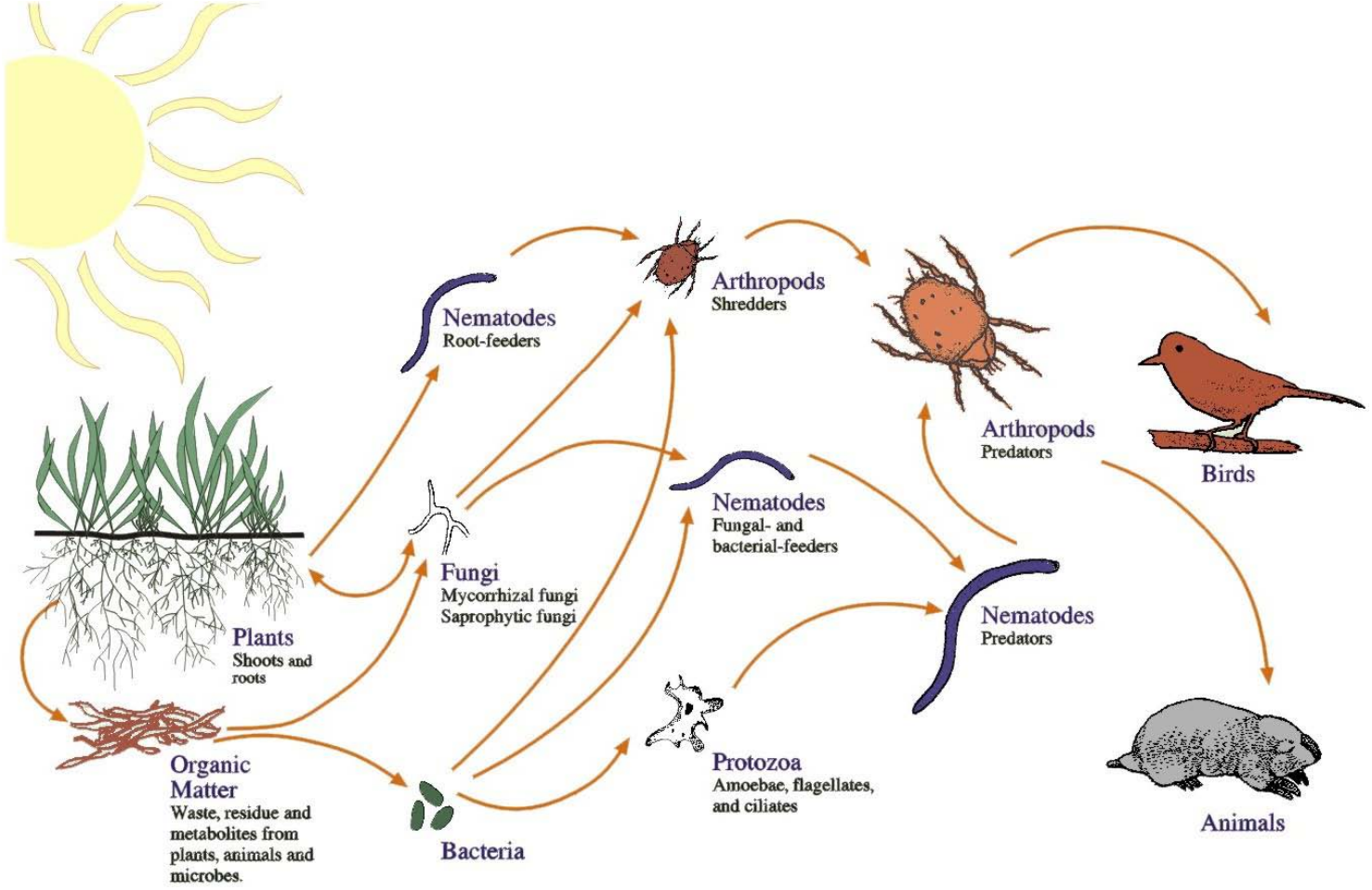
-- This is an indication of what will be available that growing season

-- Soil pH will influence the availability of these and micro-nutrients

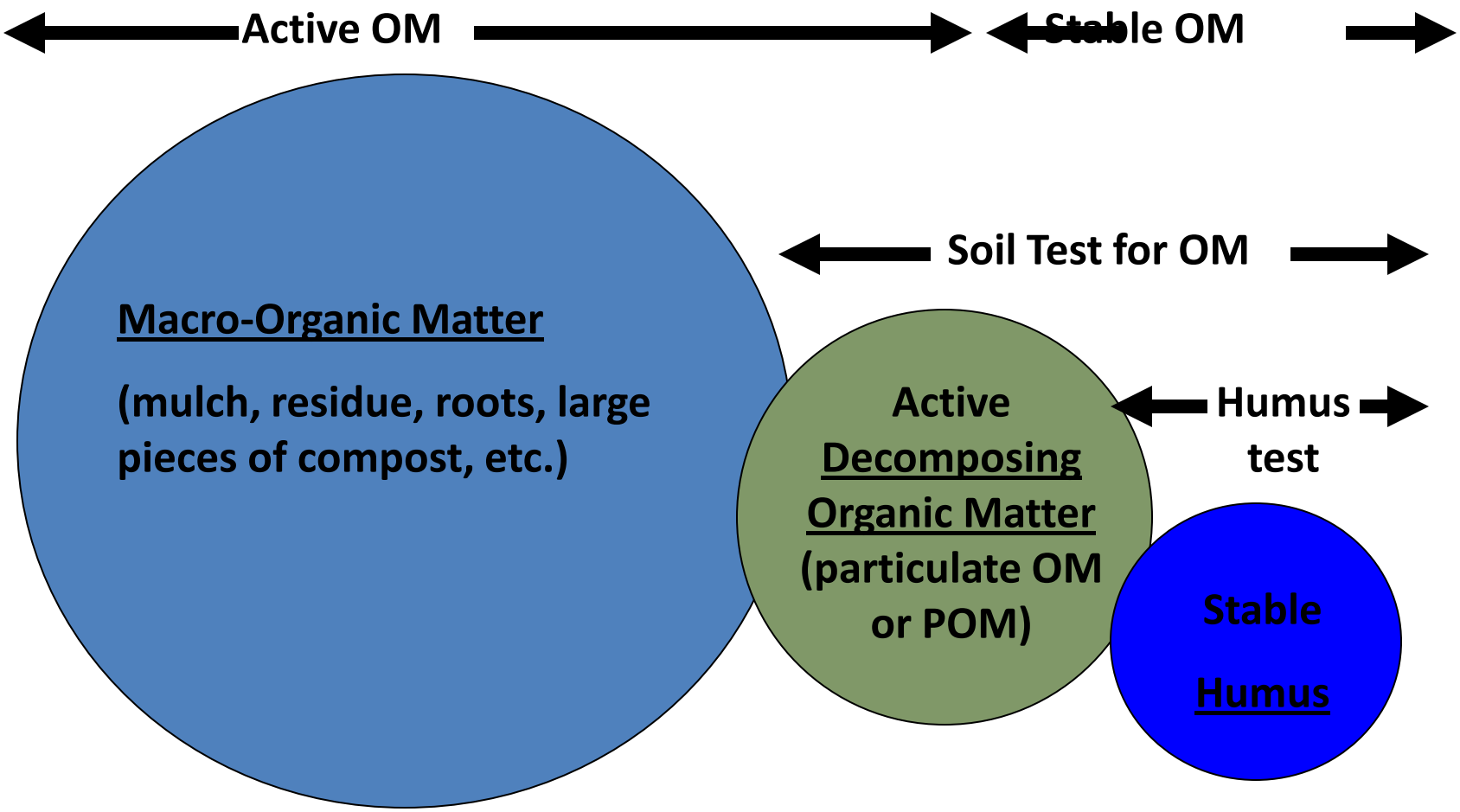
Biological Properties

- **Soil respiration (CO_2 flux)**
- **Biological community structure**
- **Floral/faunal diversity**
- **Earthworm abundance**
- **Nodulation (legumes)**
- **(Rooting patterns/ depth)**
- **Crop yield/ quality/ vigor**

The soil foodweb: It all begins with plants.



Organic Matter Pools



All organic matter is important!

Practices that deplete your soil “savings” account.

- Too much tillage.
- Bare ground (no mulch or crop on top of soil).
- No living crops (no roots in the soil).
- Soluble fertilizers without concurrent addition of carbon rich vegetation, mulches, or composts.

Good Roots Need Good Soil

- **Many “sick” plants don’t have a disease, they just need better roots/soil.**
- **Good soil conditions can also help plants fight off disease and insect pests (like a healthy immune system in a person).**
- **Try to improve the topsoil and also the subsoil. Limit compaction, and keep adding organic matter over a period of years through excellent pasture/crop growth and pulsing.**

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