SOIL HEALTH: It's All About the Soil!

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unlock the SECRETS IN THE SOIL

The case for Healthy, Productive Soils

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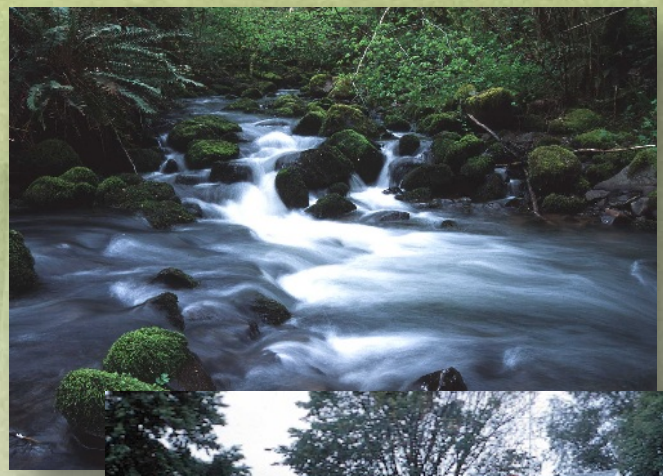
United States Department of Agriculture
Natural Resources Conservation Service

Watershed Level Soil Health Benefits

- ✓ Reductions in sediment and nutrient delivery to surface waters decreases potential for downstream hypoxic zone formation
- ✓ Increased infiltration and water holding capacity.

Soil health benefits (continued)

- ✓ Improve water quality
- ✓ Regulate water and reduce flooding
- ✓ Save water and increase drought tolerance



Soil Health Benefits *(continued)*

- ✓ Improve wildlife habitat and wetland food production

Good Soil Health Condition

Good soil tilth

Sufficient rooting depth

Sufficient but not excessive nutrients

Good drainage

Beneficial organisms

Low weed population

Resistance to degradation

Adequate Organic Matter

Moderate Bulk Density

Good Soil Health Condition

Resilience to Unfavorable Conditions

Free of chemical toxins

Granular or Blocky Structure

Numerous Earthworms

pH 5.8 to 6.2

No clay pan or tillage pan present

Etc., Etc.

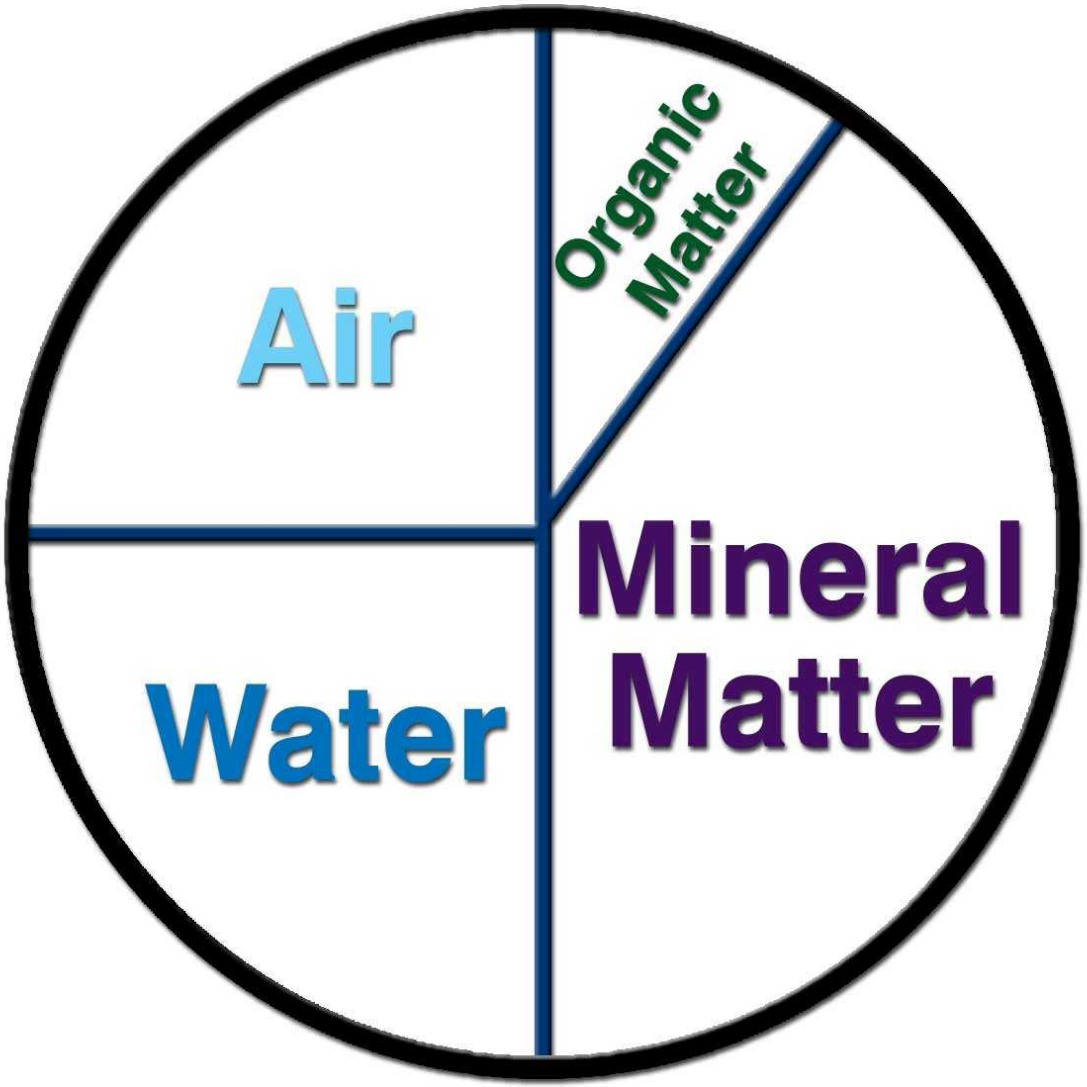
Need to Evaluate:

- Physical properties
- Biological properties
- Chemical properties

** Something needs to change!!!!


4
8
12
16
20
24

Soil



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Physical Properties

- Bulk density
- Water content
- Infiltration rate
- Aggregate stability
- Slaking
- Texture --------
- Structure ------
- Etc.

INHERENT

DYNAMIC !!

- Bulk density is a measure of the compactness of a soil.
- Natural and man-influence.
- Good surface soil will have Bd of 1.5 g/cc.
- At this density, porosity is about 45-50%

- Bulk density of compacted surface or tillage pan can be 1.7 to 1.8 g/cc.
- At this compaction level, porosity decreases to 30 to 35%.

A landscape example…

By **increasing water absorption** of all cropland in the Mississippi River Basin by just **one-half inch** through improved soil health, that water retention would be the equivalent of…

A landscape example…

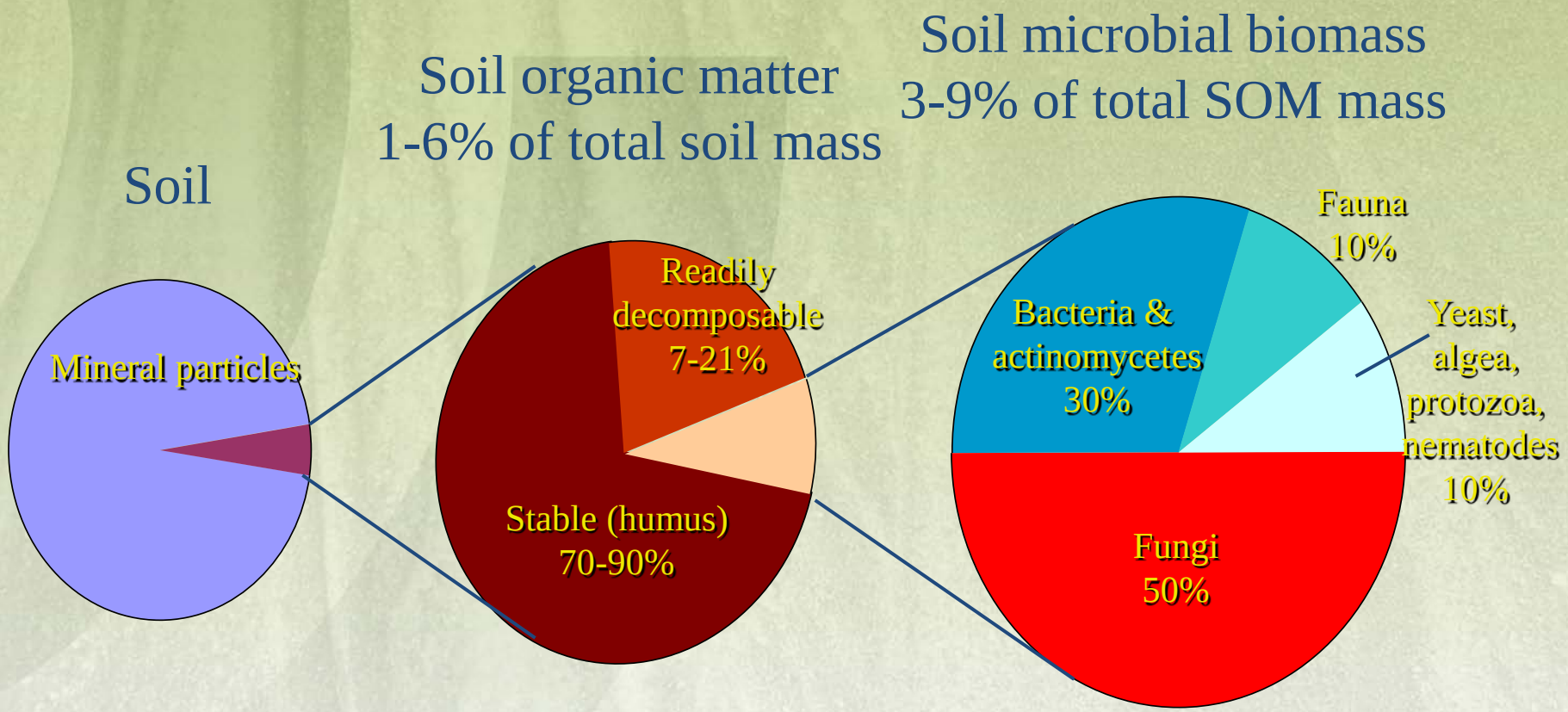
The amount of water that flows over Niagara Falls in 83 days.

Biological Properties

- Soil respiration
- Earthworm numbers and activity
- Organic matter content
- Microbes present in the upper 12 inches
- Microorganism diversity
- Rooting volume availability
- Micro, macro soil pores, krotovina burrows
- Etc.


MATTER
Range
COLOR
(moist soil)
3½ to 7%
2½ to 4%
2 to 3%
1½ to 2½%
1 to 2%
(Strong sunlight may eventually cause
these colors to fade slightly.)

Soil Organic Matter Composition



Organic Matter Fractions

- Living (“Fresh”)
  - Microbial biomass
  - Plant Roots
- Active fraction
  - relatively fresh residues
    - crop residues, manures, etc. (1-3 year turnover time)
    - protected fraction (5-year turnover time)
- Well-decomposed
  - humus (stabilized organic matter)
    - turnover time greater than 150 years

Chemical Properties

- pH
- Electrical conductivity (EC)
- Soil nitrate levels
- Organic matter produced P, N, and S
- Residual fertility carry-over
- Cation exchange capapcity of your soil
- Fertilizing to match your crop need and expectation
- Etc.

- **ALL SOILS CAN BE MADE HEALTHIER!!!!**

SHMS Criteria Development

- Development of templates, that provide examples for representative **cropping systems** across the country using the following guiding principles…
    - Diversify soil biota with crop diversity
    - Manage more by **disturbing the soil less**
    - Growing a living root year-round
    - Keep the soil covered as much as possible

Practices related to SHMS

Primary

- 328 Conservation Cropping Rotation
- 329 No-till or Strip-till
- 340 Cover Crops
- 590 Nutrient Management
- 595 Pest Management (Integrated)

As Applicable

- 512 Forage and Biomass Planting
- 345 Mulch
- 393,332 Conservation Buffers, Filter Strip

As Applicable (Con't.)

- 449 Irrigation Conservation
- 311 Alley Cropping
- 317 Composting Facility
- 610 Salinity Management

- **Recommended**
- Precision Application of Nutrients
- Controlled Traffic no Tillage
- Flotation Tires no Tillage
- Strip Cropping

- **Soils are highly buffered! They resist change – good or bad!!**

- PATIENCE IS A KEY WORD FOR SOIL HEALTH!!

Baby Steps to Soil Health

- **Don’t burn your stubble….esp. bean stubble!**

- Nutrients already paid for.
- Planter will cut through few inches
- Contributes some residue nutrients
- “Any residue is better than no residue!”

- Biological and Chemical Properties

- **Don’t chisel or field cultivate bean stubble!**

- No diesel fuel cost
- One less trip for compaction – eliminate one-of-four trips! (ie. 80 acres)
- No stirring of oxygen in soil to burn up existing organic matter in humus

- Biological and Physical Properties

- **Don’t field cultivate in spring before planting!**

- Ground is already in good condition.
- Most years, moisture is adequate. Don’t disturb.
- Ground has been fluffed from winter. Doesn’t need another compaction pass.
- Physical Properties

- **Wait one more day!!**

- If top six inches makes a nice compact ball with glistening on the surface……wait.

- Physical Properties

- **Know and understand residual nutrient carryover from prior year!!**

- 10, 20, 30 pounds of N carryover?!
- Adjust current rates accordingly!!

- Chemical properties!

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