"ABC's of Soil Health"

Improving soil health and increasing farm resilience with no-till cropping systems

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What is soil quality?

Soil quality refers to the capacity of the soil to function.

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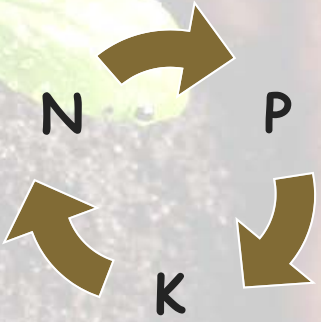
What *functions* do soils perform???

1. Support plants and buildings
2. Cycle nutrients
3. Filter water
4. Regulate water flow
5. Maintain productivity



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Soil Quality Indicators *Indirectly* Measure Soil Function

Indicators used to asses soil function can be grouped into three categories:

- Physical

- Chemical

- Biological

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Tools to Measure Soil Quality:

Soil Quality Test Kit

Soil Quality Score Cards

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Physical Indicators

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Infiltration

Factors Influencing Infiltration…

- Pore size distribution
- Soil structure
- Soil water content
- Tillage intensity / No-till
- Soil compaction
- Surface crusting
- Biological activity (earthworms, etc.)

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Aggregate Stability

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Factors Affecting Aggregate Stability…

- Clay Content
- Organic Matter Content
- Glomalin (Soil Glue)
- Salinity/Sodium Levels
- Tillage

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Bulk Density

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Bulk Density/Compaction

Definitions:

Bulk Density **is the dry weight of a given volume of soil.**

Compaction **is the reduction of pore space.**

Why is it important?

- **Root growth and development**
- **Water and air movement**

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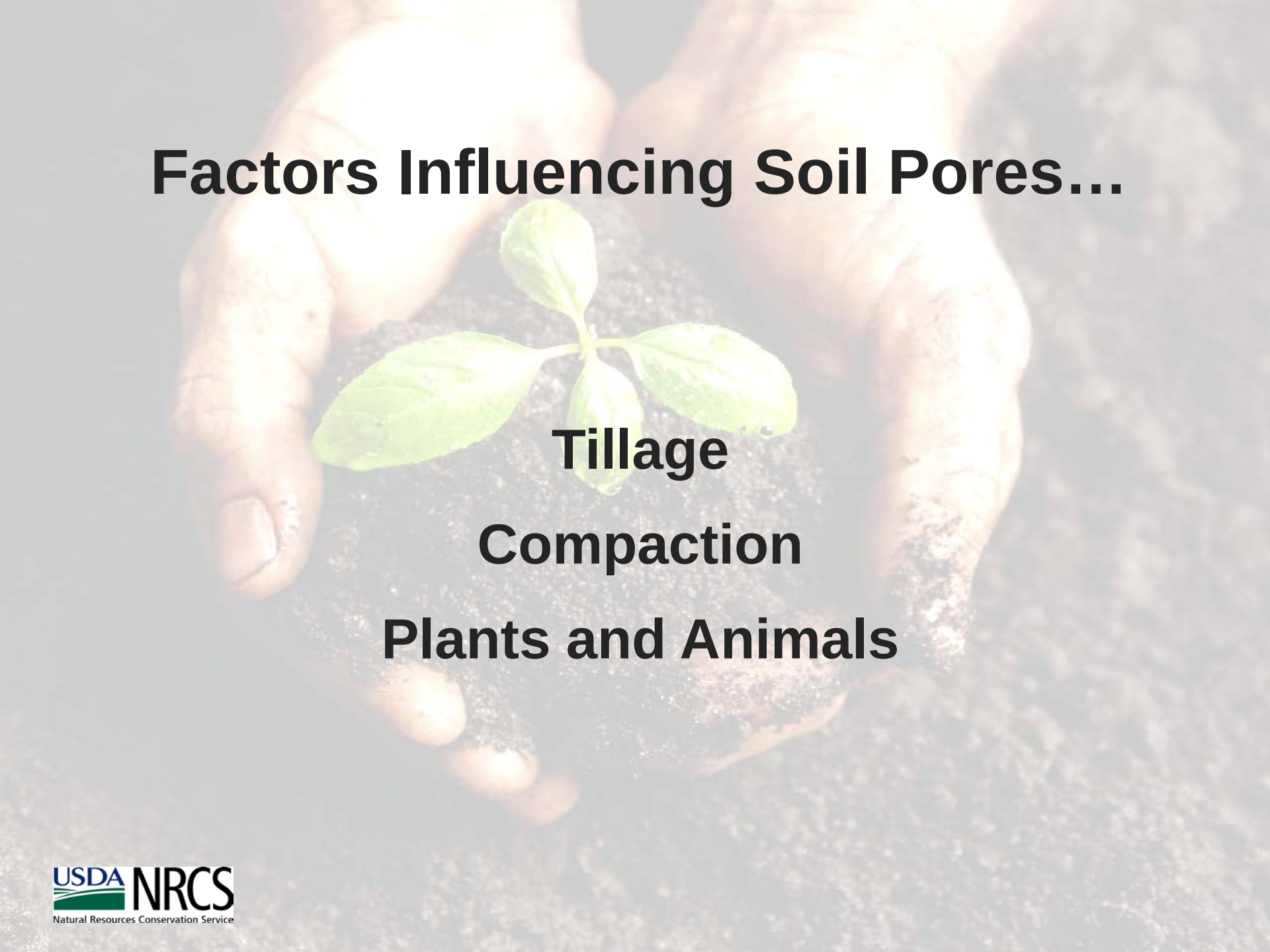
Factors Influencing Soil Pores…



Tillage

Compaction

Plants and Animals

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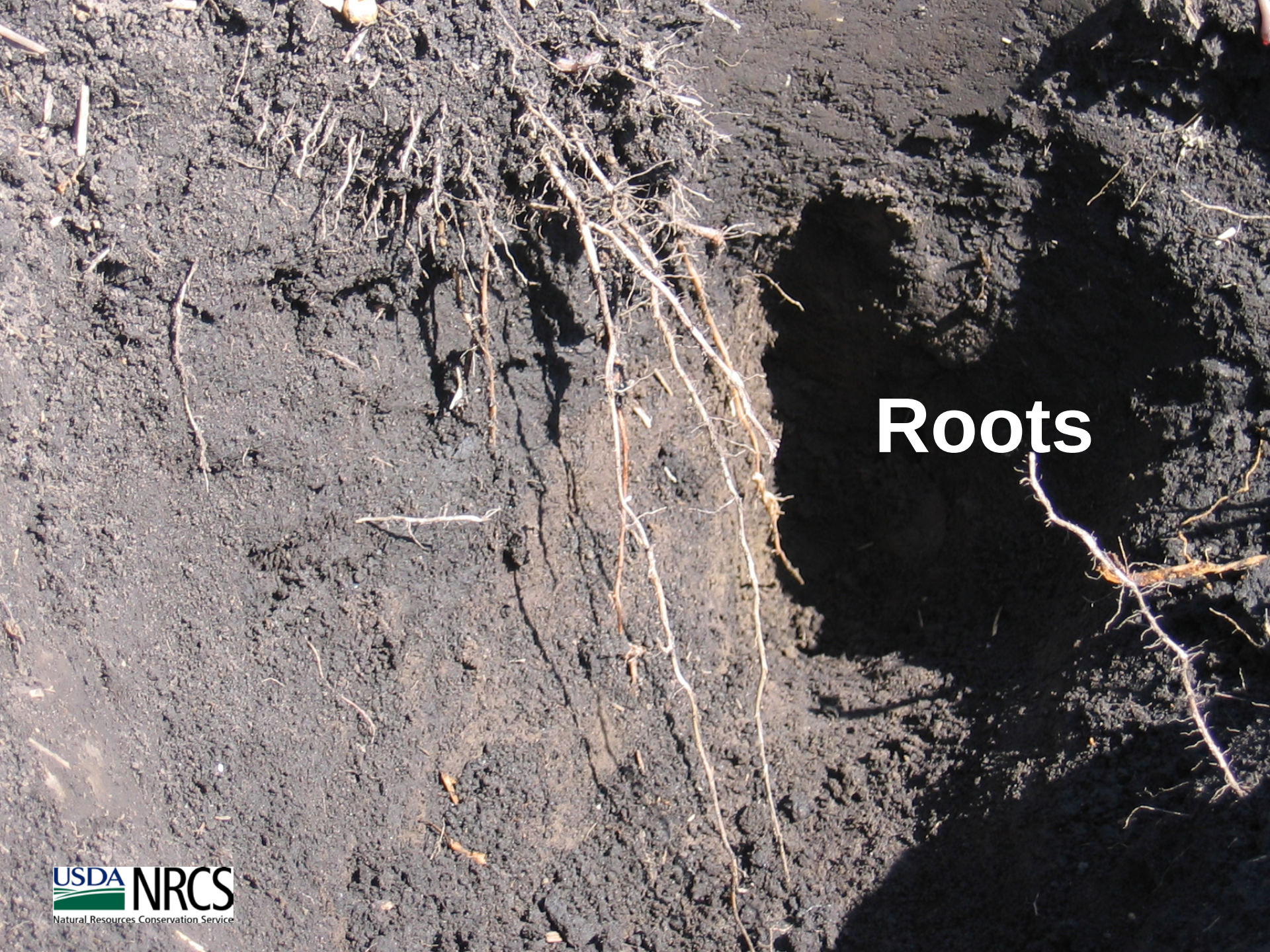

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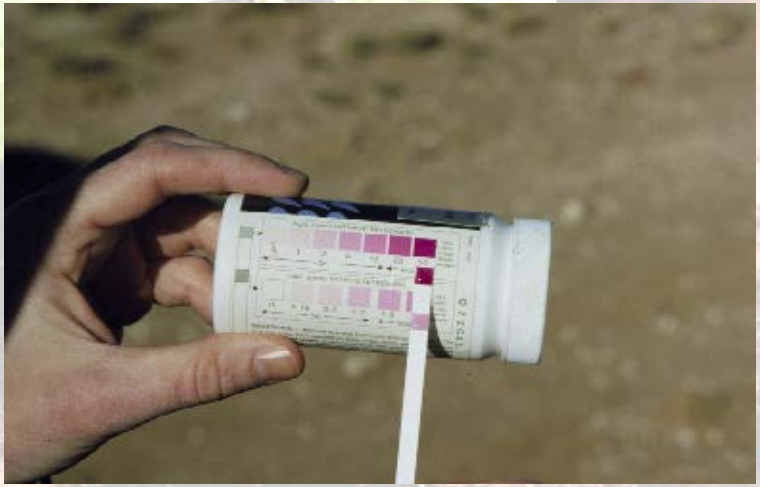
Chemical Indicators

Soil pH

Soil Nitrate



Salinity (Electrical Conductivity or “EC”)

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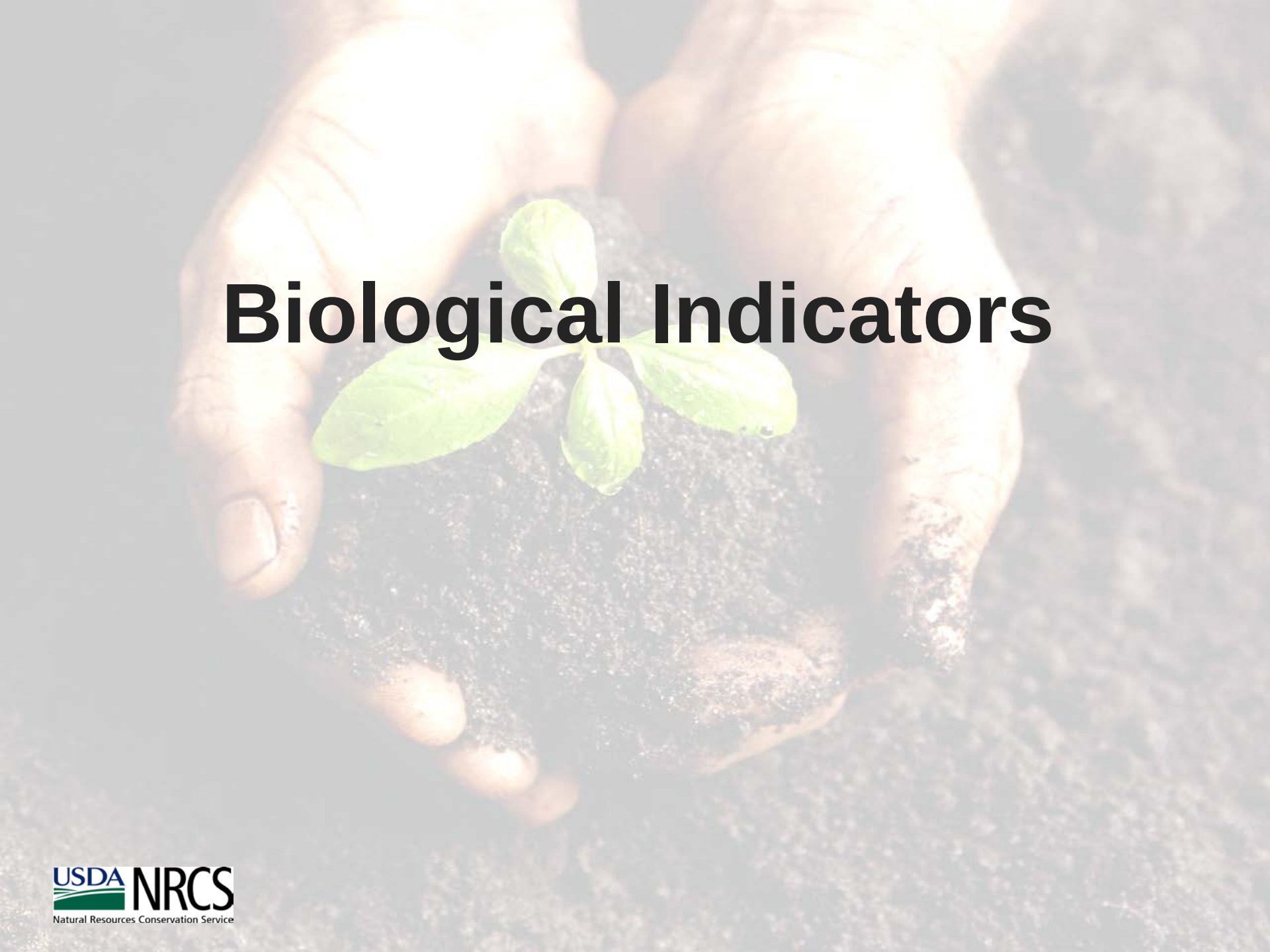
Biological Indicators



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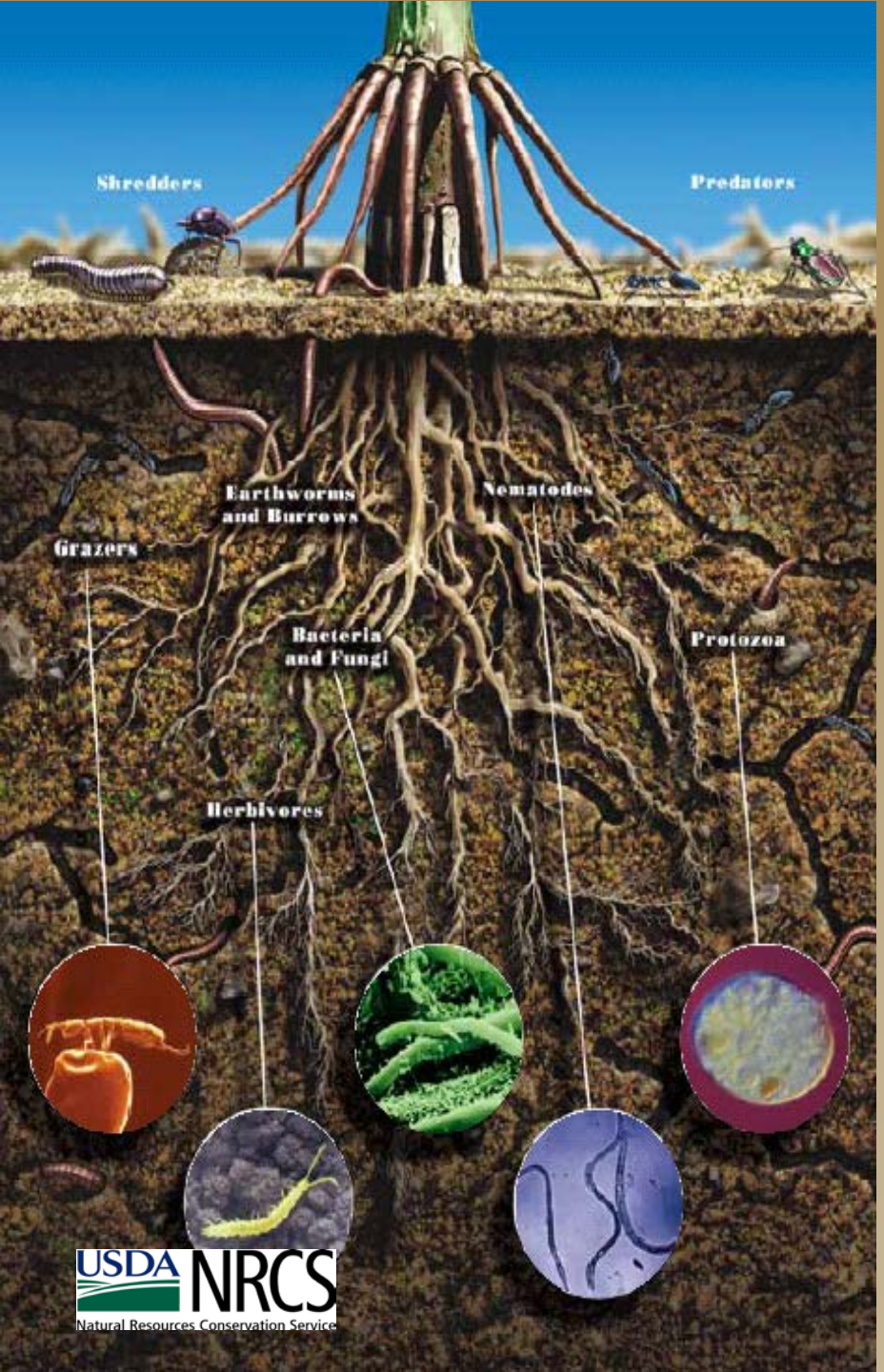
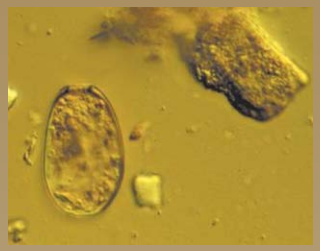
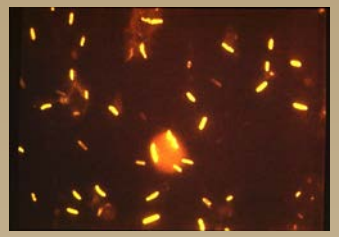
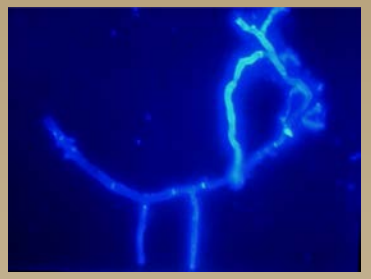


Life in the Soil

- Bacteria
- Fungi
- Protozoa
- Nematodes
- Arthropods
- Earthworms








Measuring soil respiration in the field.
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0.1
0.2
0.3
0.4
0.5
0.6
0.8
1.0
1.2
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Soil Organic Matter

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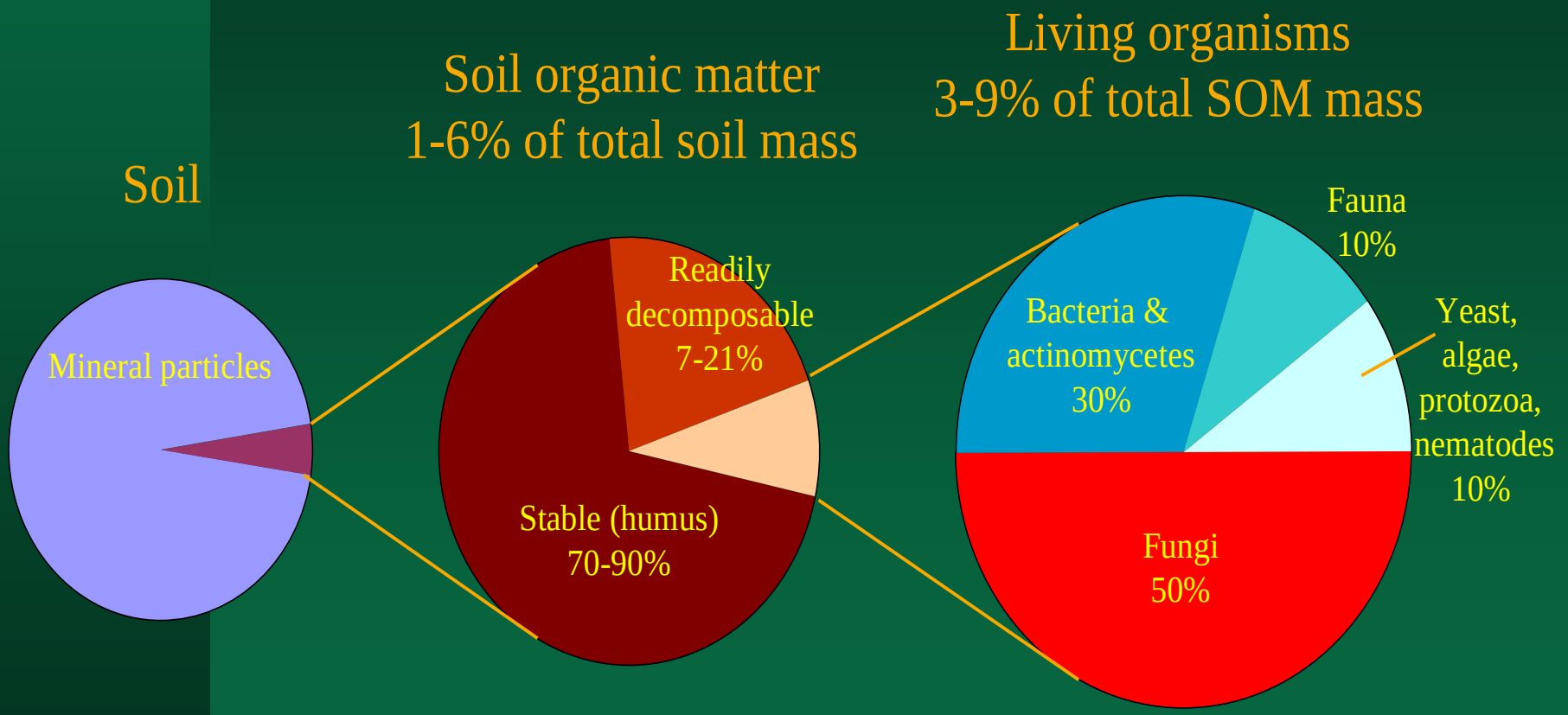
Soil Organic Matter Composition



(Modified from Gregorich et al.,1997)

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Soil Organic Matter (SOM)
(1-6% of *TOTAL* soil mass)

(Alive) Living organisms 3-9% of SOM

Bacteria, fungi, earthworms, nematodes, insects, plant roots

(Recently Dead) organic matter 7-21% of SOM

Fresh or partially decomposed fraction (labile/dynamic)

(Really Dead) Humus 70-90% of SOM

Well decomposed and very stable

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Soil Organic Matter Influences…

- Aggregation and Structure
- Water movement into and within the soil
- Nutrient cycling
- Pest suppression

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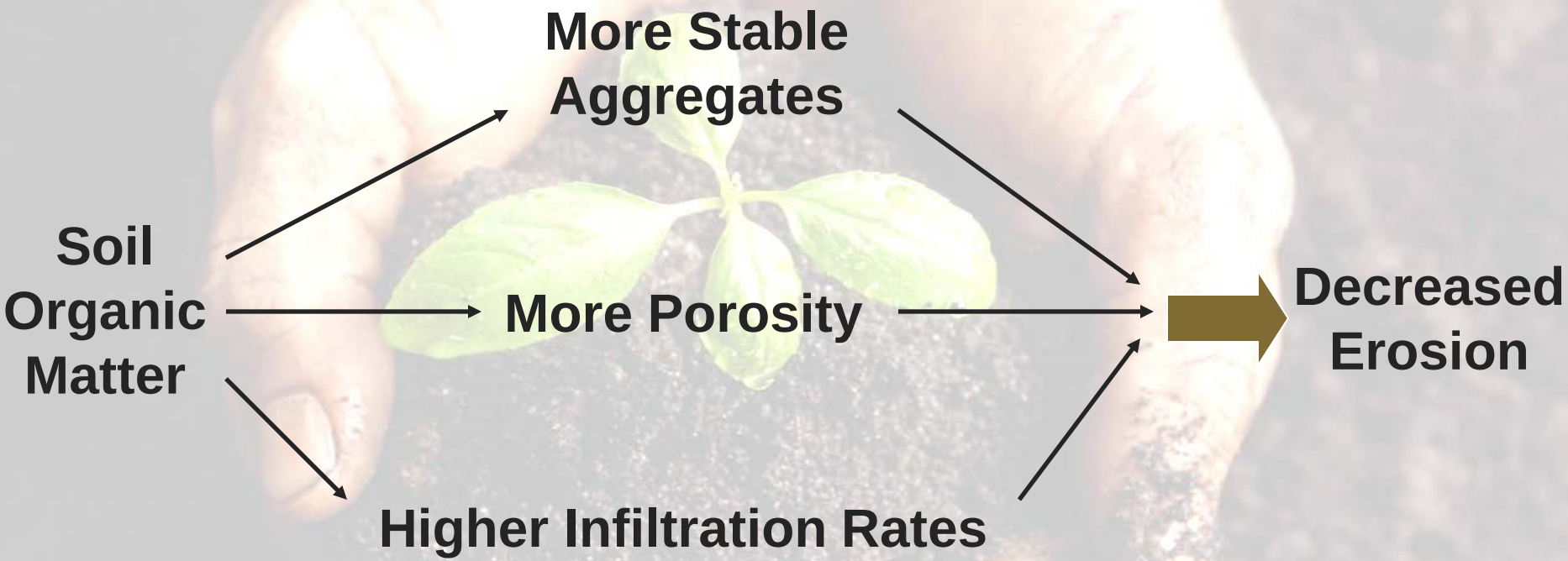

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Intensive tillage destroys the biological and ecological integrity of soil

Before Primary Tillage

After Primary Tillage

After Secondary Tillage

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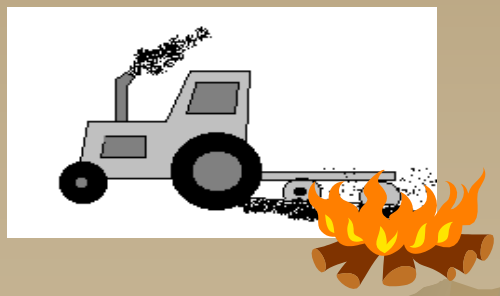
Reicosky (2004)

Consequences of tillage include…

- Reduced organic matter
- Reduced aggregate stability
- Reduced water movement into and within the soil
- Compromised nutrient cycling
- Reduced pest suppression
- **REDUCED SOIL FUNCTION**



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Strategies to Increase Soil Quality:

- ✓ **Residue Management**

  Create a soil environment to slow the rate of residue decomposition and increase the quantity and quality of organic matter.

- ✓ **Crop Rotation**

  Increase diversity of roots and residue to the soil.

- ✓ **Reduce Tillage (No-Till)**

  Reduce pore disruption, compaction, and degradation of soil structure.

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Top 10 Reasons to No-till:

10. Weed control
9. Pest control/Reduced pesticide use
8. Reduced fertilizer use
7. Increased crop diversity
6. Reduced field operation/decrease compaction
5. Reduced input costs $$$$
4. Reduced erosion (wind and water)
3. Increased soil biological activity
2. Increased available water capacity
1. **Increased Organic Matter/Soil Carbon**


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