Objectives

1. List and explain the soil health principles
2. Identify and explain how conservation practices address soil health principles
3. Identify core soil health practices in your region
What are General Characteristics of Cultivated Soils?

- ↓ H₂O Infiltration & Storage
- ↓ Biological Activity
- ↓ Biological Diversity
- ↓ Efficient Nutrient Cycling
- ↑ Summer Temps
- ↓ Contribution to Vigor
- ↑ Erosion Potential
- ↓ Aggregation

The productivity of conventional agricultural systems are maintained with increased technology, labor, fuel, nutrients, pesticides, water...
The Challenge

How can we regain soil function so that...

1. Resource concerns are addressed?
2. Inputs can be reduced?
3. Agricultural productivity is sustainably maintained?

Is it possible to achieve all 3?
The 4 Principles that Conserve the Soil Ecosystem

1. Minimize Disturbance
2. Maximize Living Cover
3. Maximize Biodiversity
4. Maximize Continuous Living Roots
Soil Health Principles to Support High Functioning Soils

Feed
- Fuel Soil Biology
- Improve Resilience
- Improve SOM

Maximize
- Living Roots

Minimize
- Disturbance

Protect
- Soil Aggregates
- Organism Habitat
- SOM

Maximize
- Biodiversity
- Soil Cover
How Soil Health Principles Support Soil function – PROTECT

- Maintain stable aggregates
- Manage erosion
- Buffer temperature
- Reduce evaporation
- Maintain soil organic matter
Minimize Disturbance

Disturbance can:
- ↓ Habitat for soil organisms
- Destroy soil structure

What Types of Disturbance are Common in Agriculture?
- Physical (excess tillage)
- Chemical (over use of fertilizer, pesticides)
- Biological (overgrazing, fallow systems)
What Practices Minimize Disturbance?

- Residue & Tillage Mgmt. (329/345)
- Conservation Cover (327)
- Nutrient Mgmt. (590)
- IPM (595)
- Prescribed Grazing (528)
Why Maximize Soil Cover?

• ↓ Erosion
• ↑ Infiltration
• ↓ Evaporation
• ↔ Soil Temp

• Habitat for Soil Organisms ↑
• Food for Biota ↑
• ↔ Compaction from Machines & Livestock
What Practices Maximize Soil Cover?

- Cover Crop (340)
- Residue & Tillage Mgmt. (329/345)
- Conservation Cover (327)
- Mulching (484)
- Controlled Traffic (334)
- Forage & Biomass Planting (512)
- Prescribed Grazing (528)
How Soil Health Principles Support Soil Function – FEED

- Stimulate below-ground diversity
- Increase SOM
- Improve nutrient cycling
- Enhance plant growth
- Break pest cycles
- Increase predator & pollinator populations

Maximize Living Roots
Maximize Biodiversity
How Do We Maximize Living Roots?

- Grow crops in the off-season
- Avoid fallow & ↓ re-cropping interval
- ↑ time in perennial crops
- Manage rotations & forage height

What Practices?

- Conservation Crop Rotation (328)
- Conservation Cover (327)
- Cover Crop (340)
- Forage & Biomass Planting (512)
- Prescribed Grazing (528)
How Do We Maximize Biodiversity?

- Grow diverse cover crops & legumes
- ↑ diversity of crop rotations
- Integrate livestock & graze cover crops
- ↑ time in diverse perennial crops

What Practices?

- Conservation Crop Rotation (328)
- Conservation Cover (327)
- Cover Crop (340)
- Forage & Biomass Planting (512)
- IPM (595)
- Prescribed Grazing (528)
### Core Practice Review

#### Cons. Crop Rotation

**Principles Addressed**
- ✔ Disturbance
- ✔ Cover
- ✔ Diversity
- ✔ Roots

**Practice Highlights**
- Provides diverse root architecture & exudates
- ↑ Development of diverse soil microbial communities
- Breaks disease & pest cycles
- ↑ nutrient cycling

#### Conservation Cover

**Principles Addressed**
- ✔ Disturbance
- ✔ Cover
- ✔ Diversity
- ✔ Roots

**Practice Highlights**
- Eliminates mechanical soil disturbance
- Provides year-round roots
- Keeps the soil covered 365 days a year
- Offers a diverse plant community with above & below ground benefits

#### Cover Crop

**Principles Addressed**
- ✔ Disturbance
- ✔ Cover
- ✔ Diversity
- ✔ Roots

**Practice Highlights**
- Provides diverse root architecture & exudates
- Covers, protects, and adds C to soil during non-cash crop periods
- Erosion, compaction & weed mgmt. benefits
- Adds diversity & fix N
Core Practice Review

Residue/Tillage Mgmt.

**Principles Addressed**
- 👇 Disturbance
- ✔ Cover
- ❓ Diversity
- ❓ Roots

**Practice Highlights**
- 👇 Physical destruction of aggregates
- 👇 Erosion & evaporation
- 👇 Amount of SOC oxidized to CO₂
- Keeps residue on the surface to protect aggregates, moderate soil temps & moisture

Mulching

**Principles Addressed**
- ❓ Disturbance
- ✔ Cover
- ❓ Diversity
- ❓ Roots

**Practice Highlights**
- Armor dissipates raindrop energy
- Moderates soil temps & 👇 evaporation rates
- Protects soil organisms & aggregates
- 👇 erosion
- Suppresses weed growth

Nutrient Management

**Principles Addressed**
- ✔ Disturbance
- ❓ Cover
- ❓ Diversity
- ❓ Roots

**Practice Highlights**
- 👇 disruption of the soil ecosystem due to over-or mis-use of plant nutrients
- Supply only those nutrients not provided by the soil system
Core Practice Review

**Prescribed Grazing**

**Principles Addressed**
- ✓ Disturbance
- ✓ Cover
- ✓ Diversity
- ✓ Roots

**Practice Highlights**
- Manure improves activity & diversity of soil organisms
- Managed forage heights promote deeper rooting
- Maintains higher levels of residue on the soil surface
- Reduces chemical & mechanical disturbance

**Forage/Biomass Planting**

**Principles Addressed**
- ✓ Disturbance
- ✓ Cover
- ✓ Diversity
- ✓ Roots

**Practice Highlights**
- Provides year-round roots
- Keeps the soil covered 365 days a year
- Offers a diverse plant community with above & below ground benefits

**IPM**

**Principles Addressed**
- ✓ Disturbance
- ✓ Cover
- ✓ Diversity
- ✓ Roots

**Practice Highlights**
- Reduces chemical disturbance associated with over- or mis-use of pesticides
- Encourages greater diversity of soil organisms
- Manage weed resistance
Adapt, learn, and leave land better for the next generation!!!

Questions?
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