

Building Your Garden's Soil

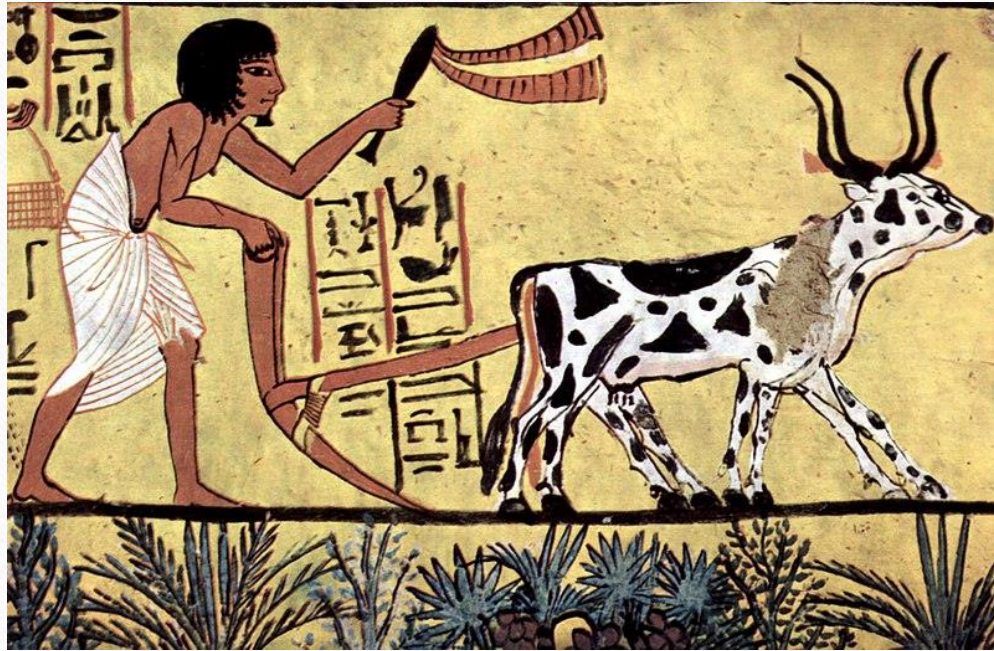
Cornell Master Gardener Volunteer Program Training

March 13th 2023

A Brief Look at Regenerative Ag Practices

- Overview of Soils and Human History
- Current State of World Soil Depletion & Carbon Loading
- Knowing your soil and setting goals for improvement
- Following the Four Principles (sometimes 5) of Soil Health:
 - Maximize Presence of Living Roots
 - Minimize Disturbance
 - Maximize Soil Cover
 - Maximize Biodiversity

The Plow in Human History



MISS J. JAY COON,

Toledo, Ohio.

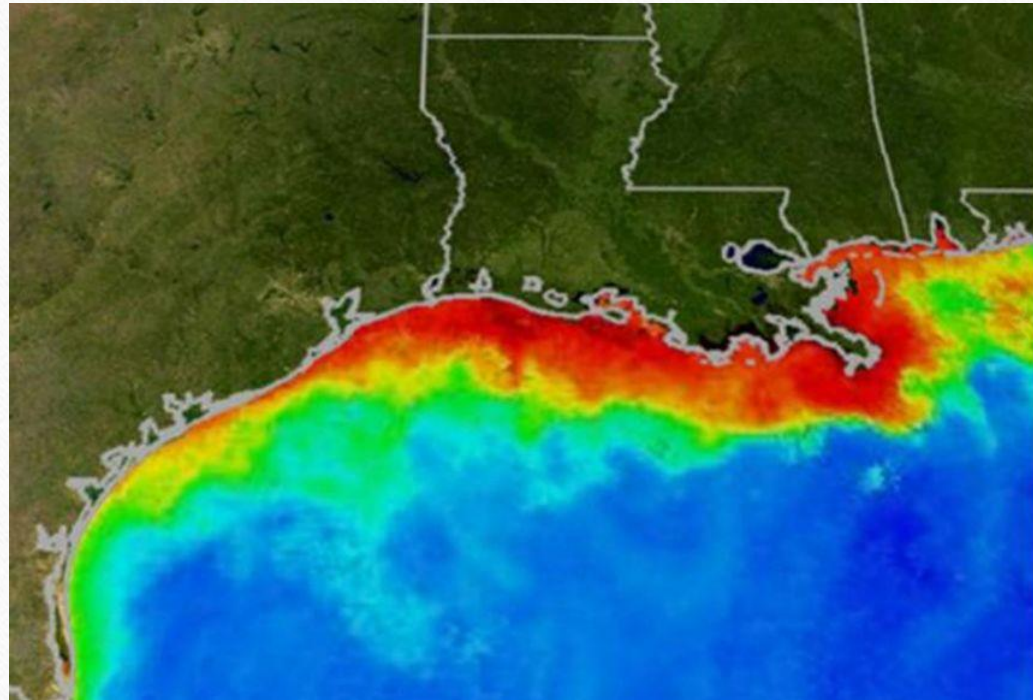
A thing or two soil tillage

- Purpose of tilling the soil:
 - Free nutrients in soil through exposure to oxygen
 - Disrupt the growth of weeds and competing plants
 - Turn over soil and bring organic matter into soil
 - Overall, favoring one plant by concentrating resources on those and reducing resources to competing plants
- Problems with overworked soil
 - Erosion of topsoil into waterways
 - Creation of compacted layer
 - Consumption of organic matter leaving little for subsequent crops
 - Reducing soil organisms like fungi, insects and bacteria that aid in plant health
 - Open, overworked soil is a major source of carbon dioxide in the atmosphere

The Plow in Human History



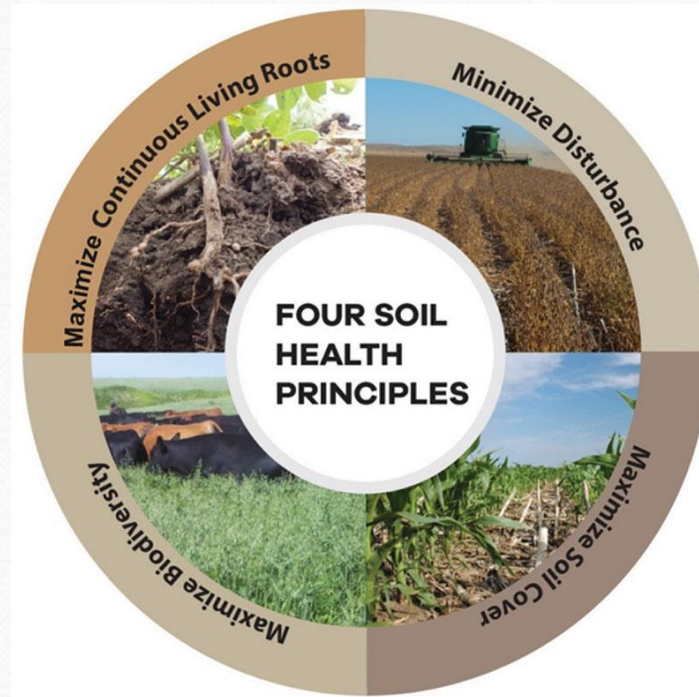
Current State of World Soil Depletion & Carbon Loading



Current State of World Soil Depletion & Carbon Loading

- Study of Ag in Iowa:
 - -Over 15 million tons of topsoil lost annually to erosion, into the Mississippi River, contributing to a "dead-zone" that is larger than the state of Connecticut and growing
 - -Topsoil loss means that ag needs means lower crop yields which in turn causes farmers to add more artificial fertilizer
 - -Cost to the Iowa Farm Economy is over \$1 Billion annually
 - This is a global problem that exists throughout agricultural communities, especially in developing nations

Regenerative Agriculture Movement



Knowing Your Soil Context & Setting Goals for Improvement

- Knowing Your Soil Context:

- Climatic Zone
- Soil Types
- The History of Your Soil

- Soil Improvement Goals:

- Fertility
- Structure
- Depth
- Drainage & Aeration
- Minimal Pests
- Toxin Free
- Resilience

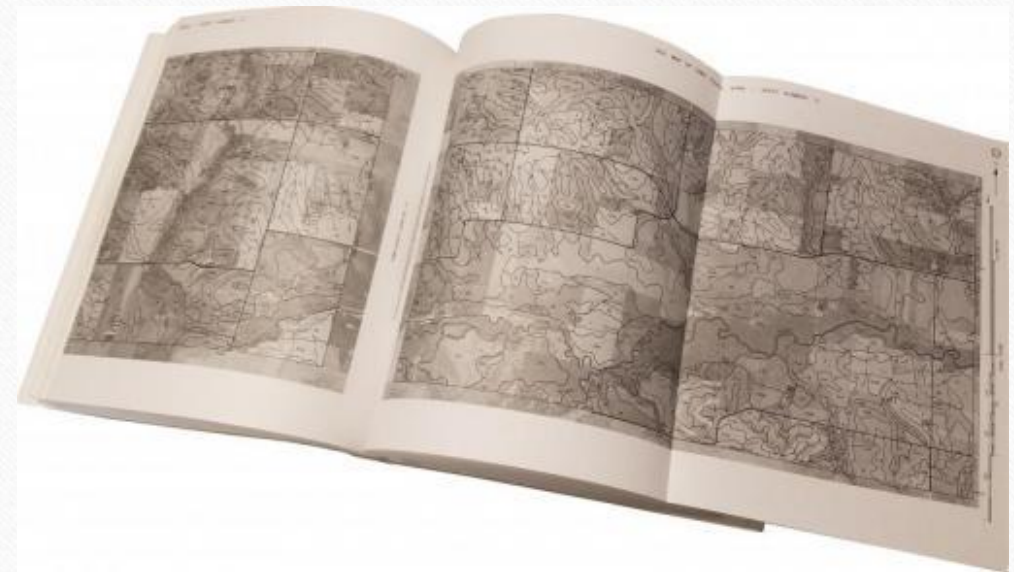
Knowing Your Soil Context

- Climatic Zone as a starting point,
 - It is changing as climate changes
 - There are microclimates down to the square foot level
 - Orientation of garden spaces and planting practices influence microclimates
 - Urban areas are heat sinks and require different strategies



Knowing Your Soil Context

- Soil Types:
 - Base Soil types can be determined by using two website:
 - <https://websoilsurvey.nrcs.usda.gov/app/>
 - <https://casoilresource.lawr.ucdavis.edu/gmap/>
 - Remember, soil structure is subject to use over time and maps are only a starting point



Knowing Your Soil Context

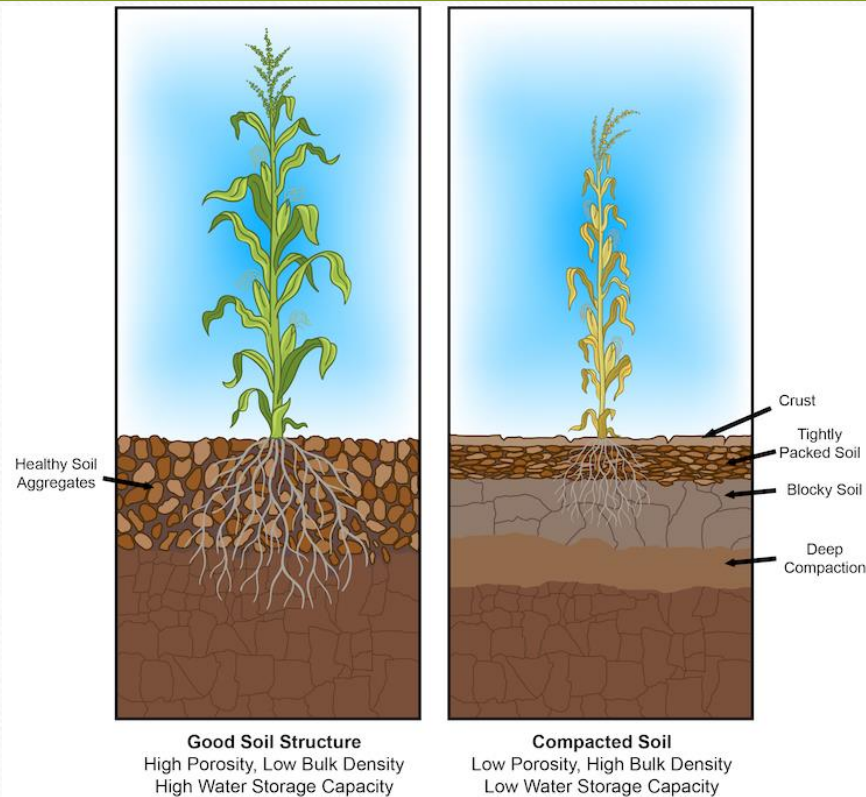
- History of Land Use
 - Former Ag Land? What were the practices followed?
 - In villages, building sites and streets often change over time
 - Places that were intensively farmed often have soil depletion/compaction
 - Previous generations used chemicals more frequently, some of which persist in the environment for decades



Principle #1: Maximize Presence of Living Roots



Maximize Presence of Living Roots

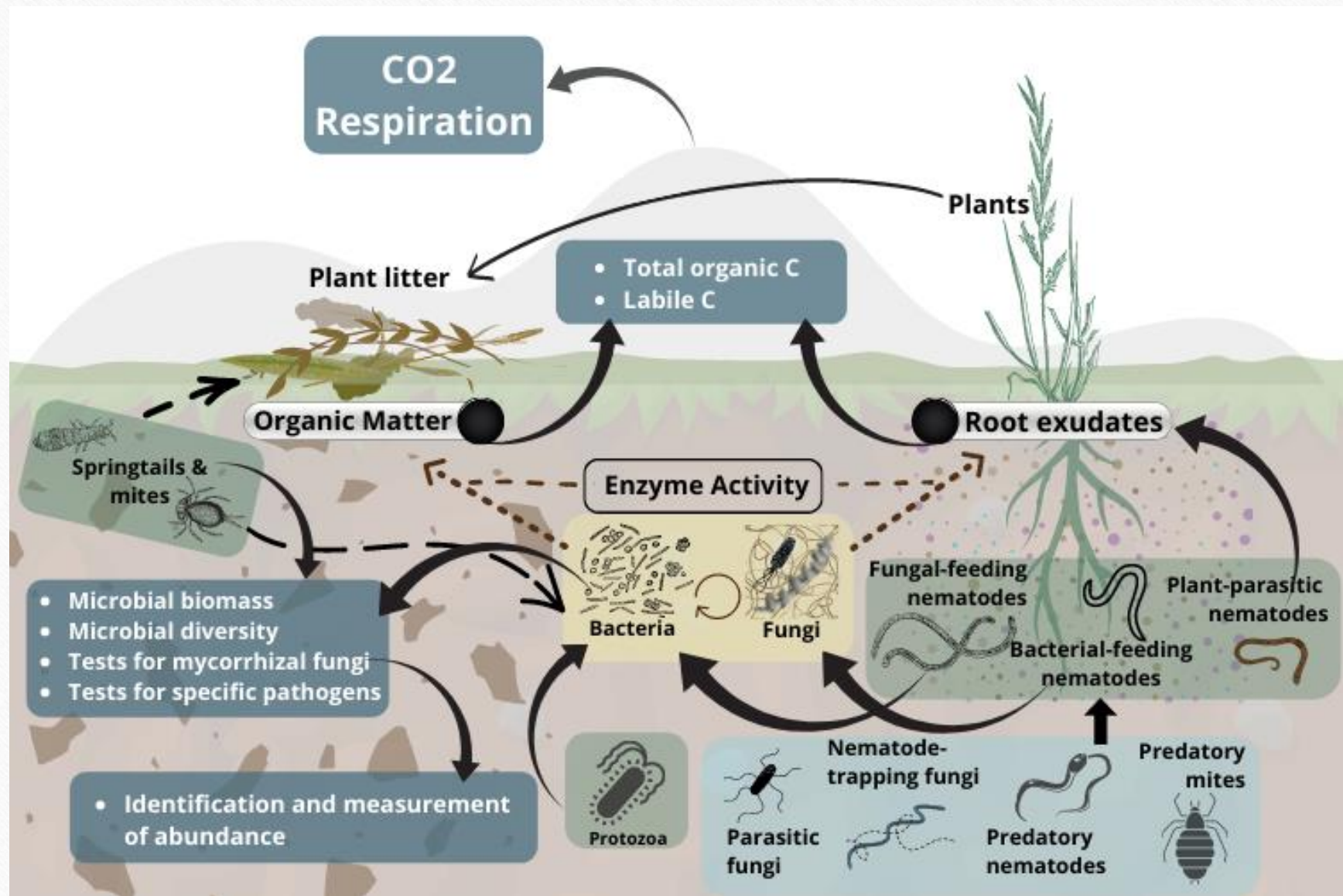


Maximize Presence of Living Roots



Maximize Presence of Living Roots

- Having living roots protects the soil from erosion and provides weed control for the following crop.
- Helps reduce the leaching of nutrients through the winter. Cover crops absorb residual nutrients (nitrogen in particular) and hold them before making them available for the next crop as it decomposes.
- Living roots replenish the soil and provide much of the energy for the base of the food web, considered very important for the maintenance of soil health.
- Living roots play a key role in soil infiltration, reducing run off and the biology which they support can boost soil aggregation through the excretion of polysaccharides (substance which acts like glue to hold soil together)



Principle #2: Minimize Soil Disturbance



Minimize Soil Disturbance

- Excessive soil disturbance destroys soil structure, upsets macro and micro organisms and puts soil in constant recovery mode
- Fungal structures in soil grow in complex forms many feet in extent. Too much mechanical tillage breaks them up and reduces their benefits
- Unnecessary nutrient release from over tillage results in nutrients leaching out of soil and will require more soil amendments for following crops

Need for tillage:

- Turning in organic matter at the end of the season to integrate into the soil
- Pest control to break the recurrence of pests that overwinter in the soil like cabbage loopers, carrot weevils and some borers
- Prepare the soil for winter cover crop like winter rye or others
- Creation of productive seed bed (can be done with hand tools)

Tillage Alternatives

- Raised Beds built 12-16 inches or taller to build soil in a confined area that allows for: enhanced root development, longer planting season, soil building through adding organic materials
- Lasagna Gardening by building alternate layers of organic material (often cardboard) and soil on top of garden base. Organic material decomposes and becomes available to plant life.
- Hugelkultur is a method of building raised beds with yard waste (tree branches, brush and other material) as a base then adding soil on top. The base material continuously decomposes and feeds the soil above.

Principle #3: Maximize Soil Cover



- Stabilize and reduce soil erosion
- Addresses specific soil problems like compaction and nutritional deficiencies.
- Increase soil biologic activity which reduces the need for further tillage
- Controls weeds and other unwanted vegetation
- Create habitat for wild creatures during the winter.

Principle #4: Maximize Biodiversity



Maximize Biodiversity

- Grow a variety of different plants and plant types including annuals, perennials, pollinator plants, etc.
- Avoid mono-cropping which weakens the bio-diversity of your soil and encourages plant specific pests and diseases
- Encourage pollinators in your home environment through plantings and reduced use of chemical inputs.
- Use of cover crops are an excellent way to increase the bio-diversity of your garden and increase available nutrition—make sure to terminate seeding varieties on time!

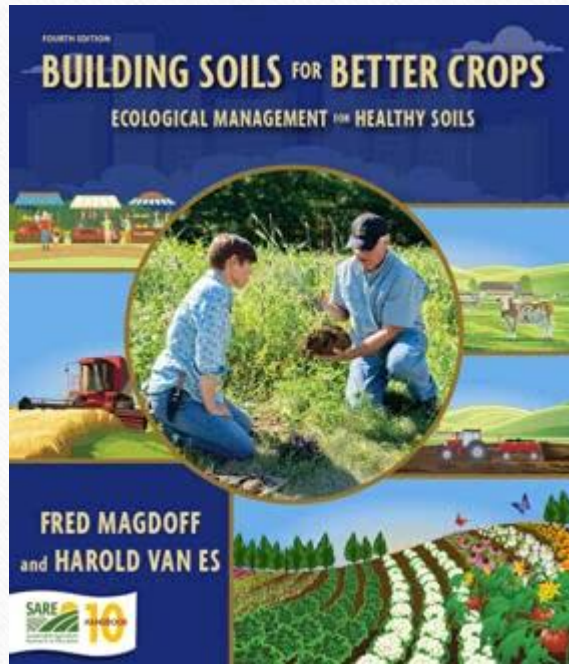
Additional Regenerative Ag Resources



Cornell Soil Health Lab

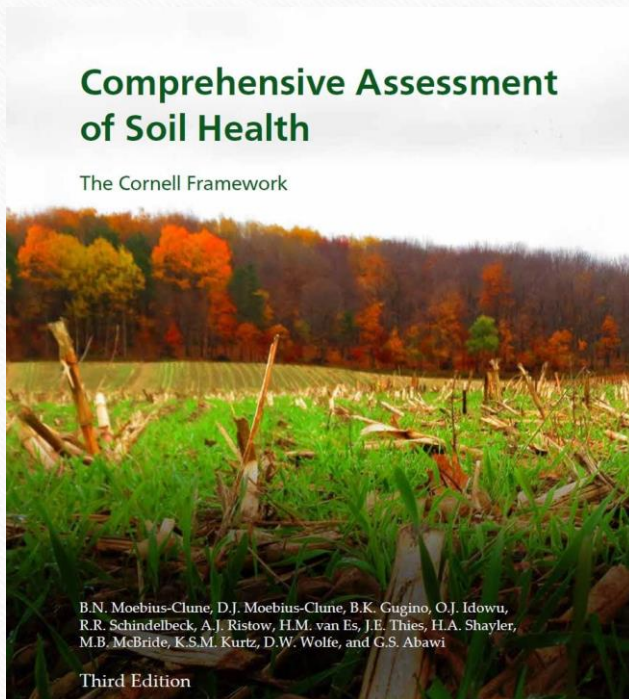
- <https://soilhealth.cals.cornell.edu/>

Additional Regenerative Ag Resources



- <https://www.sare.org/resources/building-soils-for-better-crops/>

Additional Regenerative Ag Resources



- <https://soilhealth.cals.cornell.edu/manual/>