Building Soil Health with Animal Agriculture

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Soil Fertility and Regenerative Agriculture Advocate

Outline

- Soil Health vs. Regenerative Agriculture
- Why is it the “Term du Jour”
- Soil Basics
- Principle and Practices

What is Soil Health?

The continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.

Regenerative Agriculture – 'Defined'

"a system of farming principles and practices that increases biodiversity, enriches soils, improves watersheds, and enhances ecosystem services" (Terra Genesis International, 2020)

"a long-term, holistic design that attempts to grow as much food using as few resources as possible in a way that revitalizes the soil rather than depleting it, while offering a solution to carbon sequestration" (Rhodes, 2017)

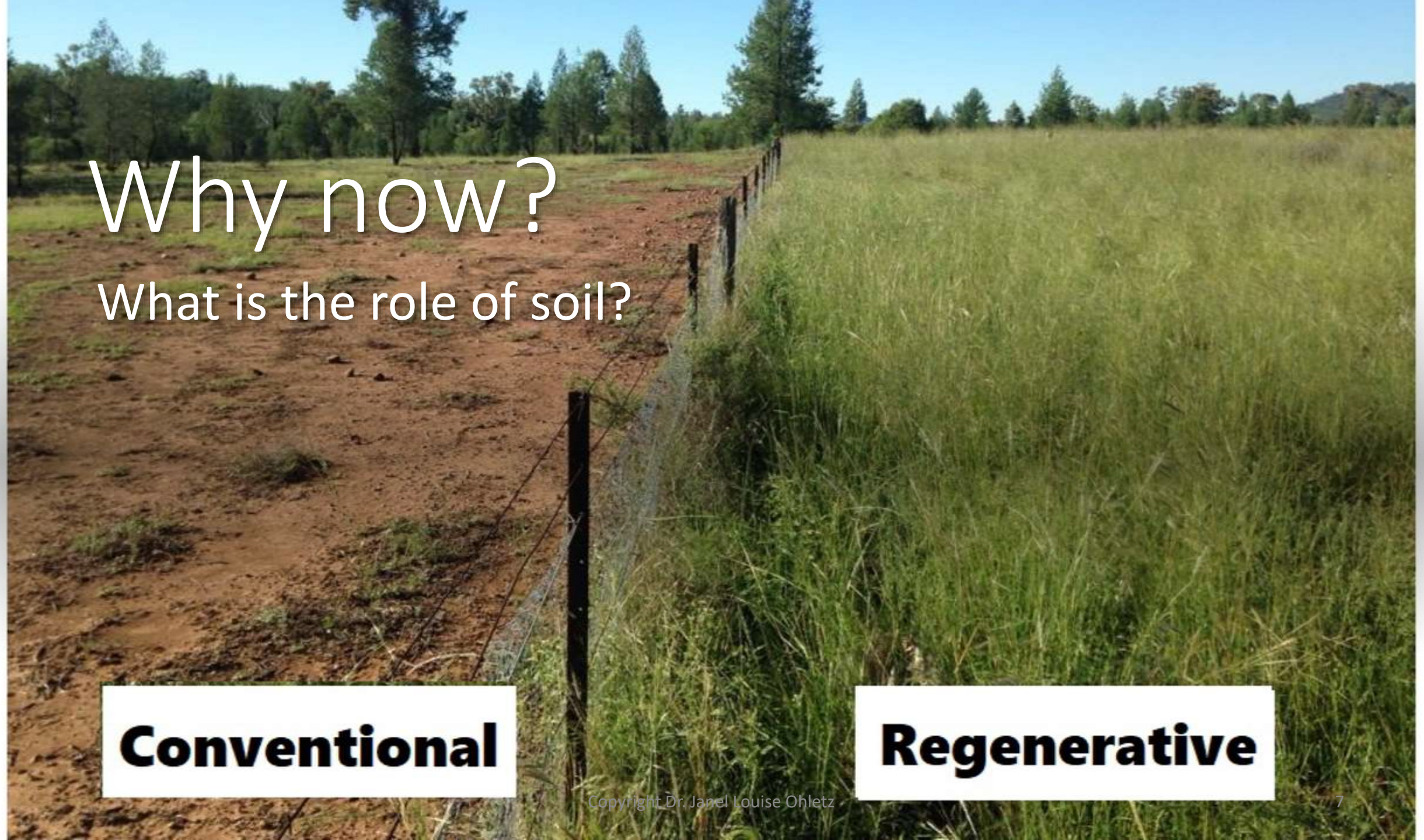
"a form of enterprise that incorporates a community of people engaged in civil labor to produce and consume the food (and land, landscape and amenity) that they, collectively, decide to grow" (Ravenscroft et al., 2013).

- organic regenerative agriculture
- agroecological farming
- alternative agriculture
- biodynamic agriculture
- carbon farming
- nature inclusive farming
- conservation agriculture
- green agriculture
- sustainable agriculture

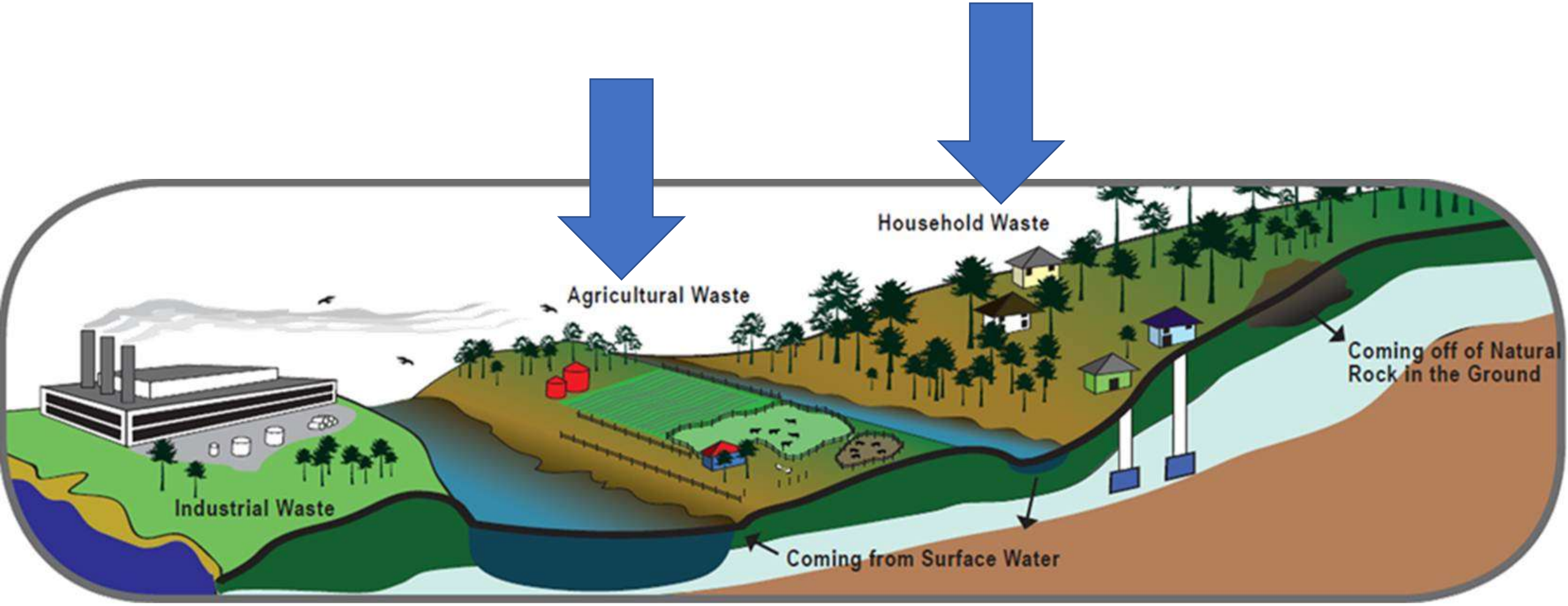
Why now?

Why now?

What is the role of soil?



Where do we start?



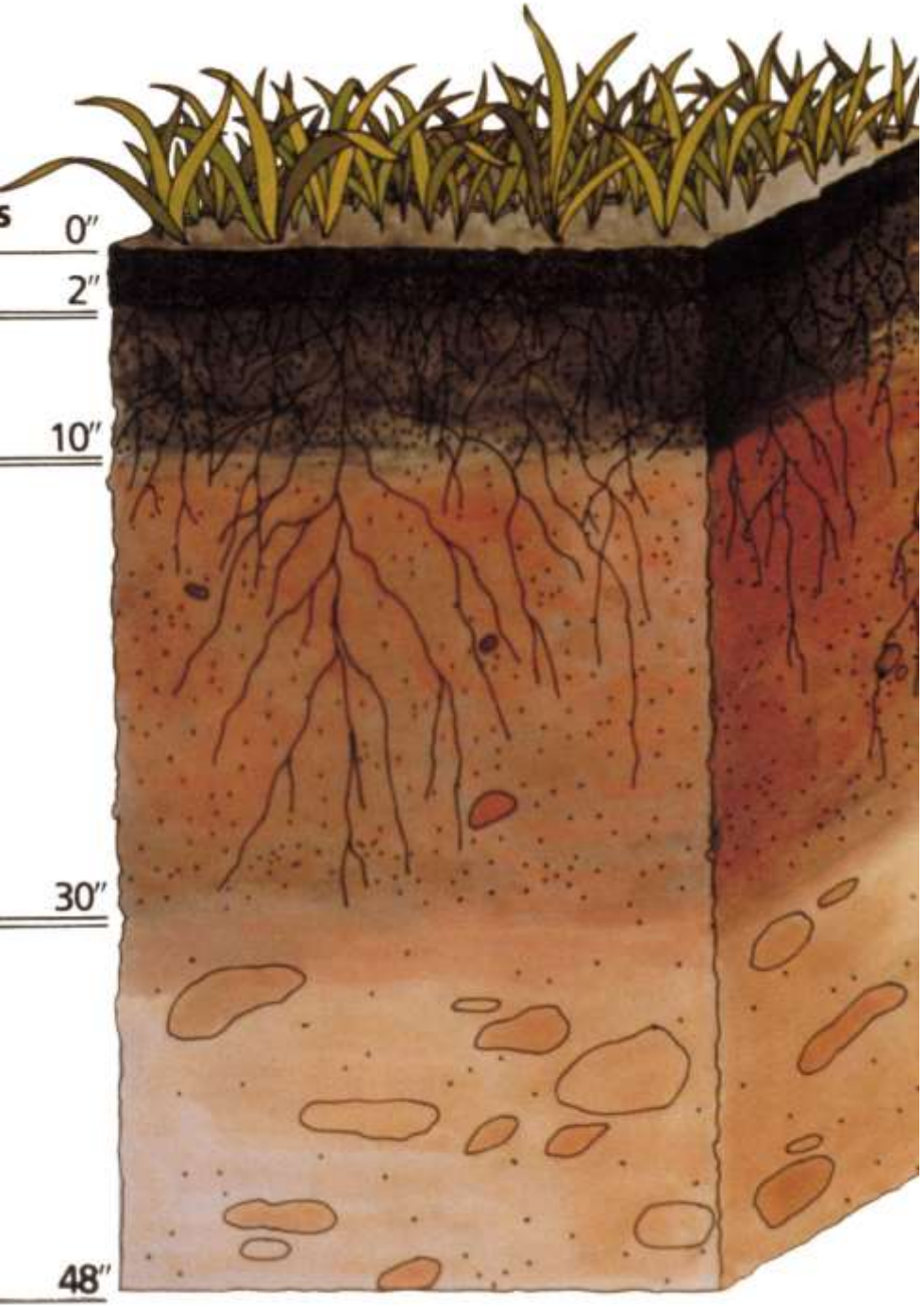
(NC Department of Health and Human Services, 2011)

Soils

- the living skin of the earth
- very thin, very precious resource
- the medium of almost all terrestrial plant life
- made up of individual 3-dimensional bodies
- differ from place to place
- those differences affect many things

Soil Forming Factors
(soil genesis)

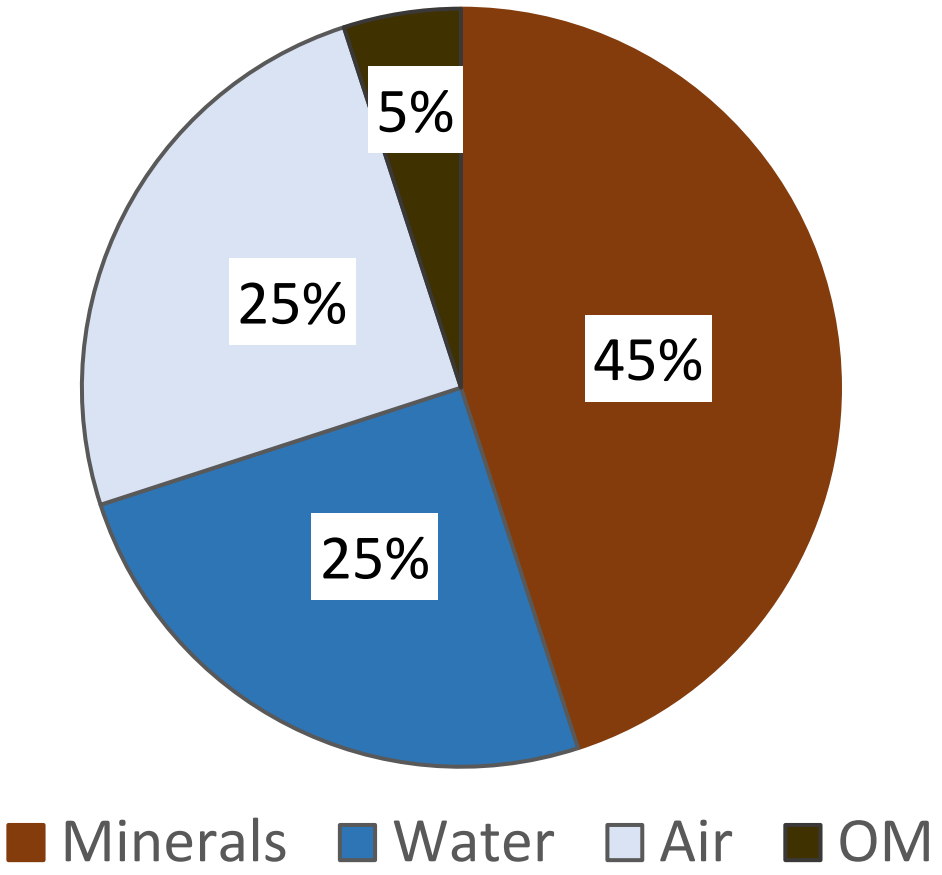
Climate	temperature, precipitation, daylight, seasonality
Organisms	the effect of plants and animals
Relief	slope, aspect (direction), topography
Parent Material	the material the soil forms from (residual / transported)
Time	how long has the soil been forming (soil genesis)



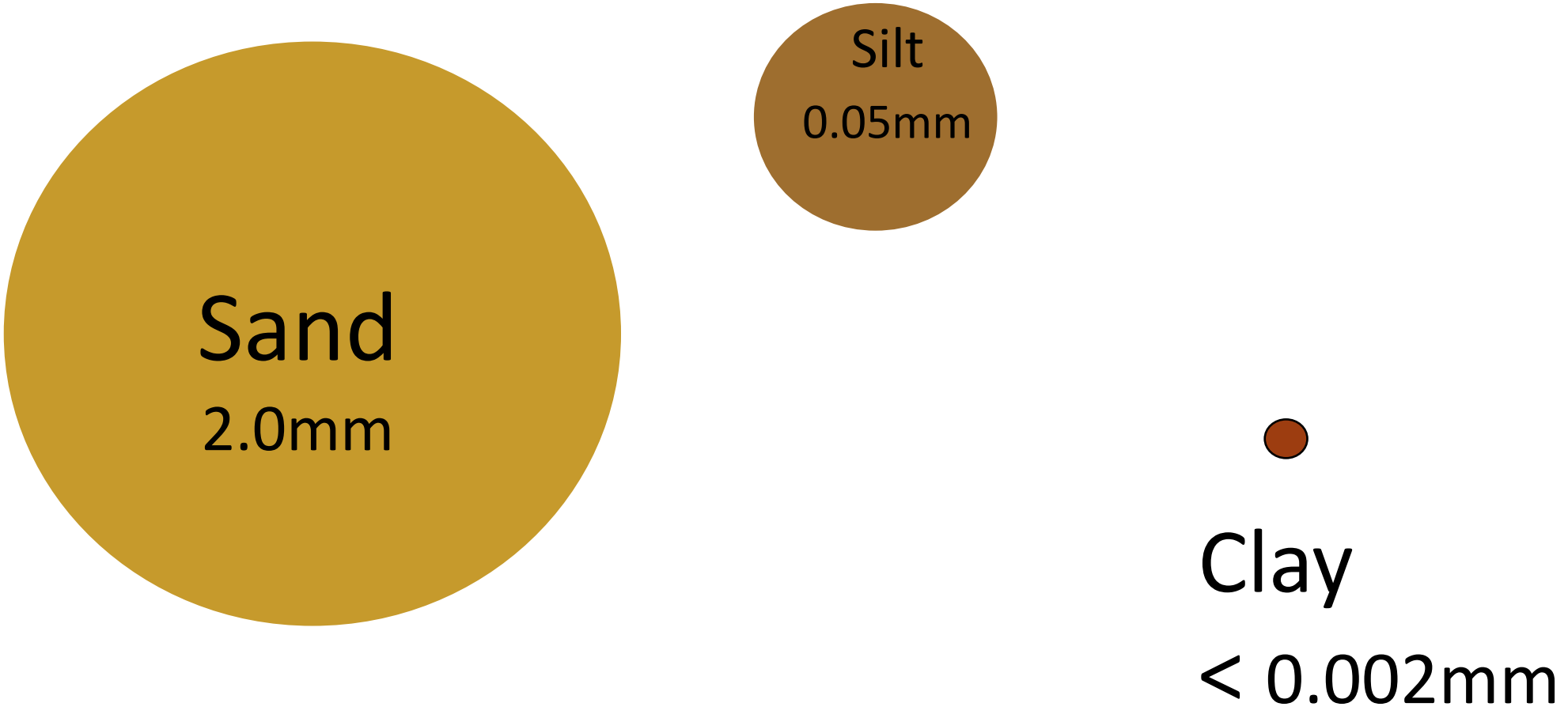
Soil Basics

- Soil is dynamic
- Made up of layers

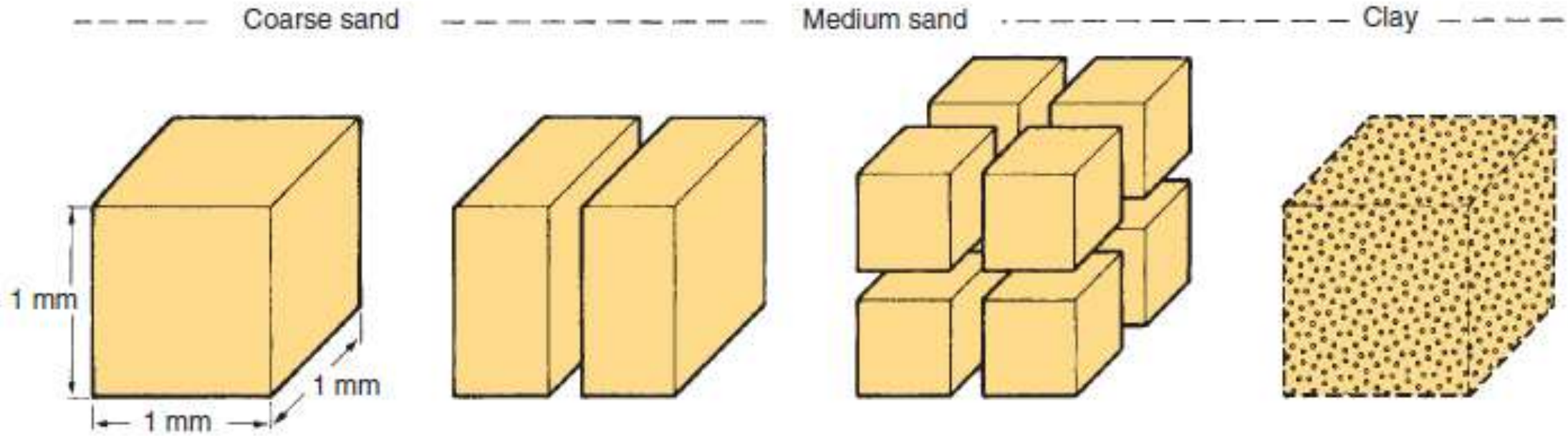
Soil Components



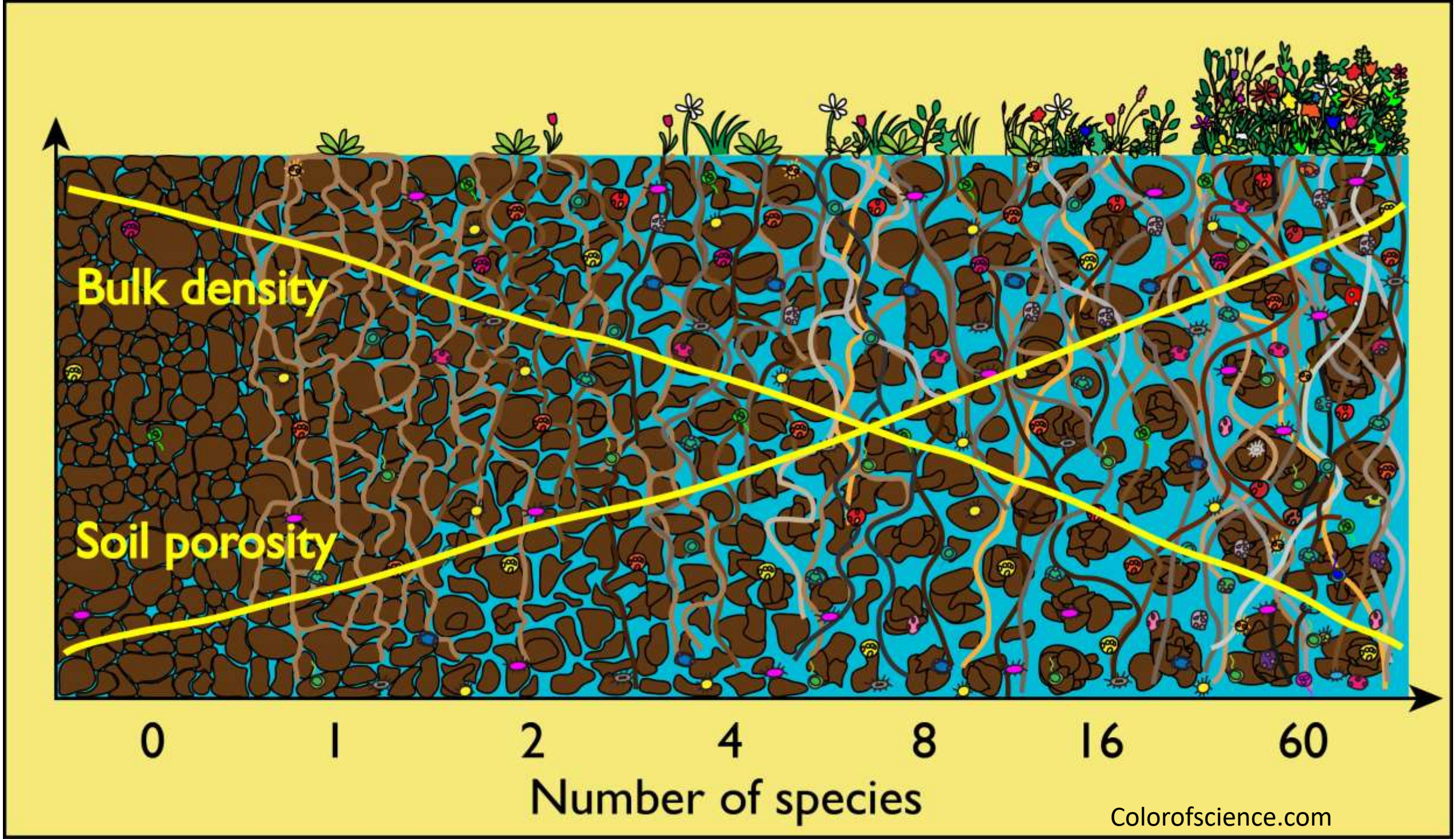
Minerals



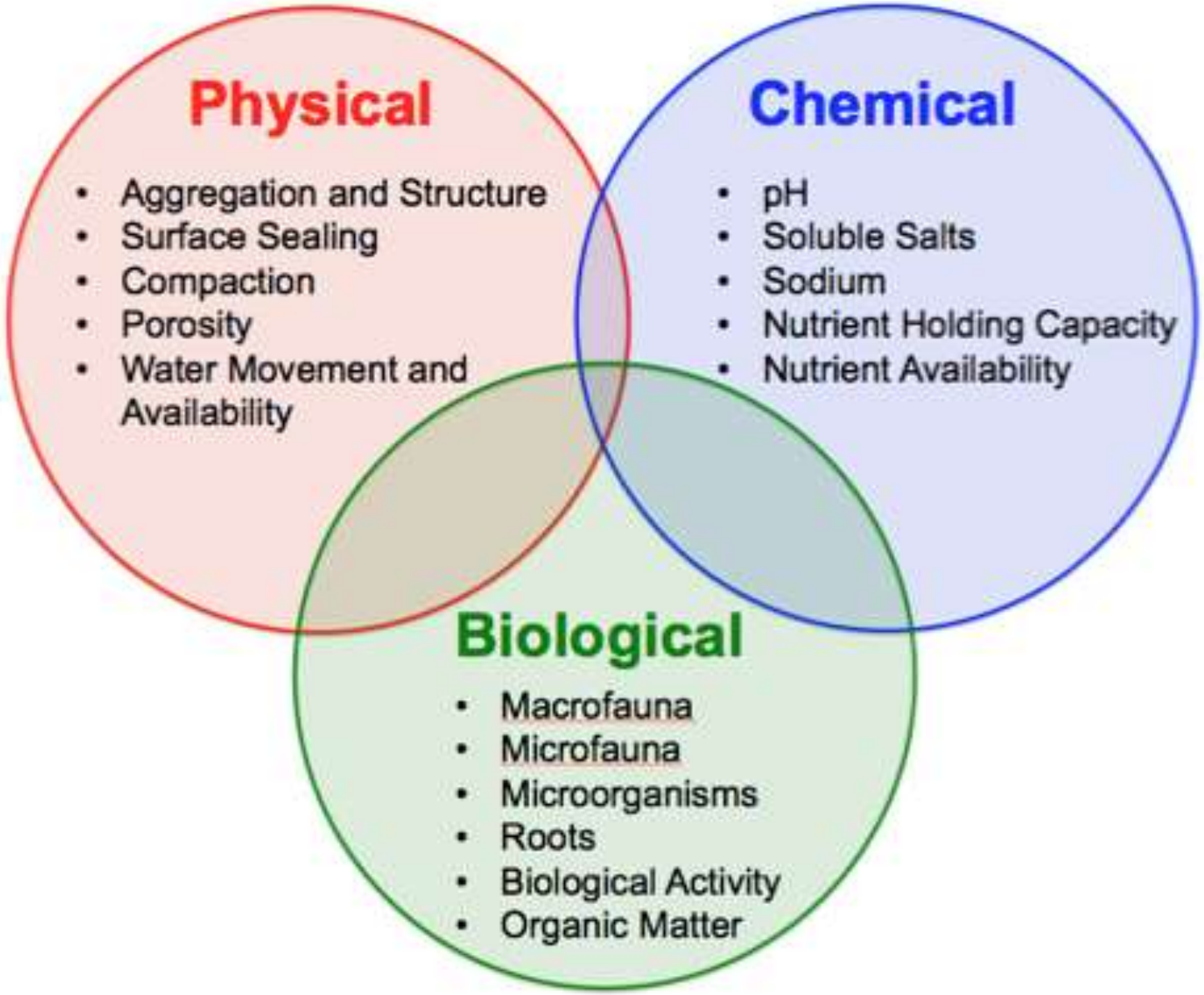
Soil Surface Area



Volume	1 mm^3	1 mm^3	1 mm^3	1 mm^3
No of pieces	1	2	8	1000 million
Total surface area	6 mm^2	8 mm^2	12 mm^2	6000 mm^2


Bulk density
Soil porosity
0
1
2
4
8
16
60
Number of species
Colorofscience.com

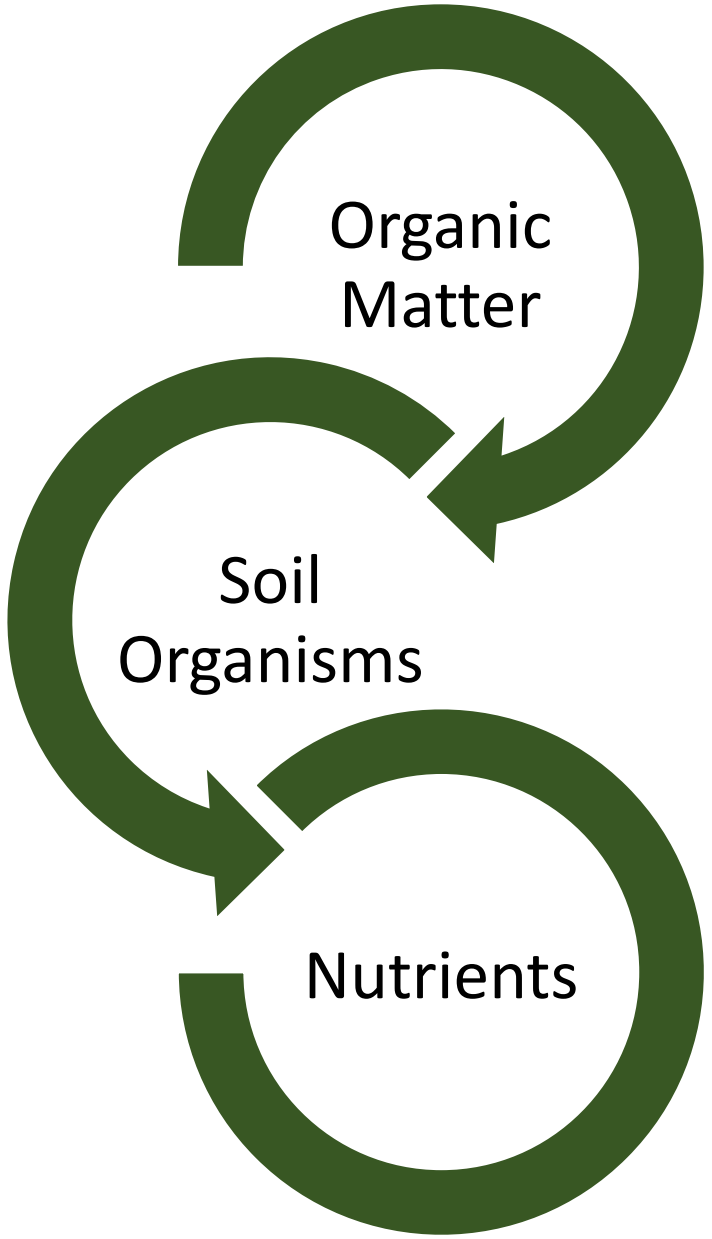
Soil Properties

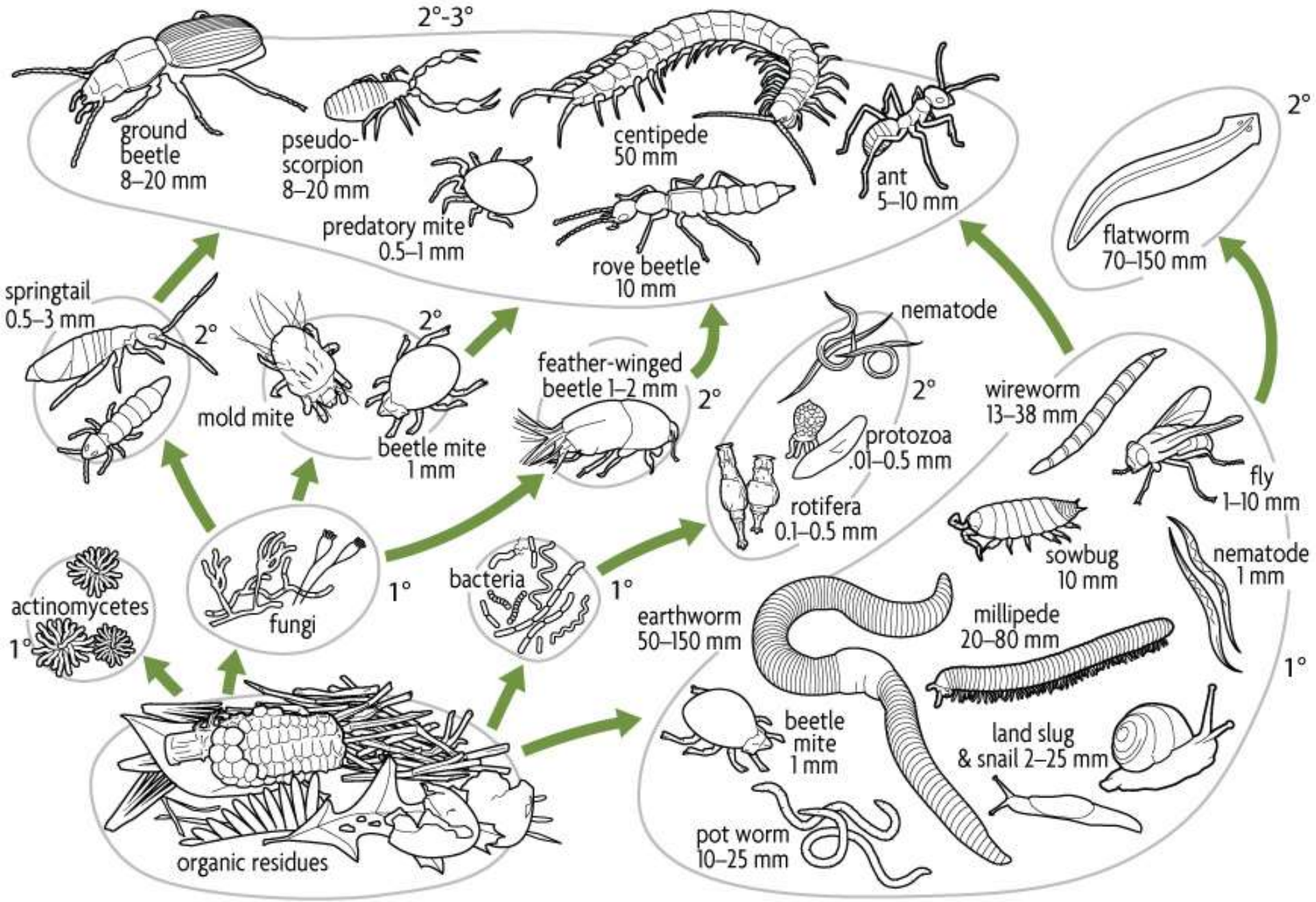


NDSU.org

Organic Matter…
Does it really matter?

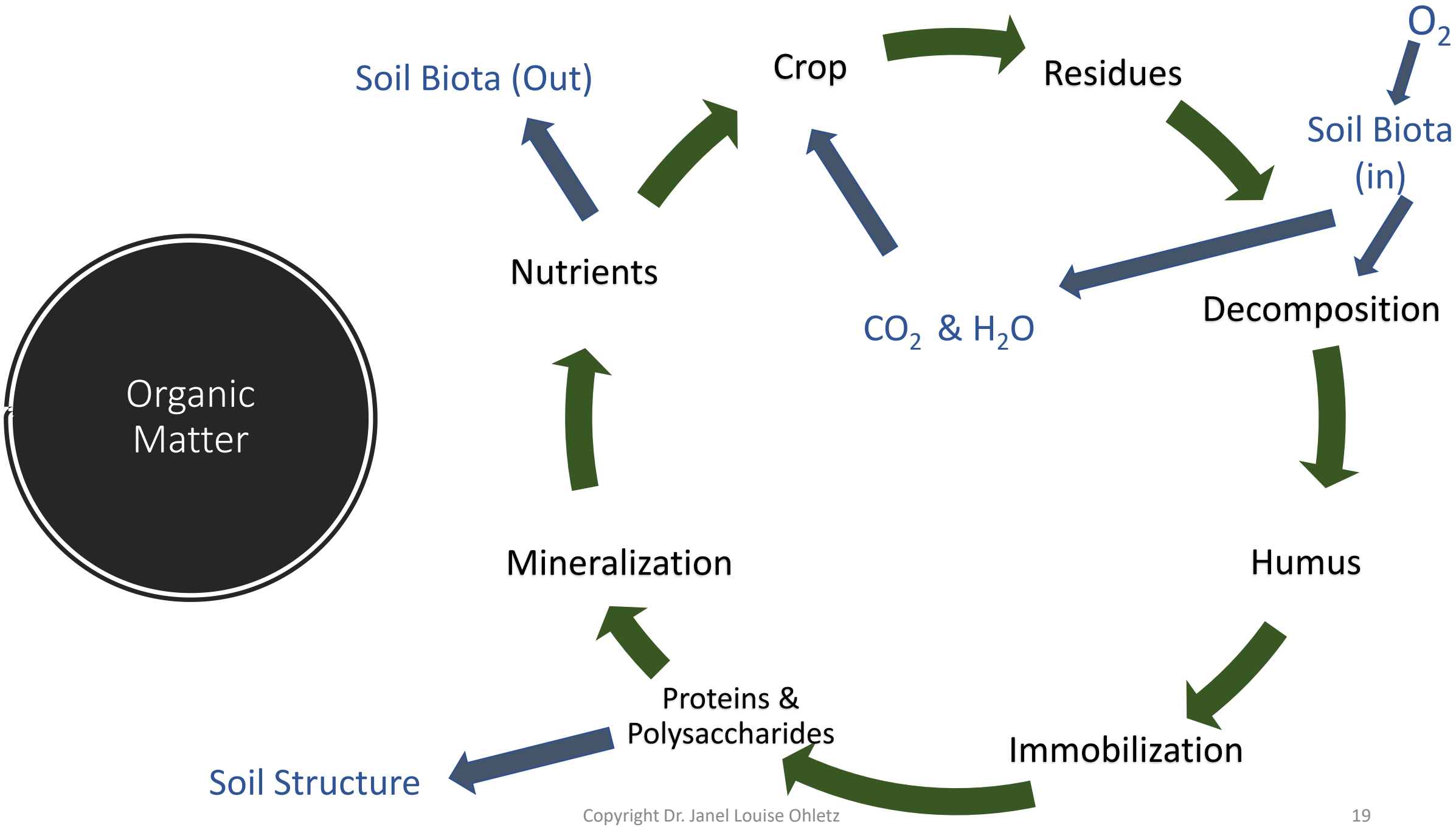
- ❑The Living
- ❑The Dead
- ❑The Very Dead



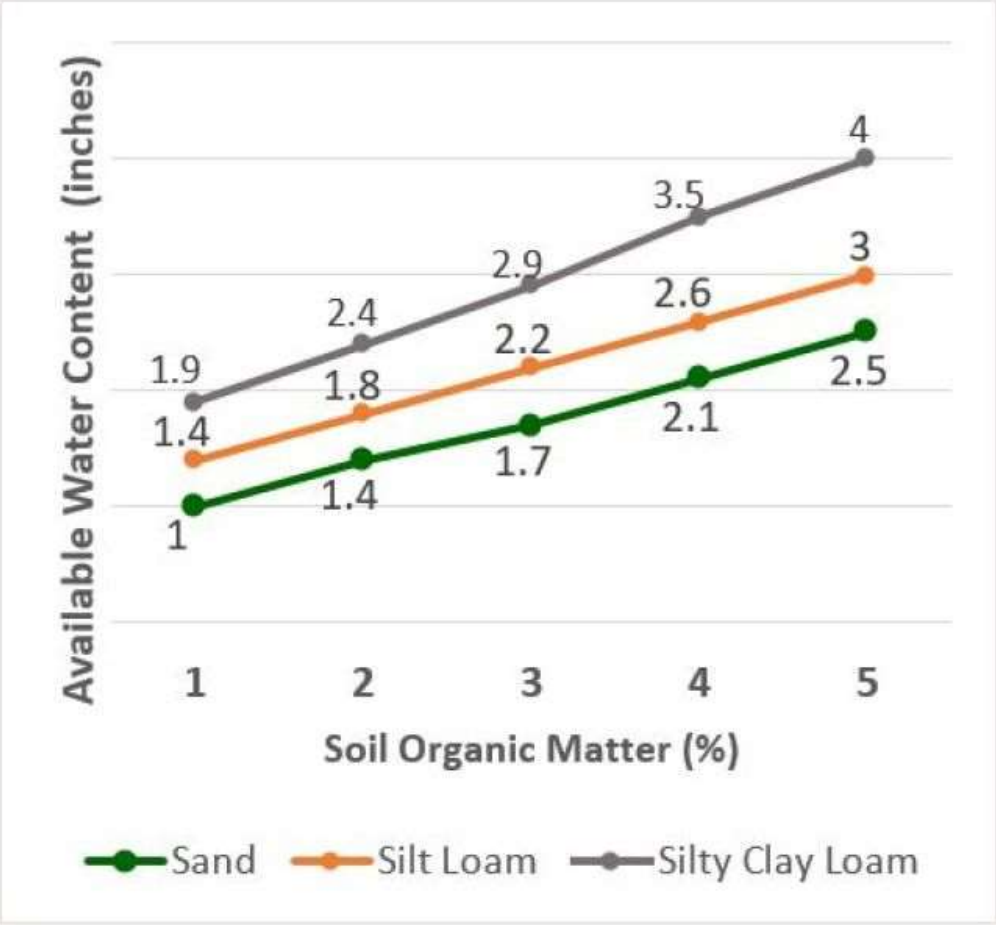


Soil Food Web

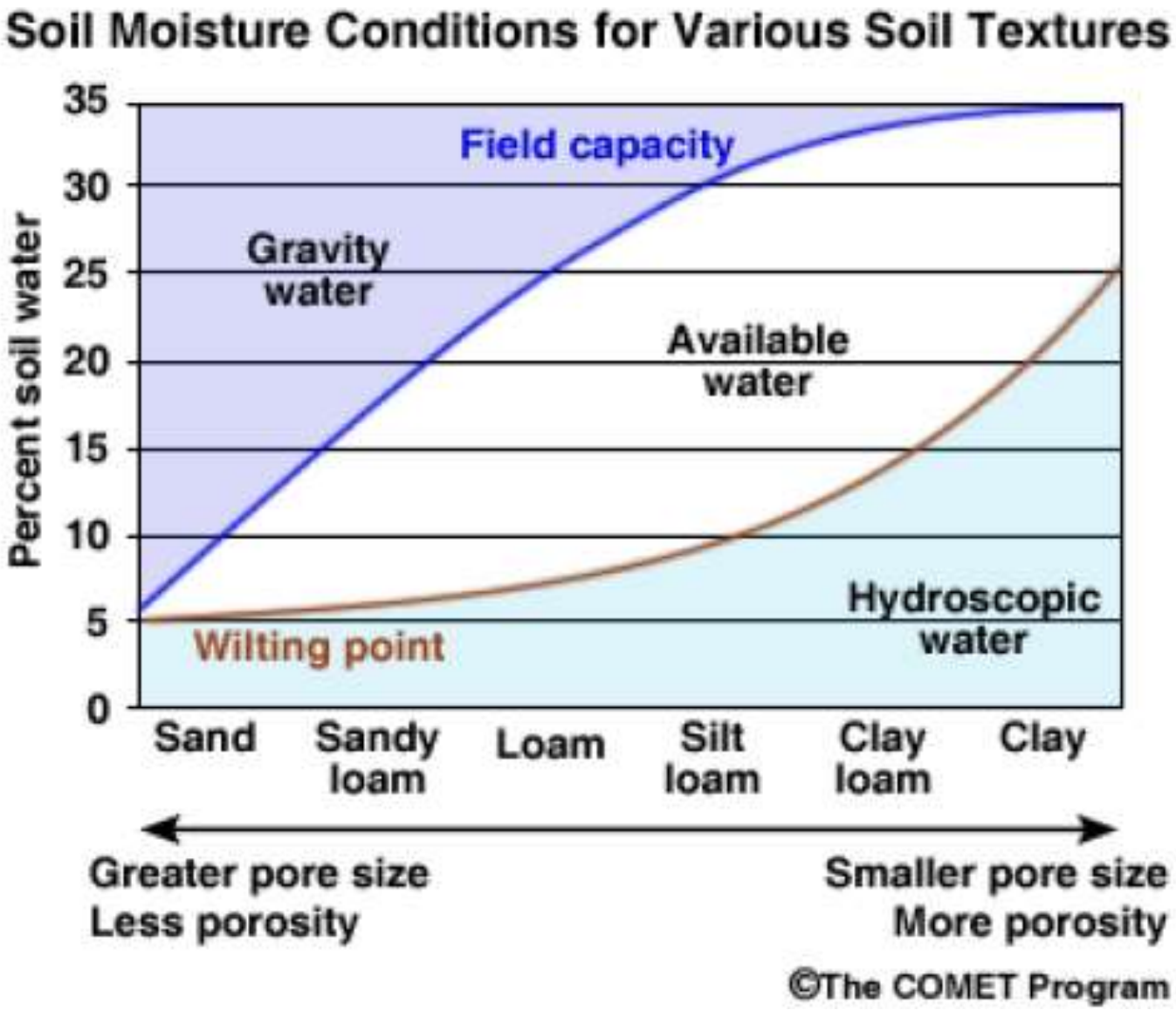
Sare.org



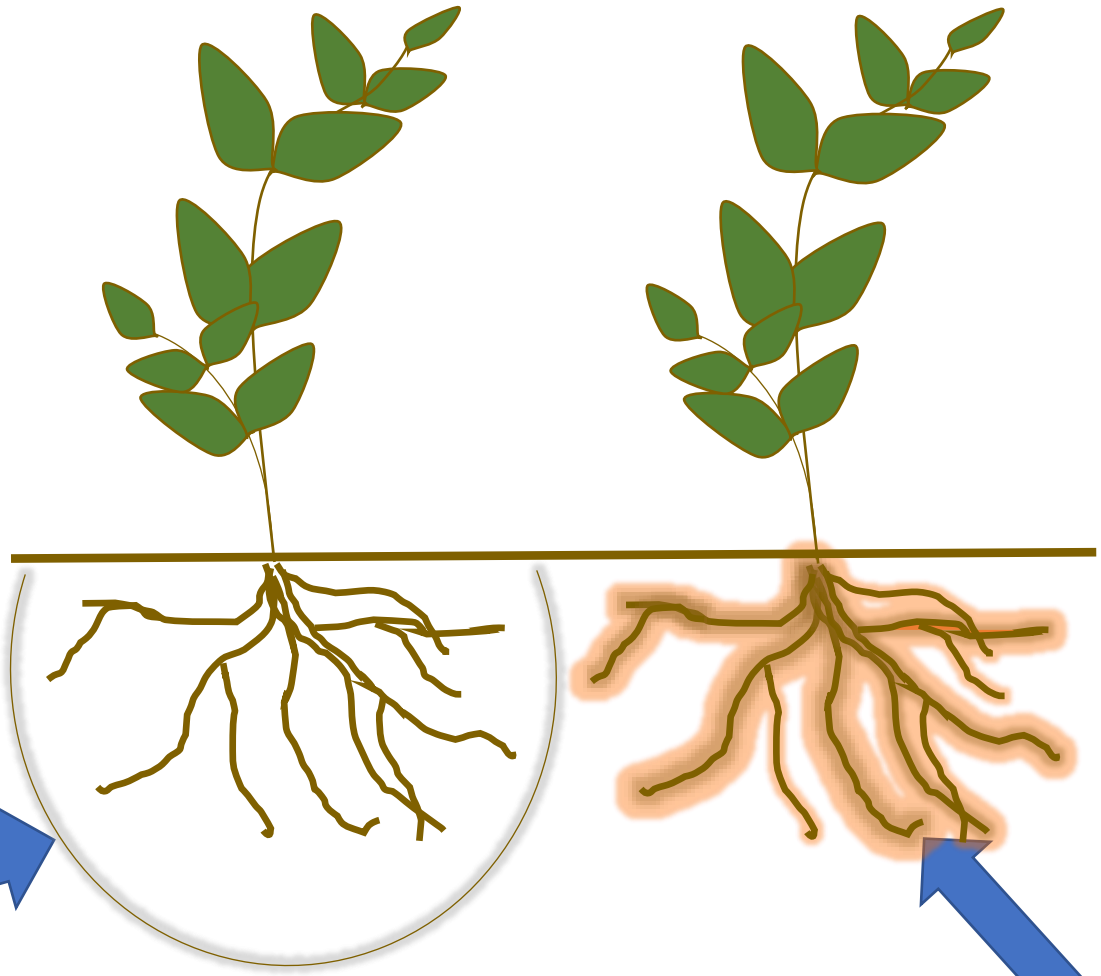
Increase water holding



Influence of Soil Texture



Nutrient Uptake



Mobile Nutrients:

- Nitrate (NO_3^-)
- Sulfur (SO_4^{-2})
- Chlorine (Cl^-)
- Boron ($H_2BO_3^4$)

Immobile Nutrients:

- Ammonium (NH_4^+)
- Phosphorus ($H_2PO_4^{-2}$)
- Potassium (K^+)
- Calcium (Ca^{+2})
  Magnesium (Mg^{+2})
- Zinc (Zn^{+2})
- Copper (Cu^{+2})
  Manganese (Mn^{+2})
- Iron (Fe^{+3})
- Molybdenum (MoO_4^{-2})

Soil Health Practices

Location matters

Practices

- Integrated Pest Management
- Proper Rotation
- Water Management
- Reduce Soil Disturbance
- Keep it Covered
- Increase Soil Organic Matter
- Nutrient Management

Soil tests

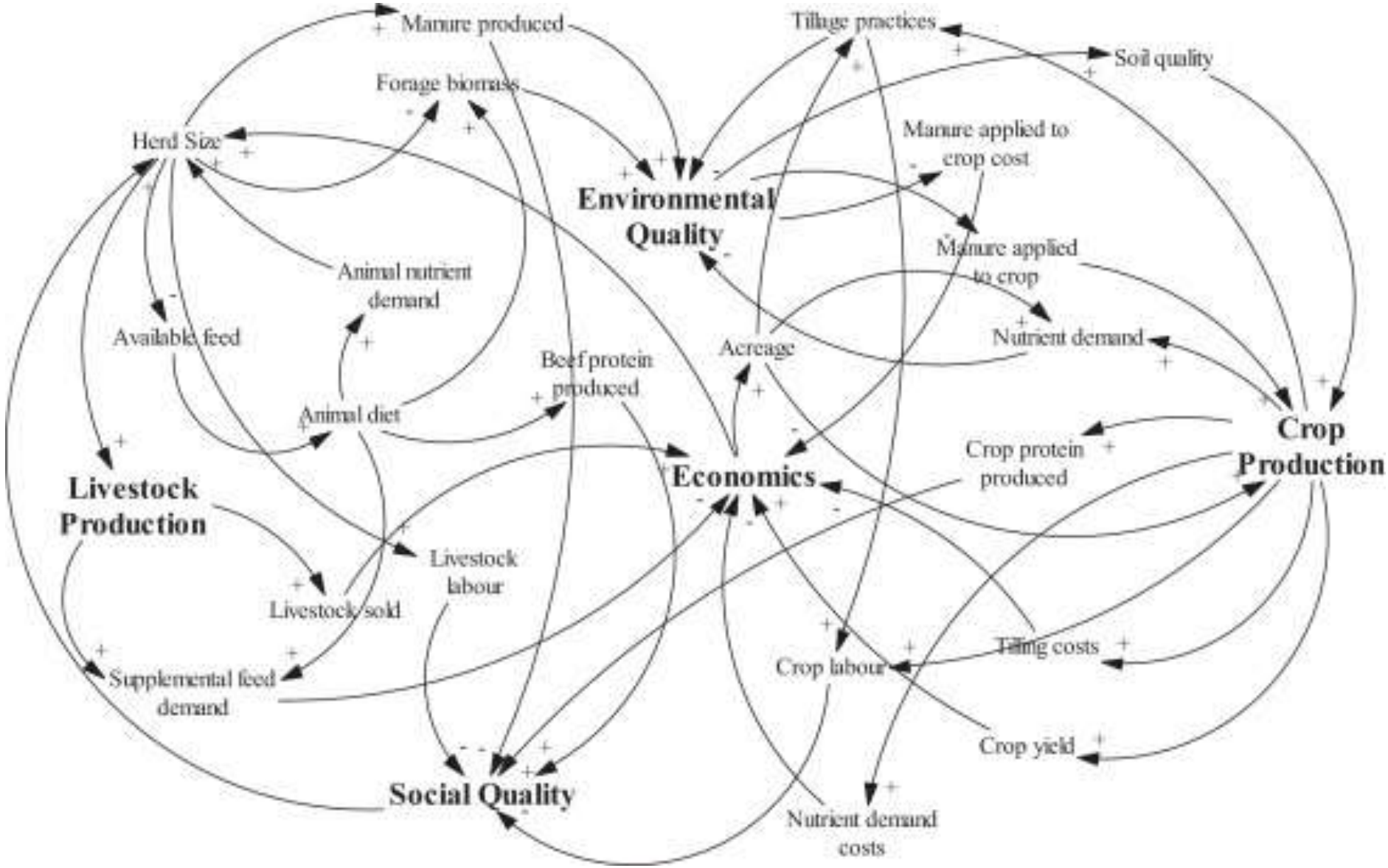
“If you do not know where you’re going, any path will get you there.”

Lewis Carroll

Take A Systems Approach

- Productivity
- Stewardship
- Profitability
- Quality of Life

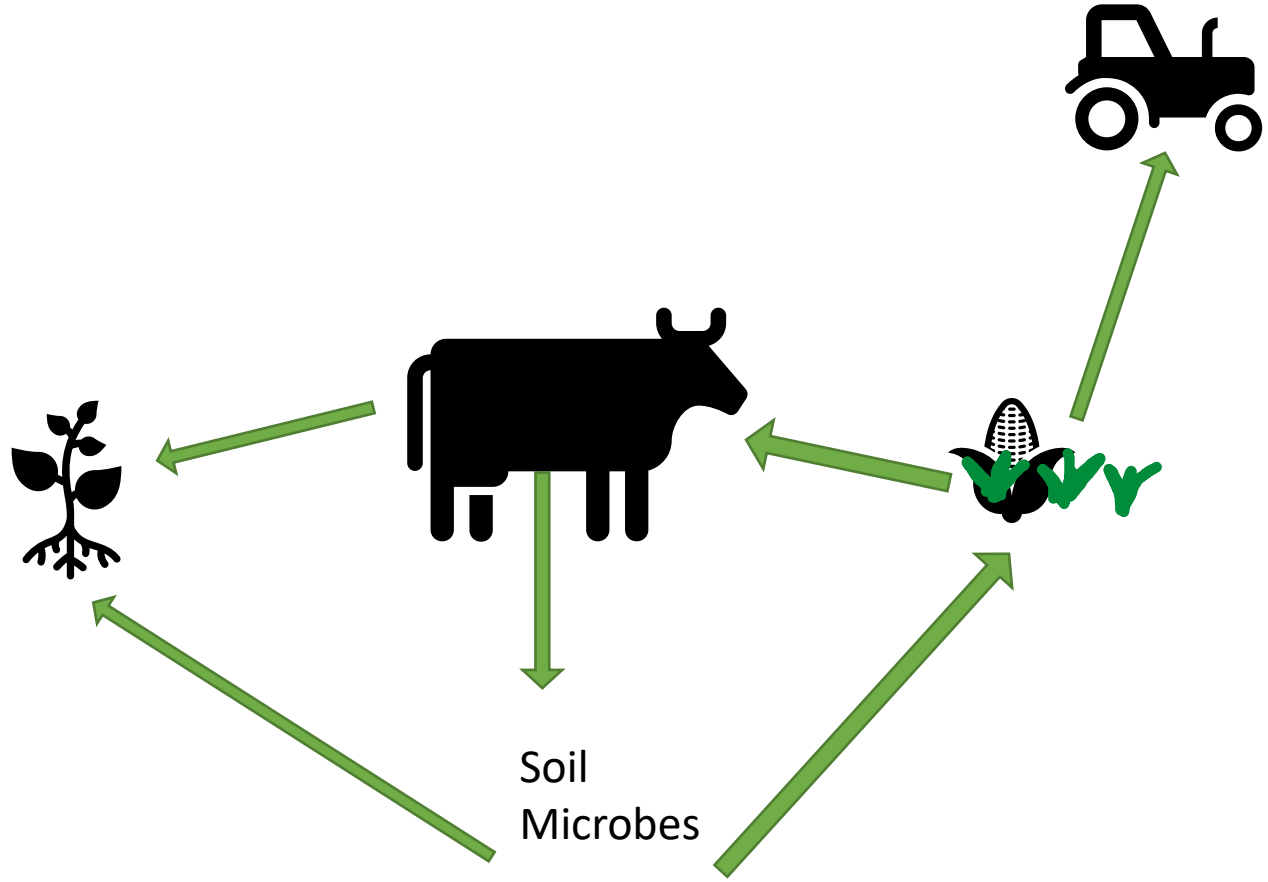
UNH – Sustainable Agriculture and Food Systems



Walters et al., 2016

Closing the loop in farming

- Carbon Farming
- Grass Farmers
- Sequestration
- Proper rotation
- Riparian strip
- Compost



Silvopasture

- Species Selection
- Proper Rotation
- Fencing
- Water Source
- Help from Cooperative Extension Service

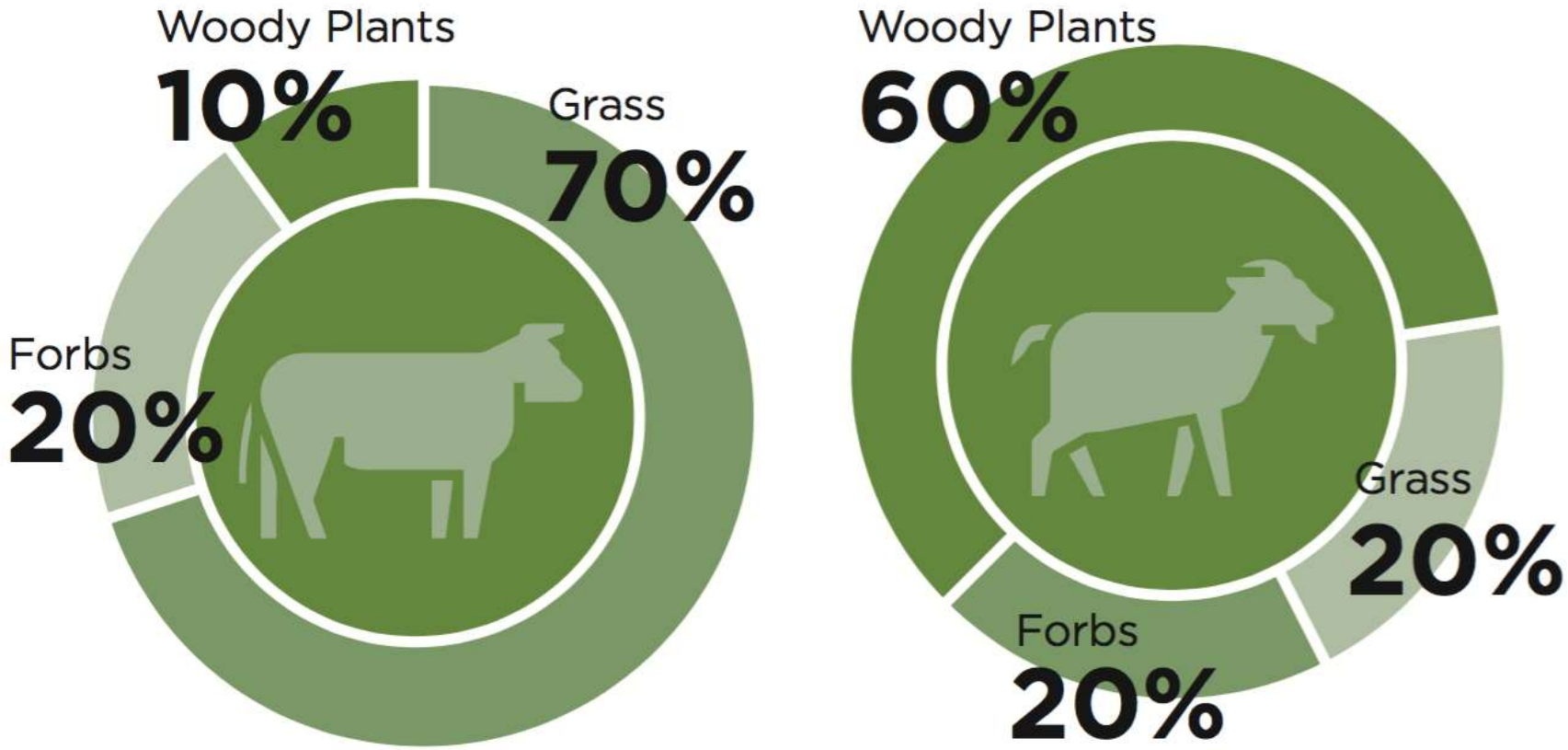
Integrate Multiple Species into the System

Reintegrating livestock with crop production can contribute to improved soil health in continuous no-till systems. (Alan Franzluebbers)

Solar grazing system

Diets compared in cattle and goats

Cattle heavily consume grasses with less than half their diet being forbs and woody plants. Goats however eat woody plants for a majority of their diet. Grazing the two together may benefit pasture land.

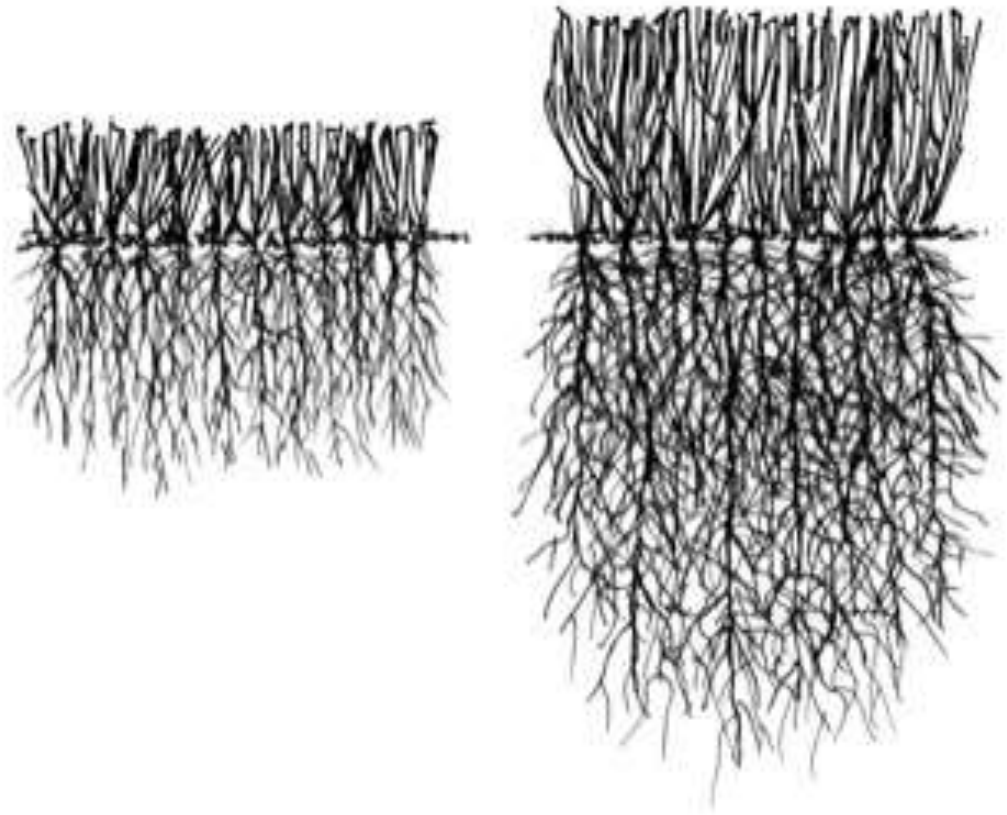


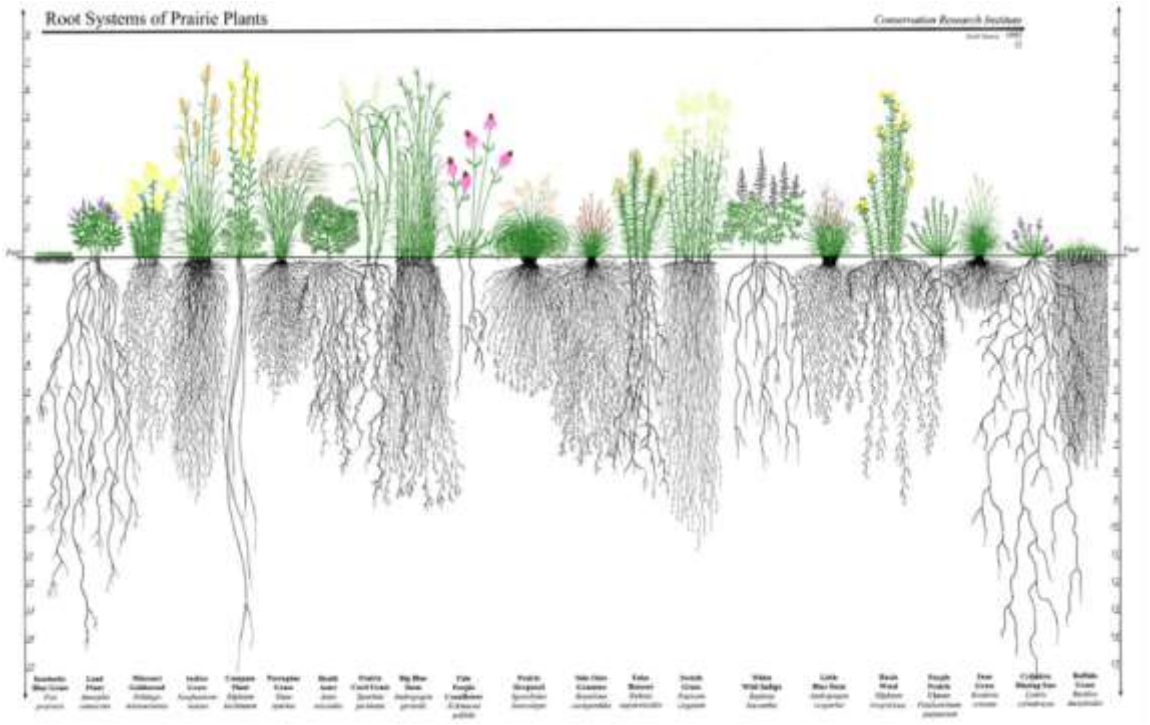
www.noble.org

Species and Pasture

- Browse = Woody Plants
- Forbs = Bushes & Broadleaf Plants
  - *Sericea lespedeza*
- Grasses
  - Grazing Height Preference
  - Species Preference

Management and Plant diversity





Managing Manure

Legacy Herbicides

The Source Matters

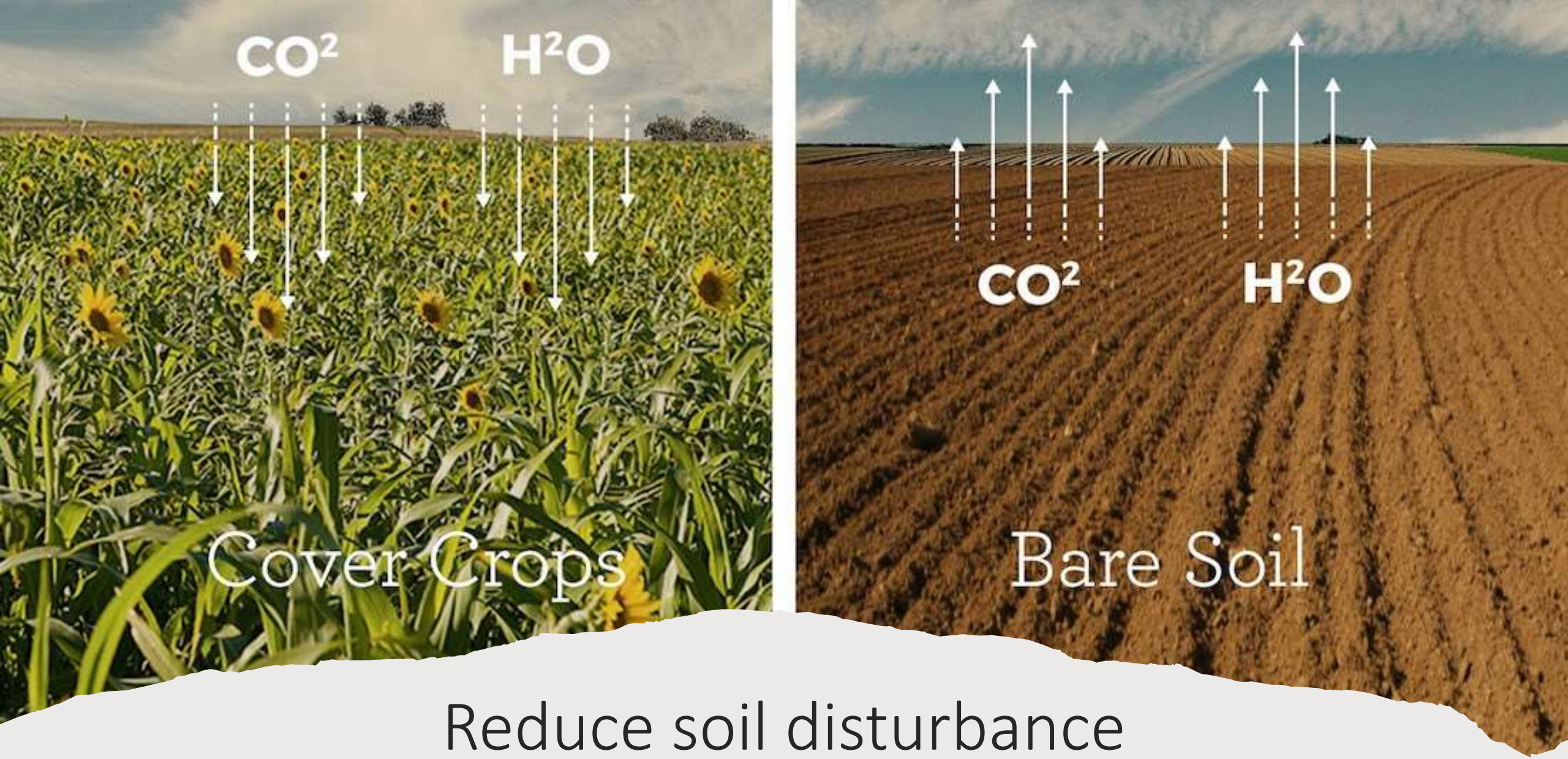
Concentration

Composting & Storage

Application Method

Test It

https://csanr.wsu.edu/can-manure-supply-n-and-p-to-ag/



Reduce soil disturbance

Keep it covered

Variety is the spice of life

Increase biodiversity

Reduce pesticide use

Attract beneficial insects