Vietnam Workshop on Soil Quality: Soil Biology and Chemistry

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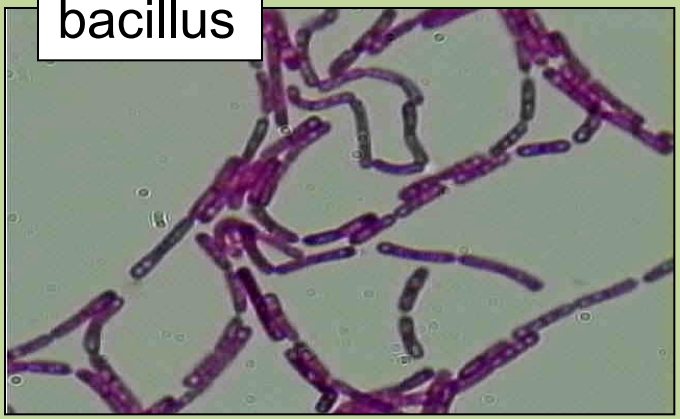
Image courtesy of www.claytoncramer.com

Soil Biology plays a vital role in maintaining soil quality and nutrient cycling in any given agricultural ecosystem.

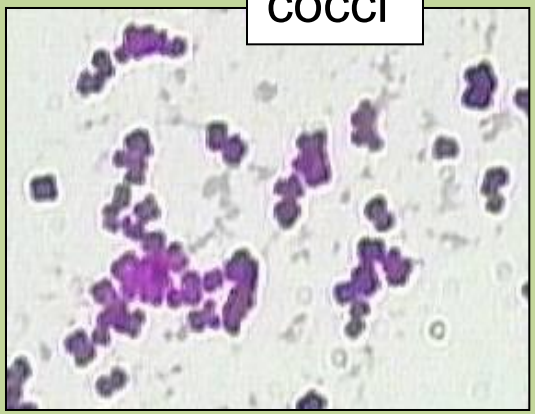
BACTERIA

have many different shapes

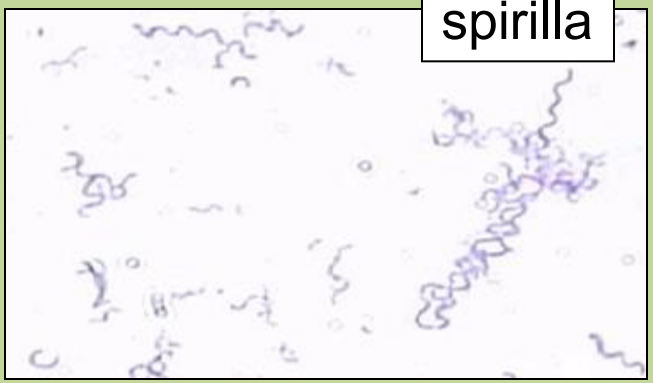
bacillus



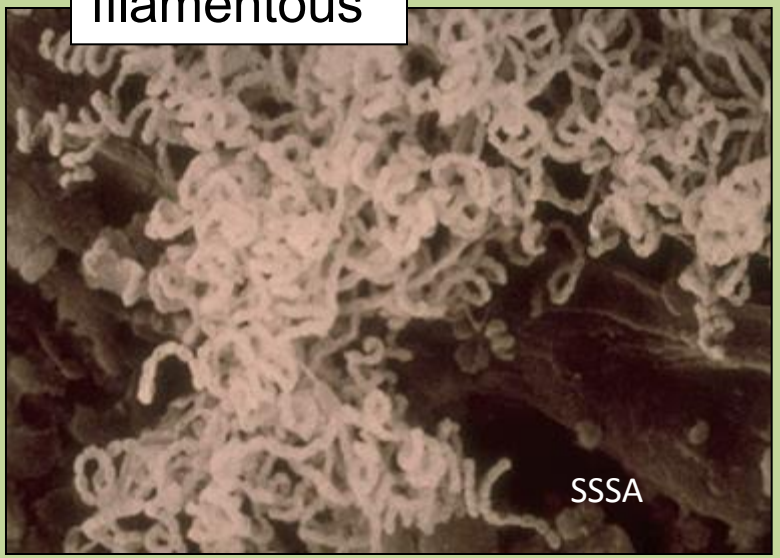
cocci



spirilla



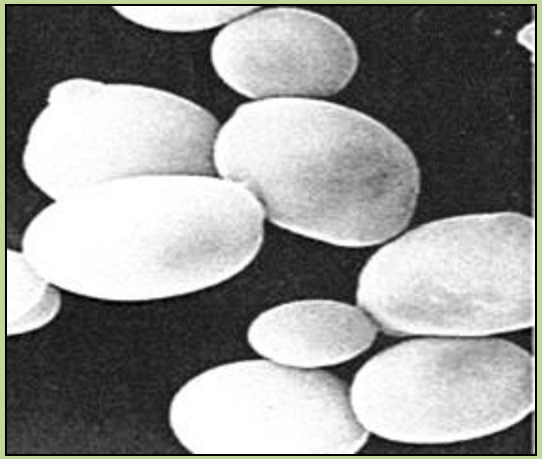
filamentous

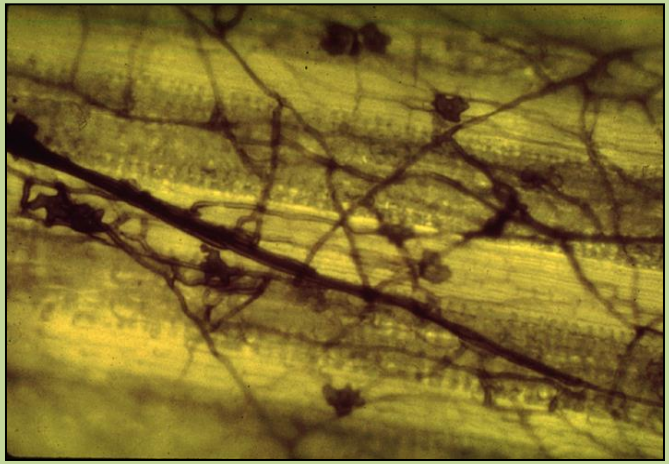


FUNGI

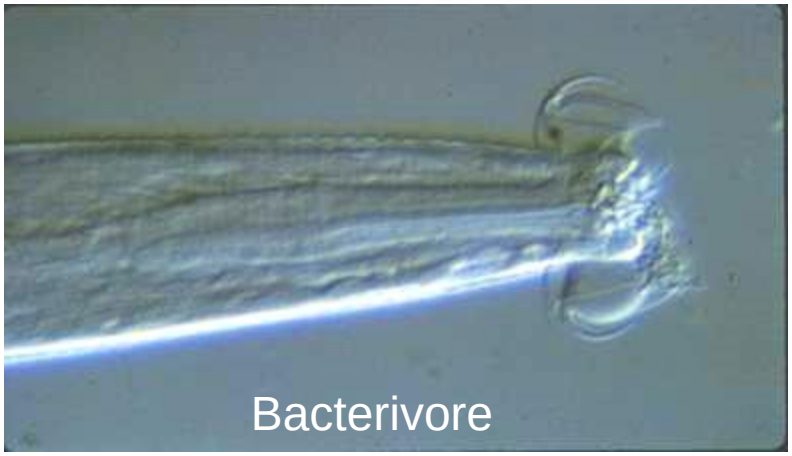
Have many different life forms

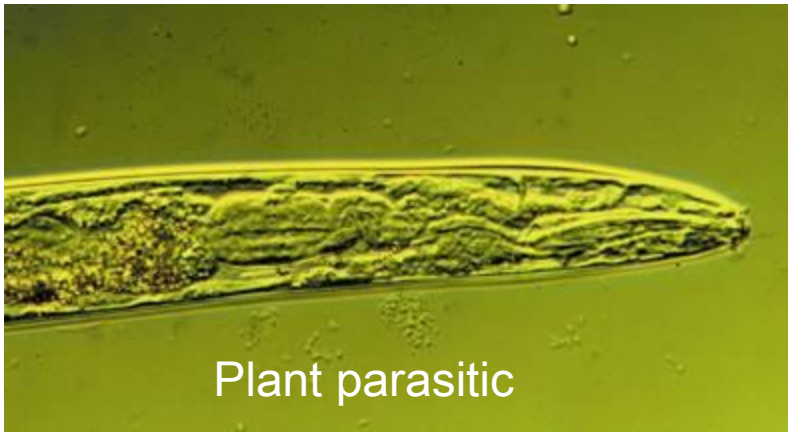
- Yeasts
- Mycelia
- Fruiting bodies
- Spores

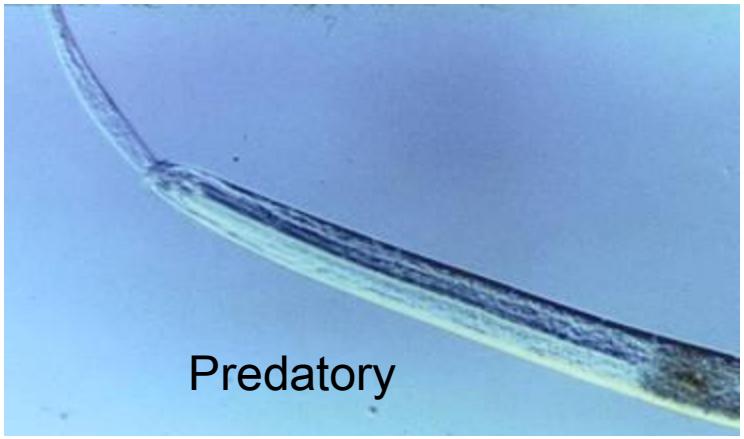




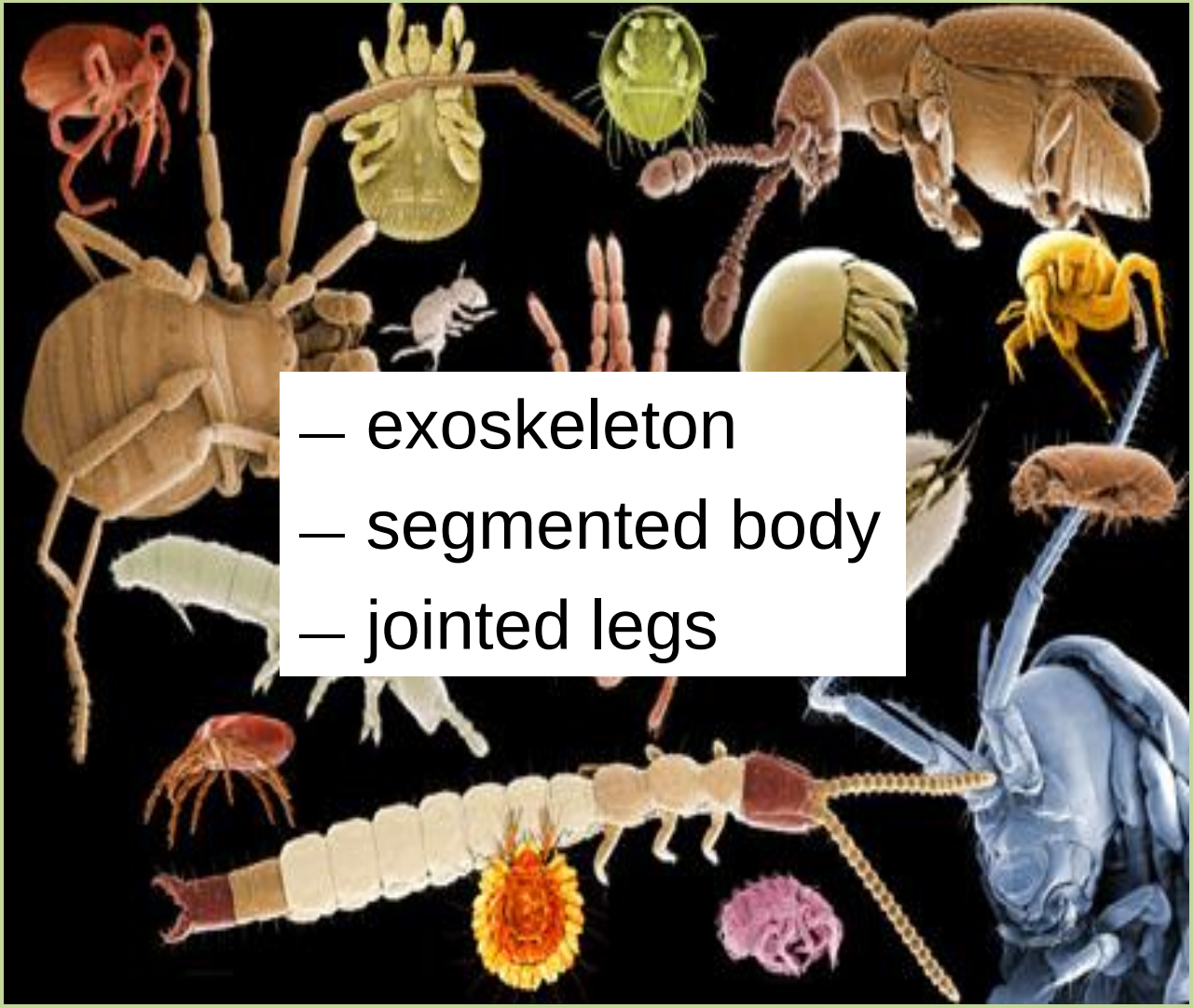
Nematode diversity







Arthropods



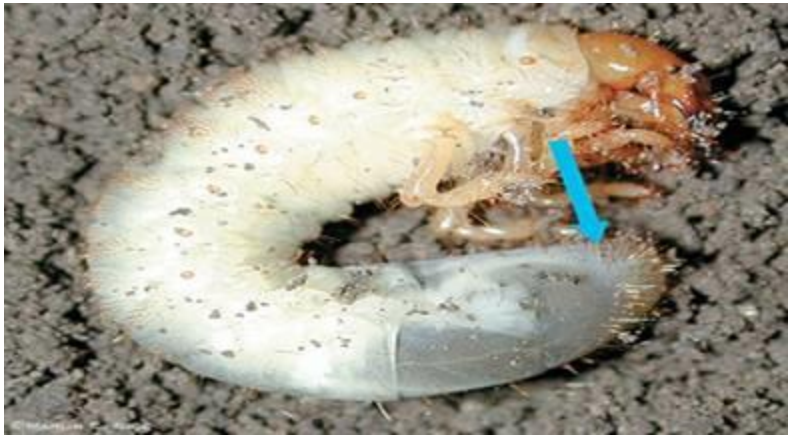
- exoskeleton
- segmented body
- jointed legs

Arthropod diversity

Litter Shredders

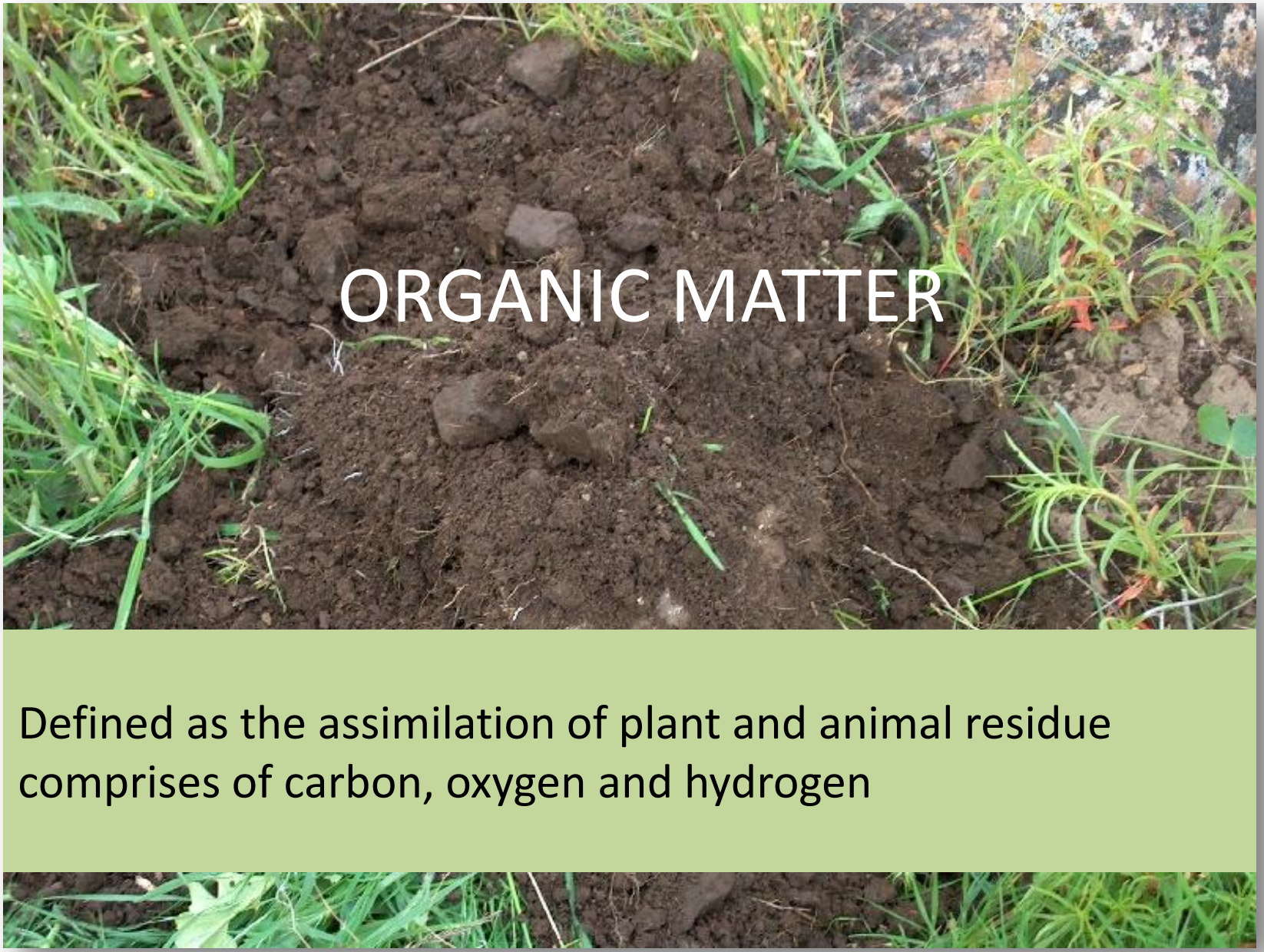
Fungivores

Predators



Herbivores

EARTHWORMS



ORGANIC MATTER

Defined as the assimilation of plant and animal residue comprises of carbon, oxygen and hydrogen

Soil Organic Matter

"Soil organic matter is a major terrestrial pool for C, N, P, S cycling and availability is constantly altered by biological process."

ORGANIC MATTER

Organic matter contains metabolic carbon and structural carbon

Organic matter composition:

- 5% sugars and starches
- 8% protein
- 45% cellulose
- 18% hemicellulose
- 20% lignin
- 4% waxes and polyphenols

Soil organic matter fuels the soil food web

ORGANIC MATTER

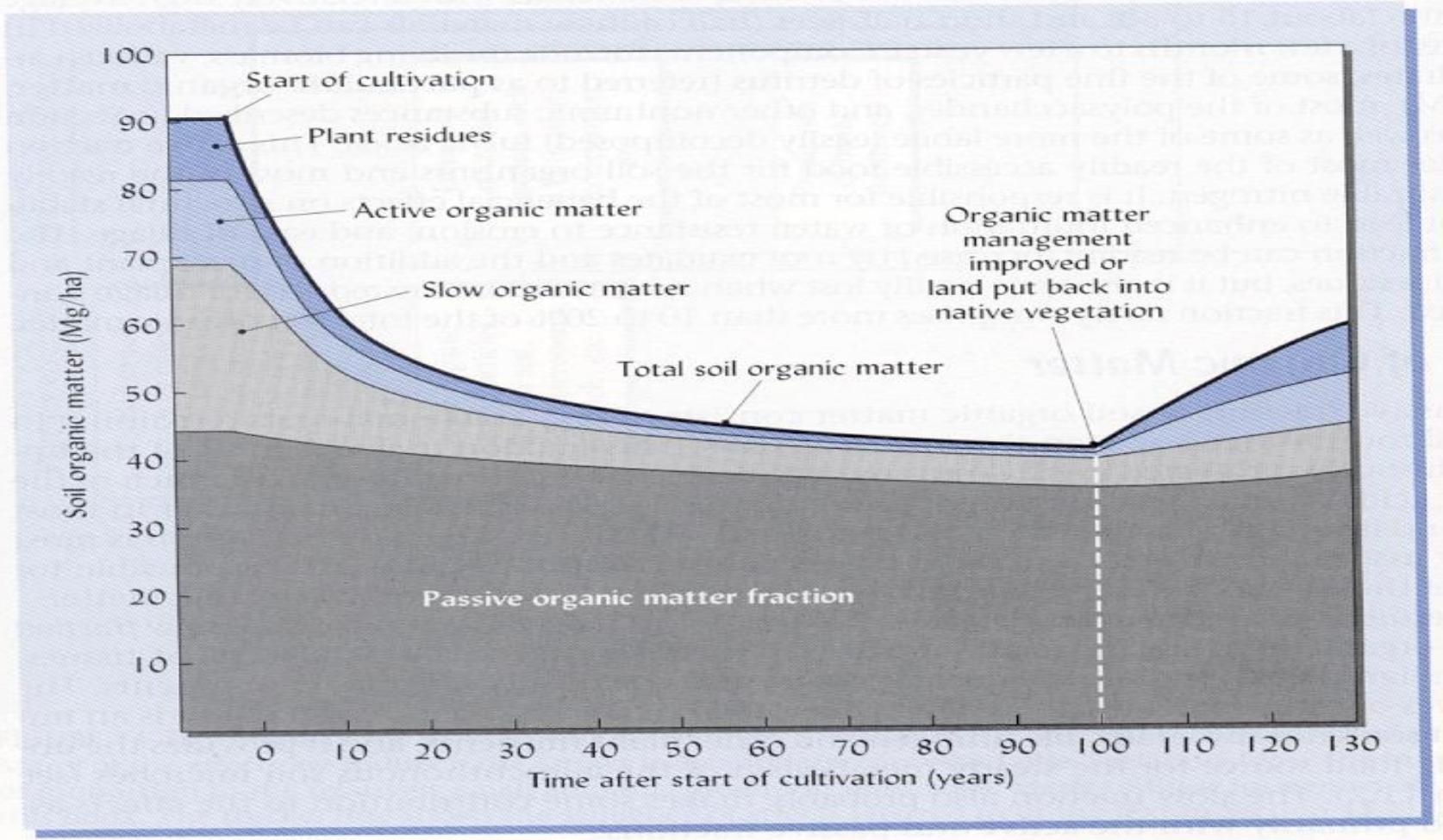
Organic matter influence on Soil Properties

- Mulching or no-till system will increase earthworm activity
- Increase in granular and aggregate stability
- Enhanced soil water retention, water infiltration, and water holding capacity
- Increased CEC
- Increased nutrient storage
- Humic fraction reduce plasticity, cohesion, and stickiness of clay soil
- Increase in pH buffering capacity of soil
- Chelates metals
- Increase in microbial populations

Factors Influencing Organic Matter Decomposition

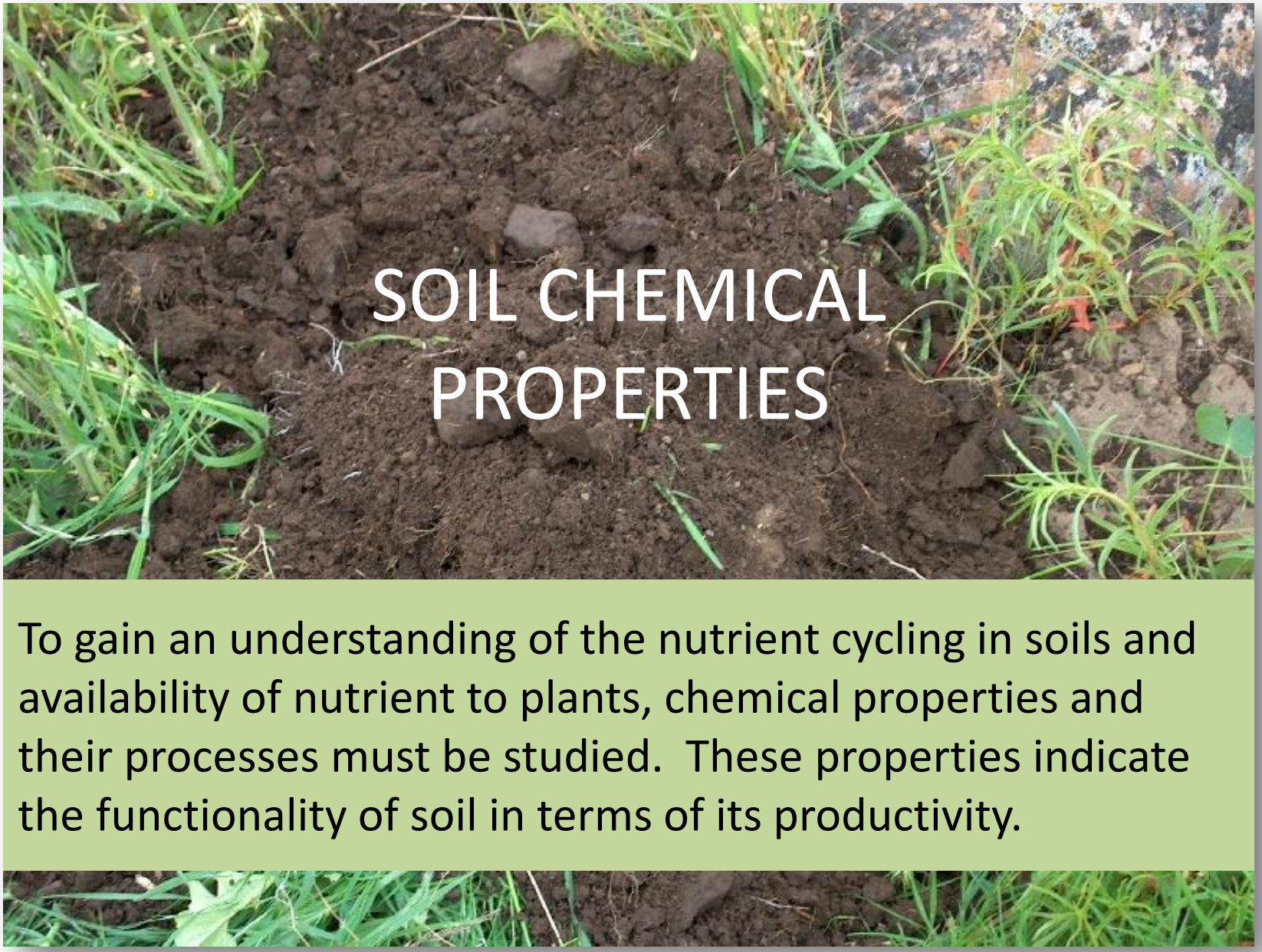
- pH
- Temperature
- Soil Moisture
- Soil Aeration
- Type of Plant Residue
- C/N Ratio
- Plant Residue location (surface Vs sub-surface)

Changes in the various organic matter fractions after bringing virgin land under cultivation



Soil Enzymes

- Enzymes are proteins that act as catalysts without undergoing permanent alteration and cause chemical reactions to proceed as faster rates

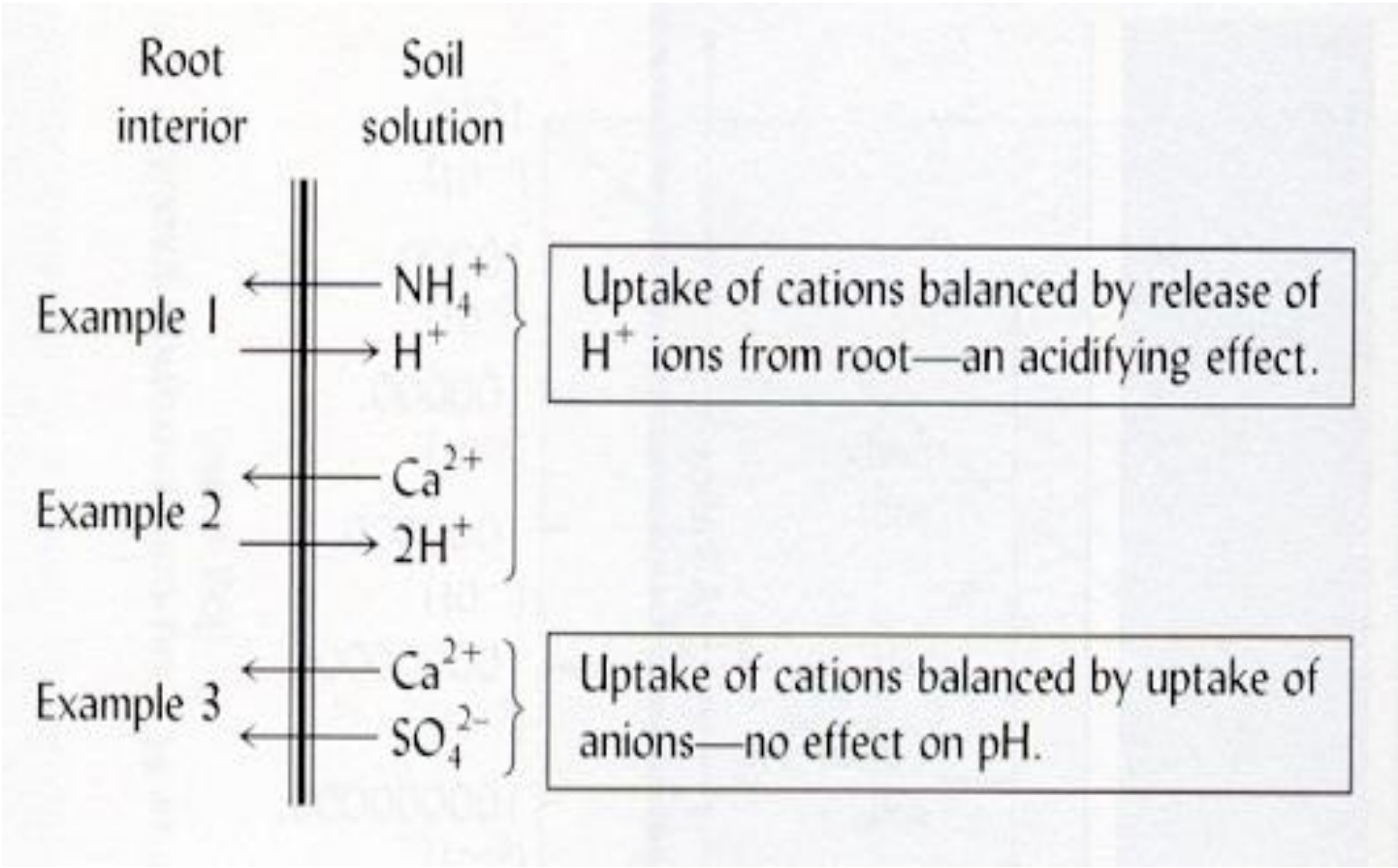


To gain an understanding of the nutrient cycling in soils and availability of nutrient to plants, chemical properties and their processes must be studied. These properties indicate the functionality of soil in terms of its productivity.

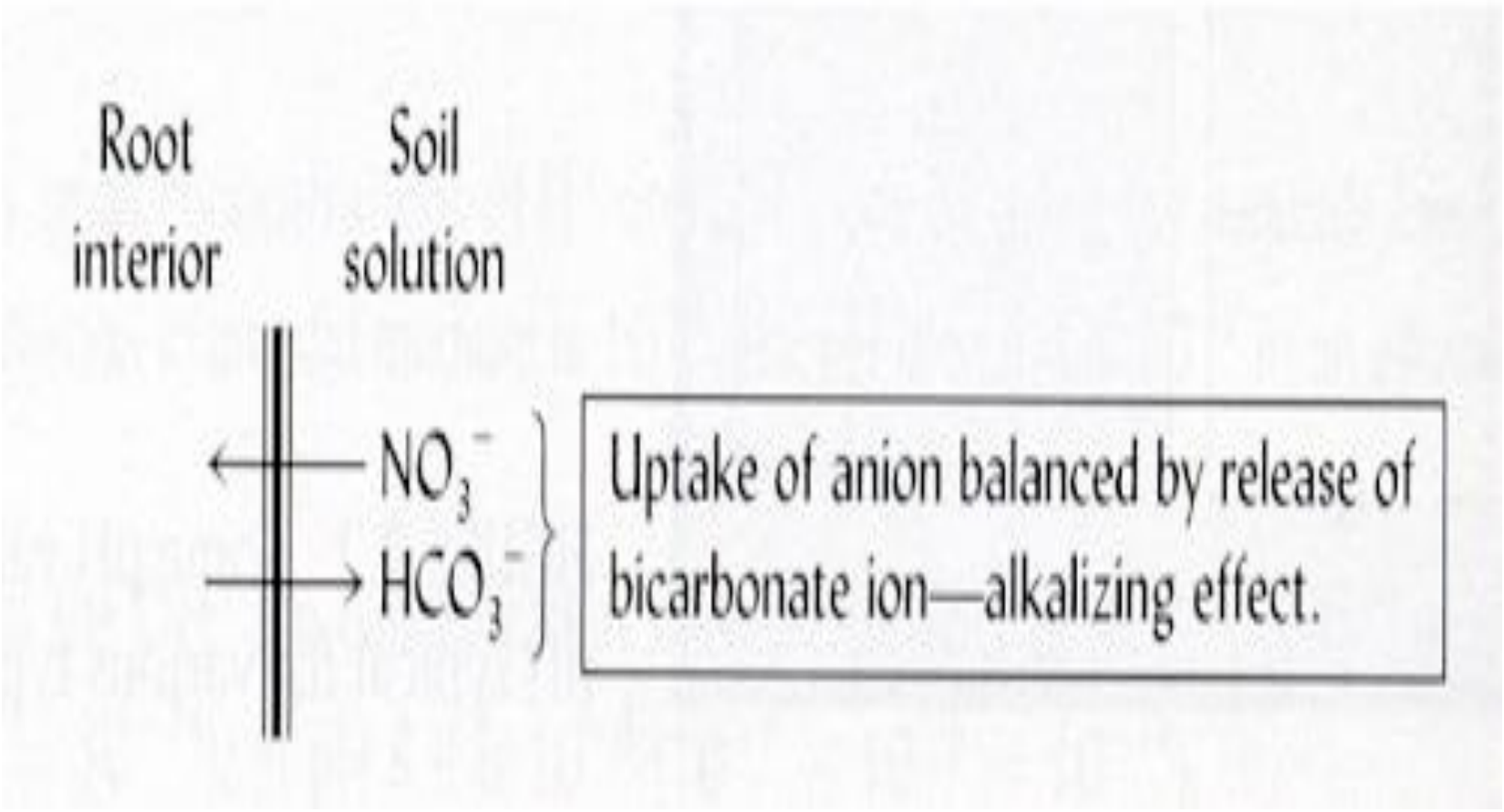
SOIL QUALITY

Soil Chemical Indicators

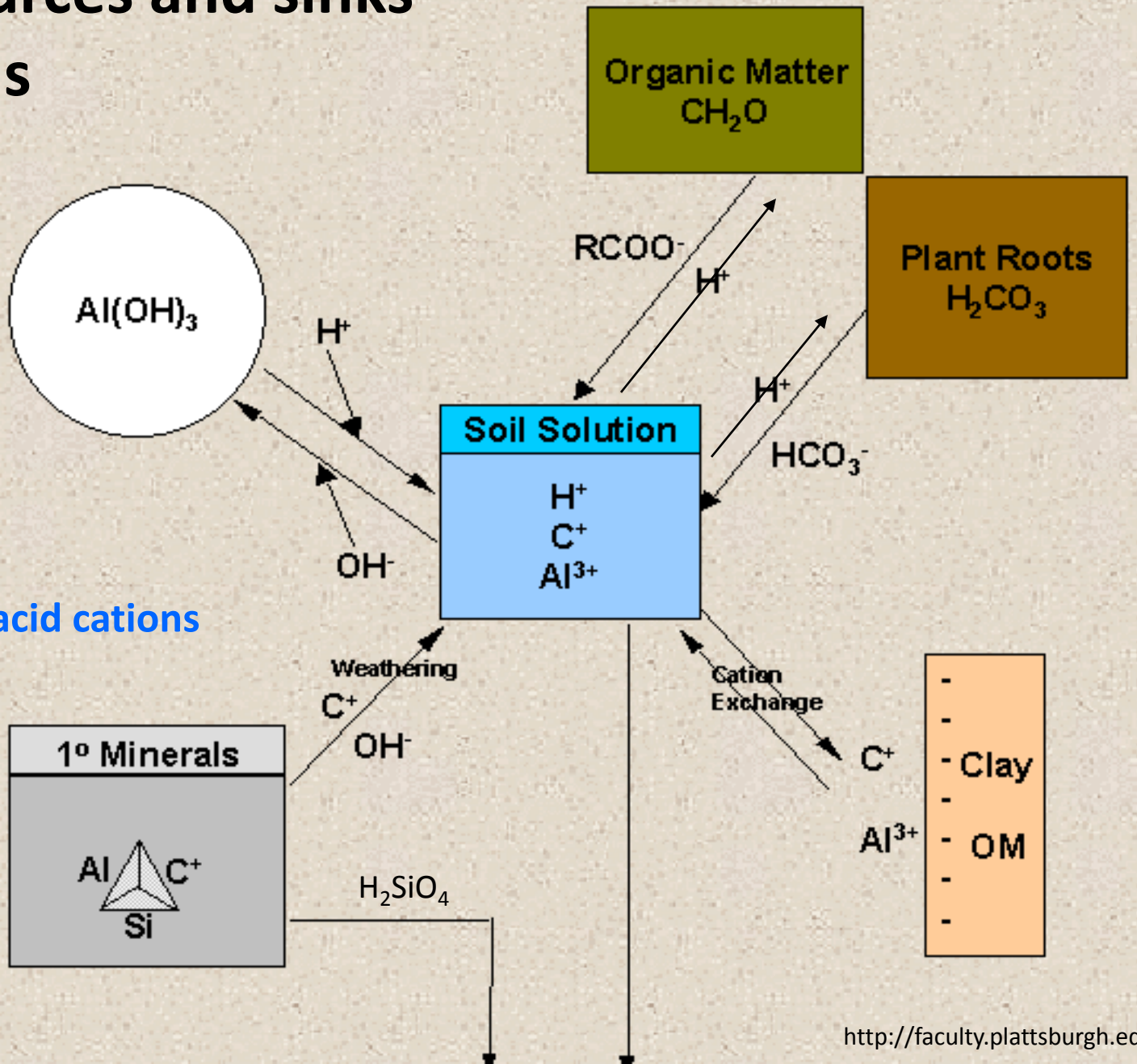
Cationic Balance



Anionic Balance

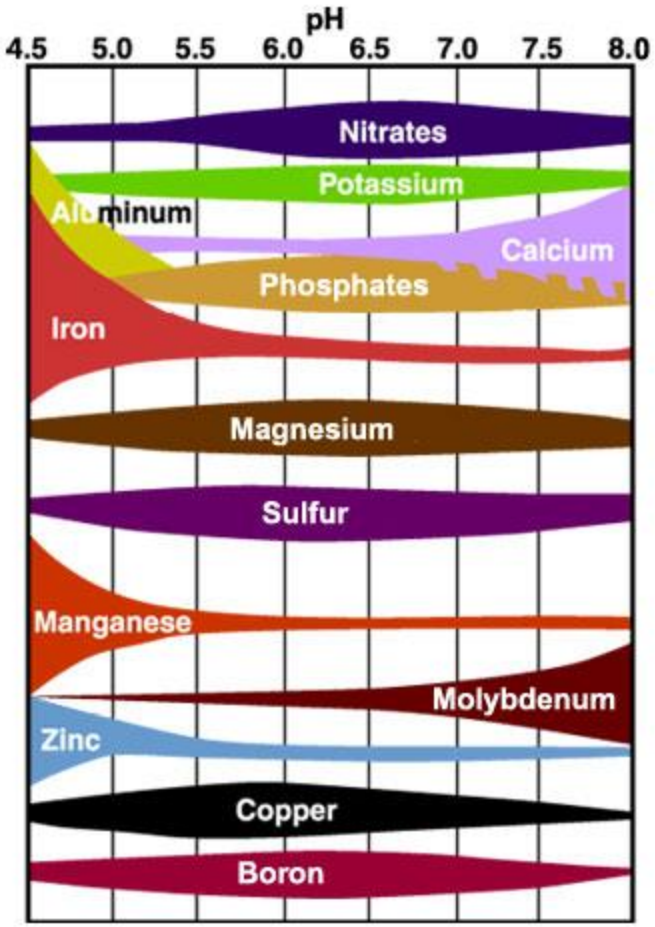


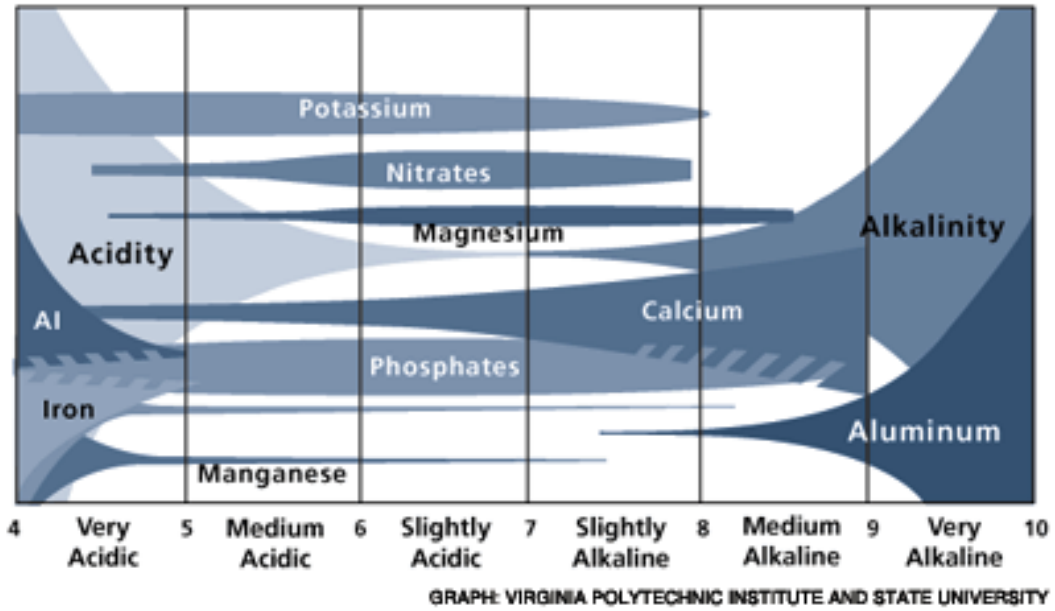
H^+ sources and sinks in soils



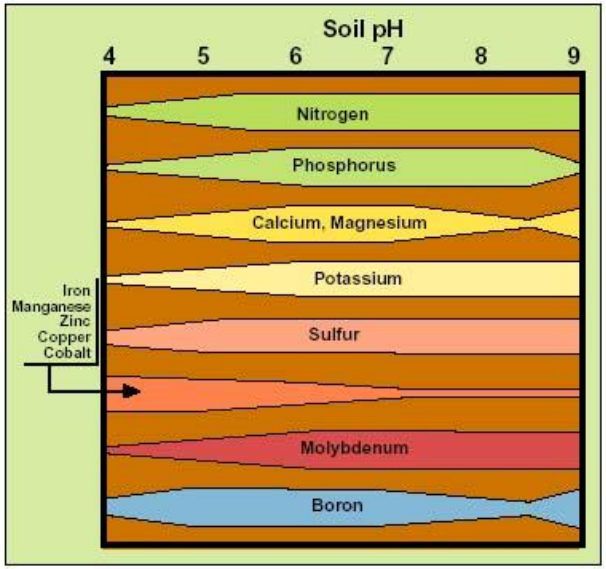
http://faculty.plattsburgh.edu/robert.fuller/

Nutrient availability varies with pH





GRAPH: VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY



Nutrient Availability: Nitrogen and Phoshporus

16 elements have been identified as essential for the growth of all plants

C O H

& water

Soil

N K Ca Mg P S

macronutrients

Cl Fe Mn Zn B Cu Mo

micronutrients

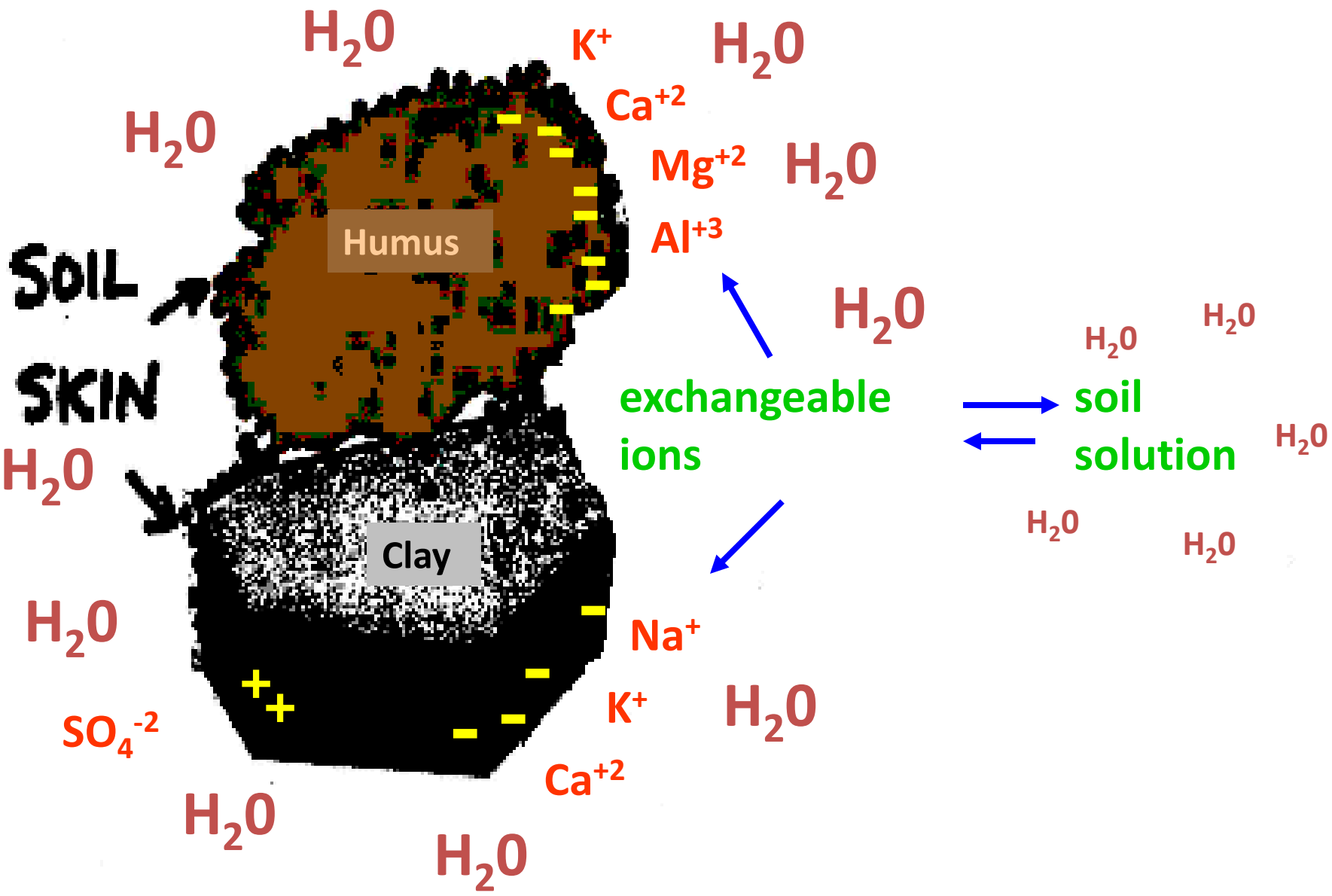
V **Ni**

Needed by some plants

Co **Si**

Na

Soil water contains nutrients



Conclusions

- **A soil quality assessment provides a basic means to evaluate the sustainability of agricultural and land management systems.**
- **Evaluation of soil chemical and biological properties is necessary for a full assessment of soil function.**
- **Soil Biology plays a vital role in maintaining soil quality and nutrient cycling in any given agricultural ecosystem.**

Conclusions

- **There are numerous soil chemical and biological properties that can be used as indices of soil quality.**
- **Properties to be selected for the assessment must provide information on the soil functions that need to be improved for better soil health.**