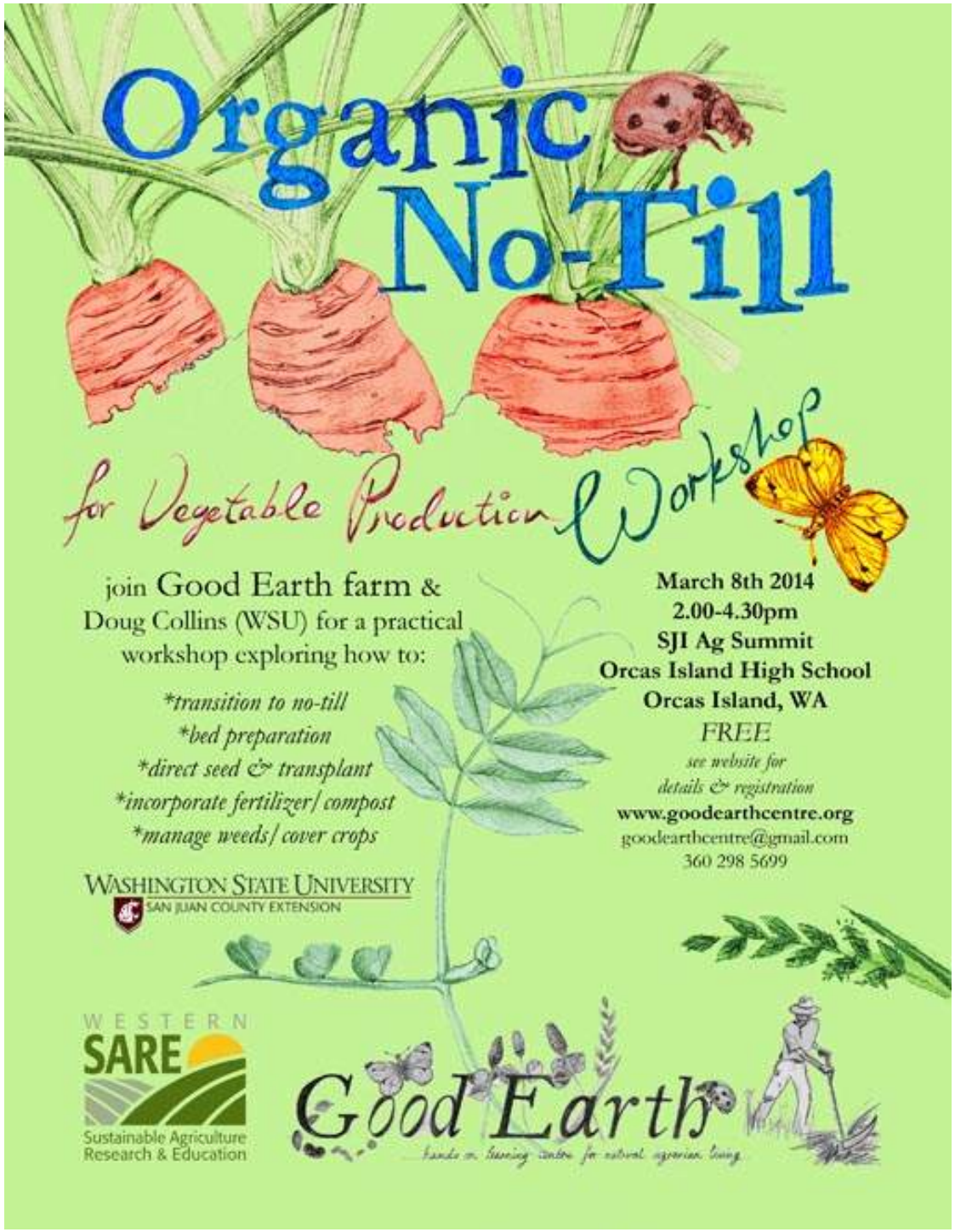


Introduction

Science Behind No-Till

Transitioning to No-Till

Cover Cropping

Bed Preparation

Managing Weeds

Experiment Results

Questions

Masanobu Fukuoka "The ultimate goal of farming is not the growing of crops, but the cultivation and perfection of human beings."

Experiment: Summary

Comparing Organic No-Till with Conventional Tillage Methods when Direct Seeding Vegetables & Incorporating Cover Crops

4 treatments / 4 beds 3'x 60'

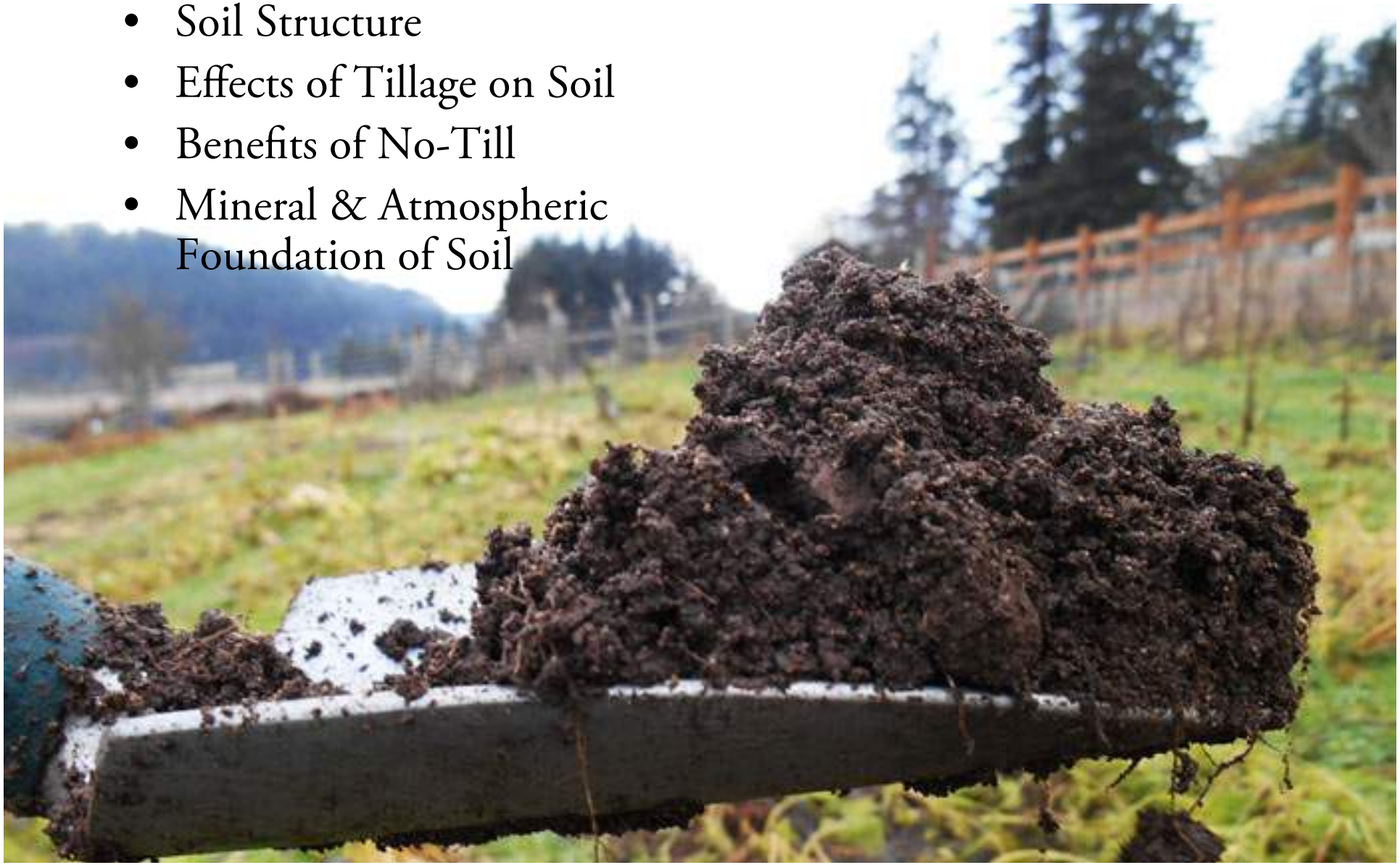
1. No-Till
2. Tillage
3. No-Till + Fava Bean cover crop
4. Tillage + Fava Bean cover crop

Experiment: 2012 crop - Mixed Salad Greens

Experiment: 2013 crop - Carrots

The Science Behind No-Till

- Soil Structure
- Effects of Tillage on Soil
- Benefits of No-Till
- Mineral & Atmospheric Foundation of Soil



Soil Structure

- Organic no-till provides optimum conditions for soil biological activity thereby maintaining soil fertility.

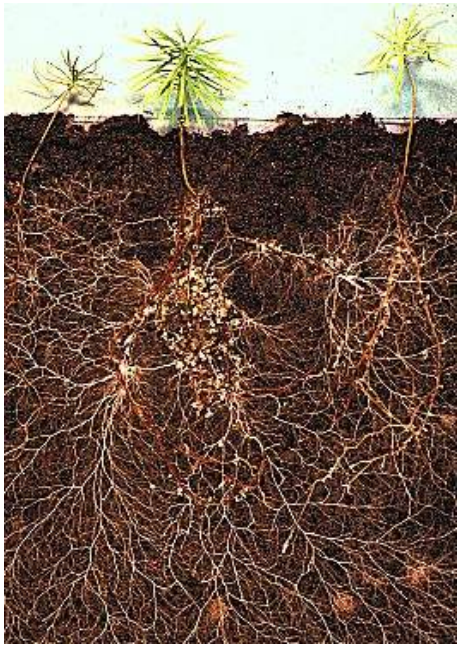
- Organic No-till is a sustainable system modeled on natural eco-systems in which diversity, complexity and recycling of energy and nutrients are essential

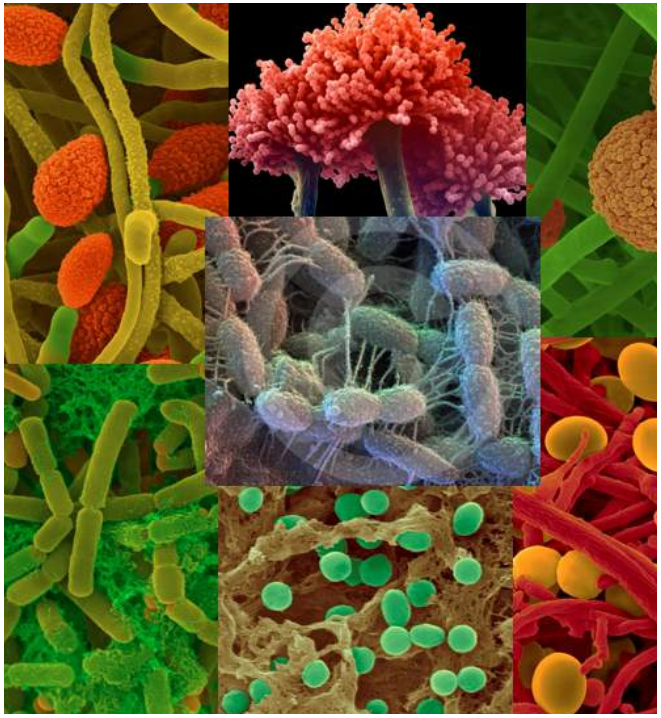
- The key to understanding the importance of no-till is soil structure

- Undisturbed soil maintains a stable structure

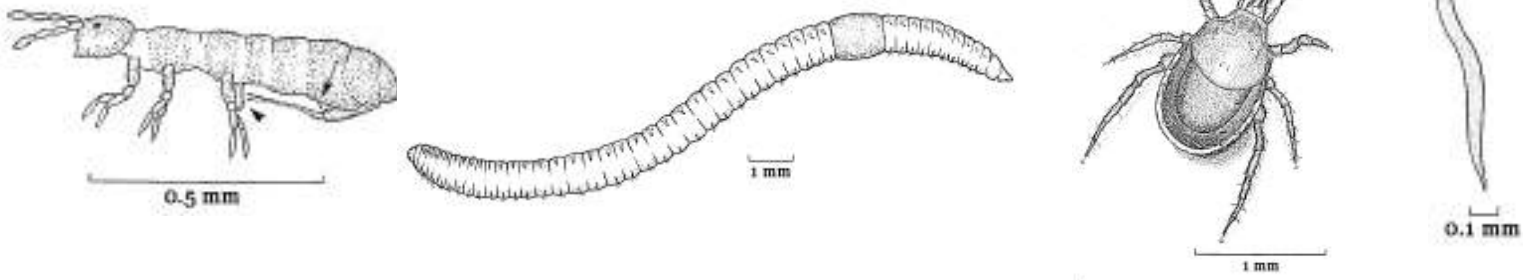
- Soil structure is not just a physical quality but a long term permanent soil formation which provides for the life of plants, animals and microbes and the self-regeneration of fertility, the normal condition of natural soils

- Soil structure is primarily created by plant roots, worms and micro-organisms

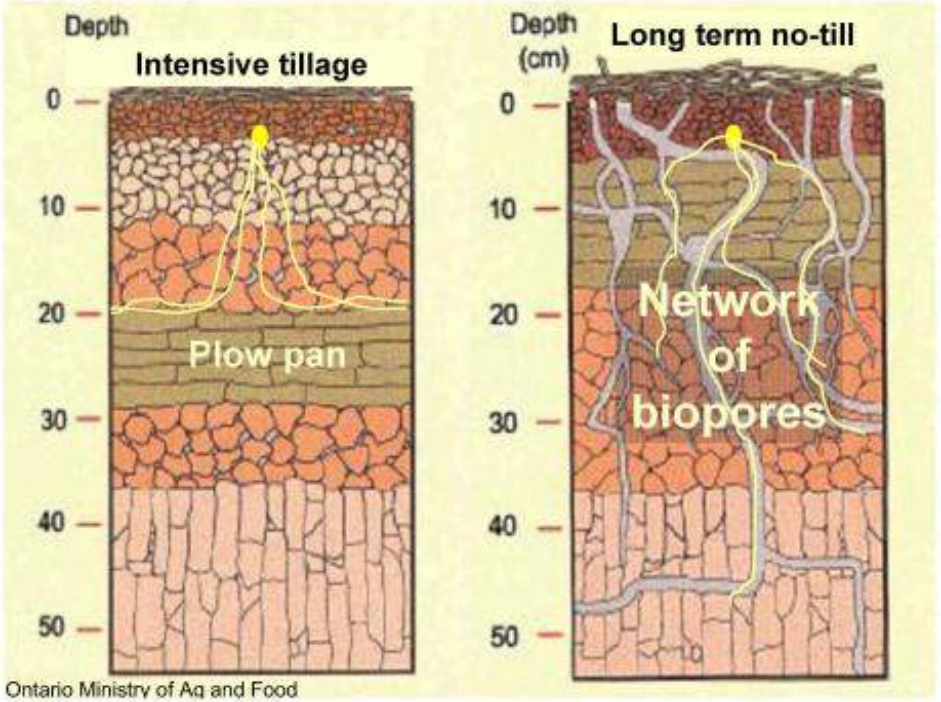


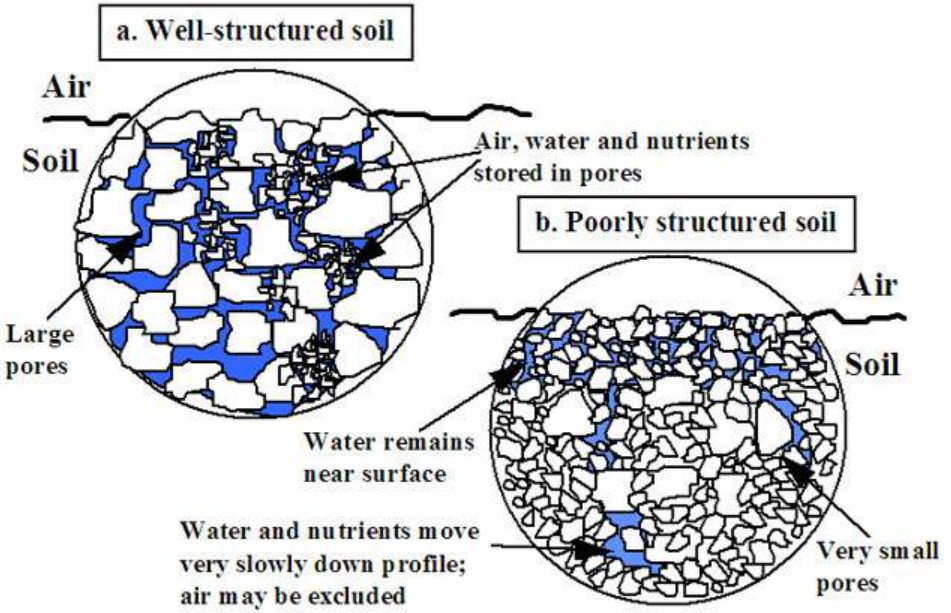


- The weight of living organisms in the top six inches of soil can be from 5,000 - 20,000 lbs



- Plants cannot properly assimilate nutrients in unstructured soils (continually ploughed or dug)
- Plowed soil looses its ability to absorb water from above and below
- Compacts with rain
- Air is squeezed out, creating conditions that anaerobic bacteria thrive in, robbing oxygen from molecules and nutrients that are converted into unavailable forms





Effects of Tillage on Soil

- Destroys soil structure: disrupting the natural food web and greatly reducing the number of beneficial soil organisms such as earthworms

- Leads to soil erosion
- Reduces organic matter
- Leads to leaching of nitrogen
- Stimulates weed production

- Reduces water retention

- We compensate for the loss of natural fertility and soil structure that tillage causes by increased labor and production costs:

1) Adding large amounts of fertilizers, manures, compost and amendments

2) Increased irrigation

3) Pest and disease intervention

4) Increased weeding

5) More need for plowing and tillage to undo compaction and other problems created by plowing and tilling

Experiment: findings in the tilled beds

- Damage from splitting and pests resulting in smaller yields than the no-till bed

- Increased weed pressure in the tilled bed observed when weeding seedlings

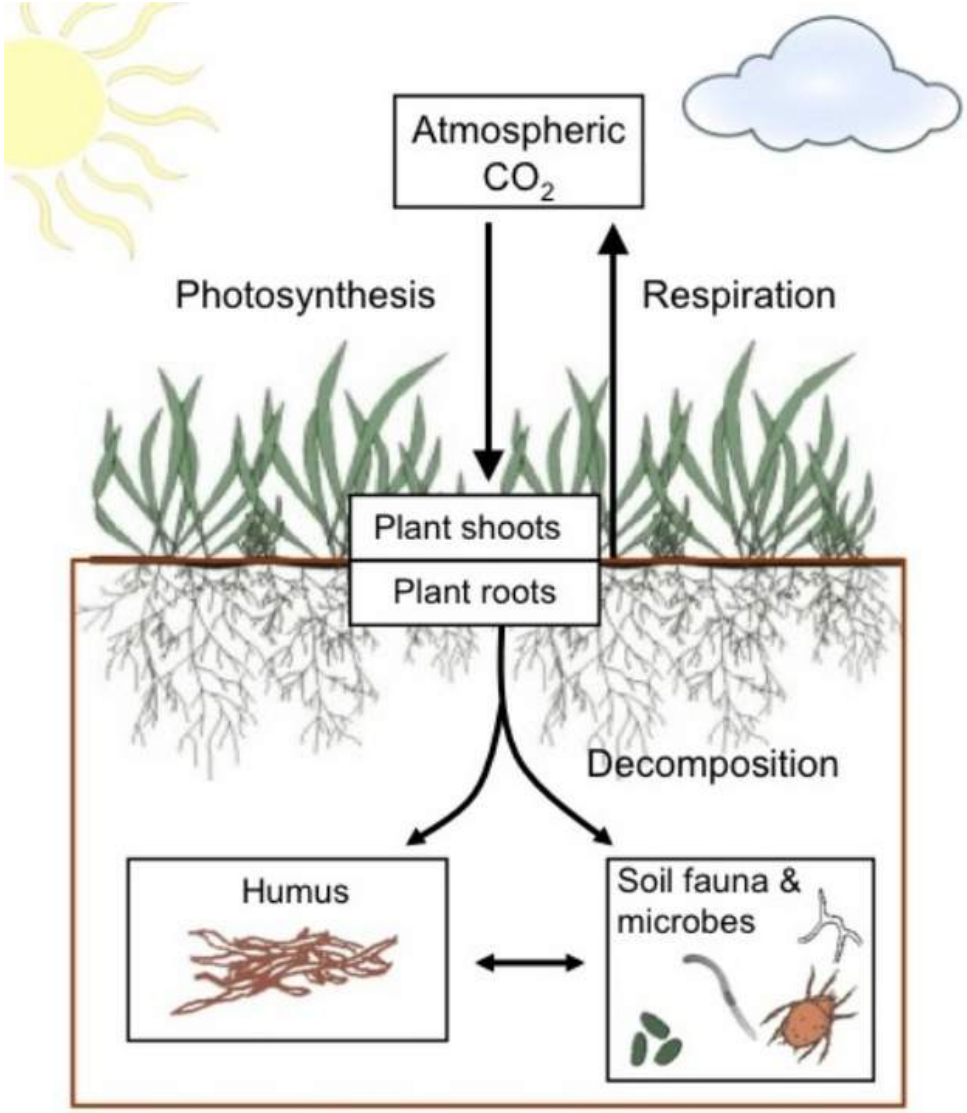
- And after harvest

Benefits of no-till

- Undisturbed soils maintain a stable structure
- It actively breaths, exchanging gases with the atmosphere
- It absorbs moisture from the air that's located in the soil through condensation
- At the surface, plant residue maintains moisture and temperature

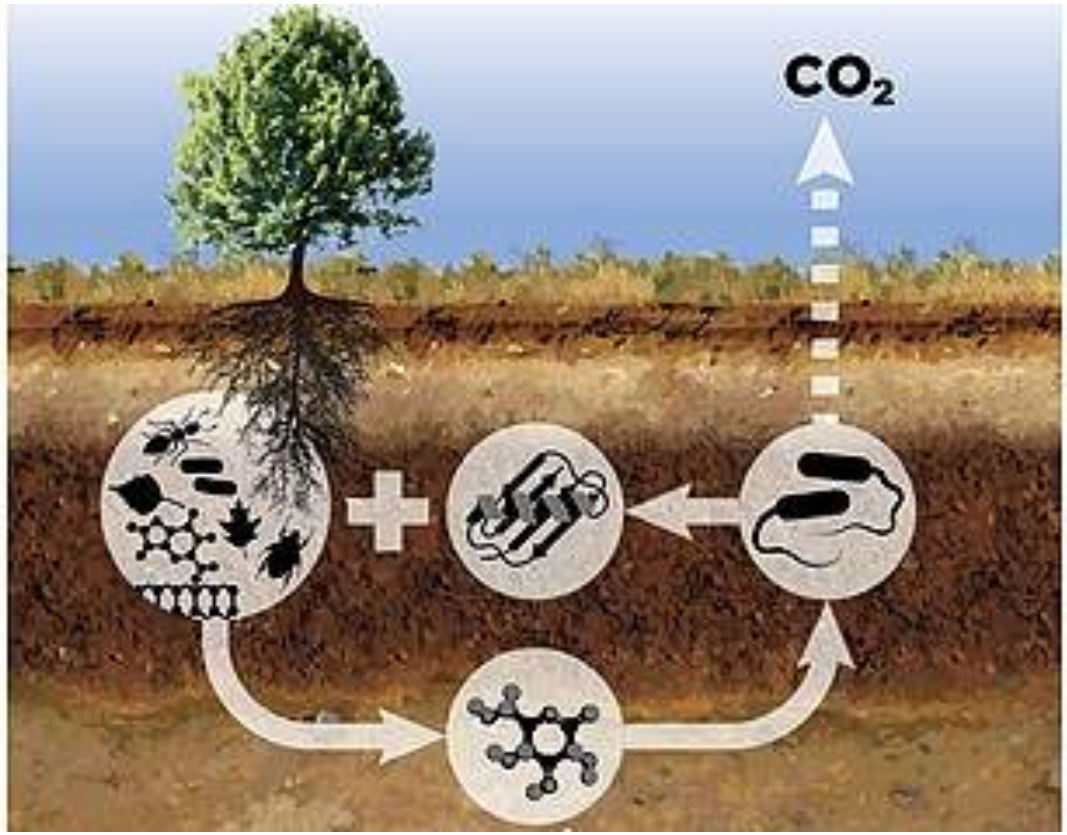
- Under these conditions bacteria thrive and breath

- CO_2 gas which in the lower strata of soil is converted to carbonic acid and with the help of humic acid dissolves minerals: potassium, phosphorous, sulphur, calcium & magnesium

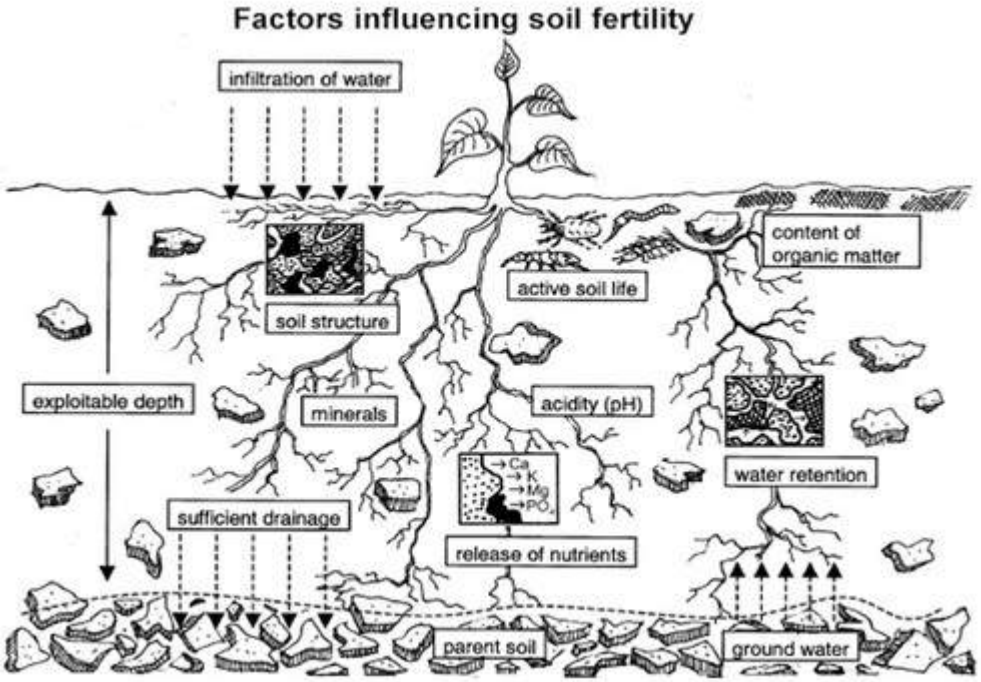


- Microbes primary output is carbon dioxide gas, containing the most important nutrient: carbon, which constitutes about half the plant mass

- In structured soils, nutrient solutions are drawn upward through capillaries in the soil as well as through the roots. At the surface microbes and fungi decompose plant residue that feed surface roots



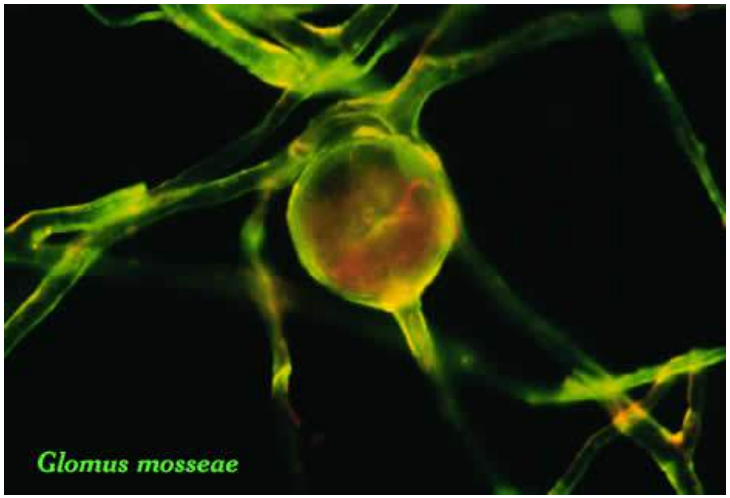
- Fertility is a living and dynamic process



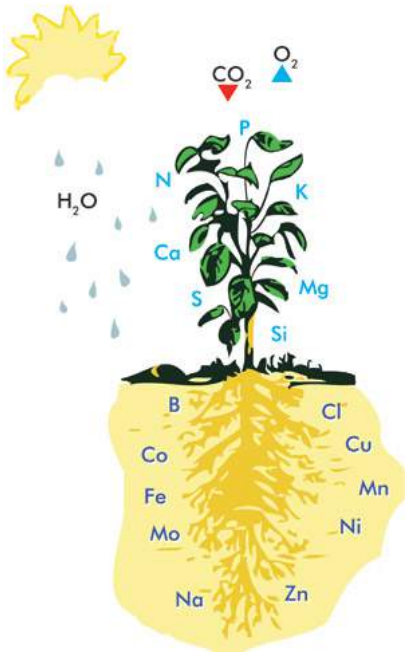
- The primary producers of fertile soil are plants, they penetrate the soil with millions of roots creating billions of pours and channels which form a conductive, breathing structure.

The channels are filled with organic remnants of roots, nourishment for the worms, insects and microbes. On the surface dead plants cover the soil with a layer of organic matter which also serves as nourishment for microbes, insects and other living creatures

- Microbes generate large amounts of biologically active substances: vitamins, stimulants, enzymes, antibiotics and glomalin which helps bind soil particles

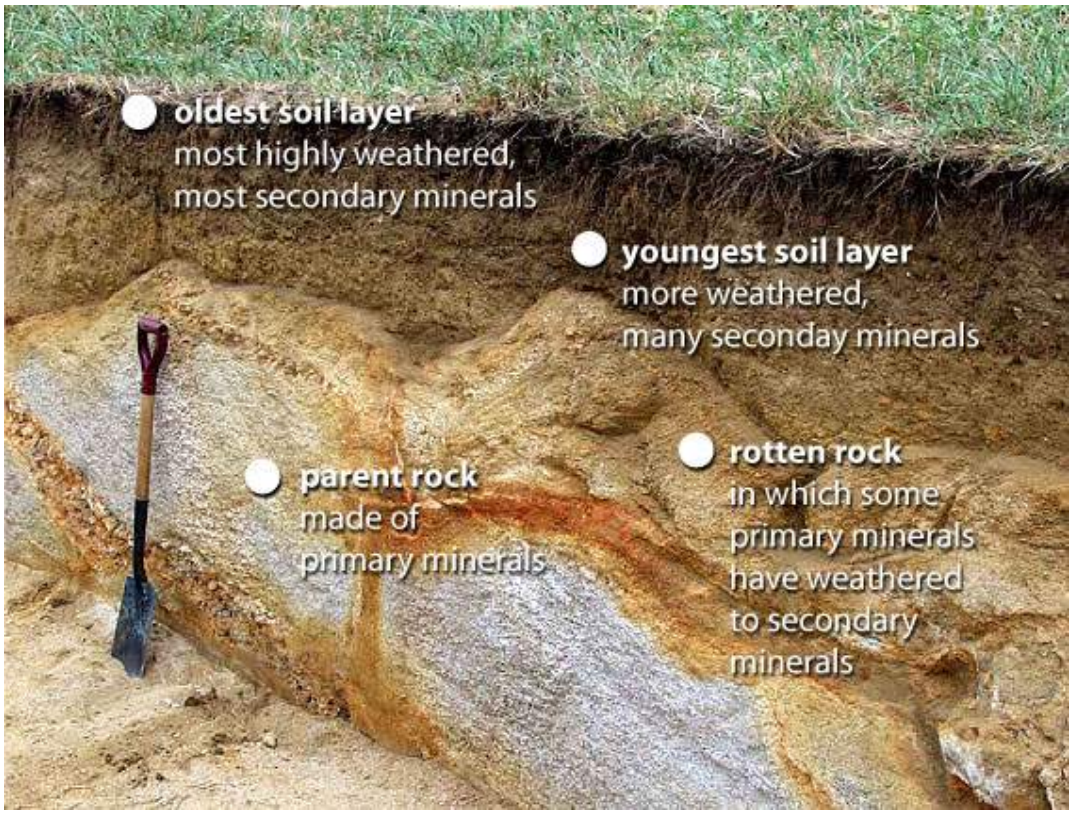


- Normal soil is packed with nutrients. Part of these nutrients are unavailable, insoluable or inoxidized state in the form of rocks and minerals. In nature somehow these are dissolved



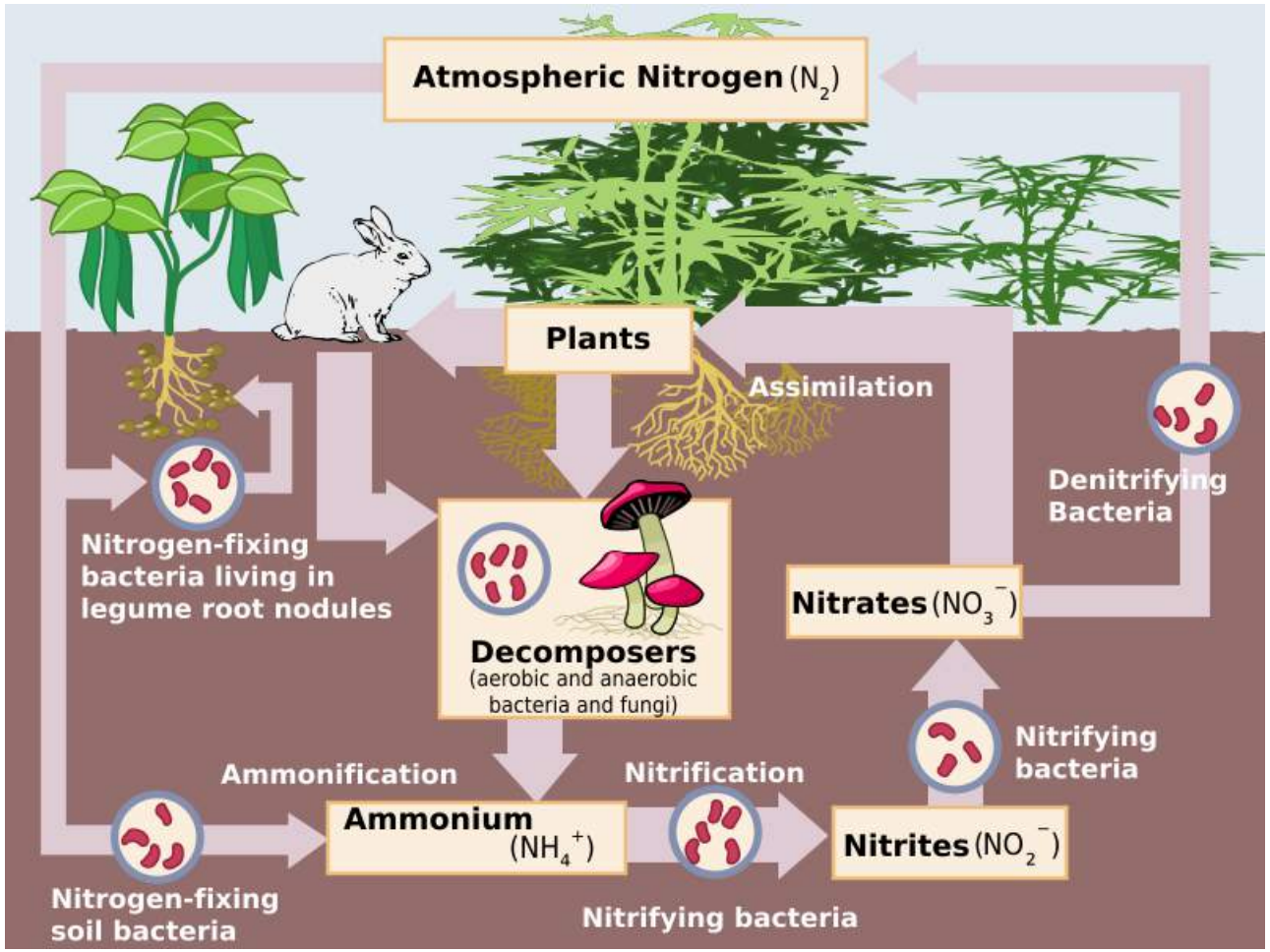
Mineral Foundation of Soil

- Sand, clay and mineral substances in sub-soil contain all the key elements: potassium, phosphorous, calcium, magnesium, chlorine and sulphur as well as all the trace elements, in quantities many times greater than crops remove each year
- Mineral deposits lack only nitrogen, in structured soil even nitrogen can be found in adequate supply



- With the abundance of microorganisms and moisture in nature, plants use various sources of nutrients

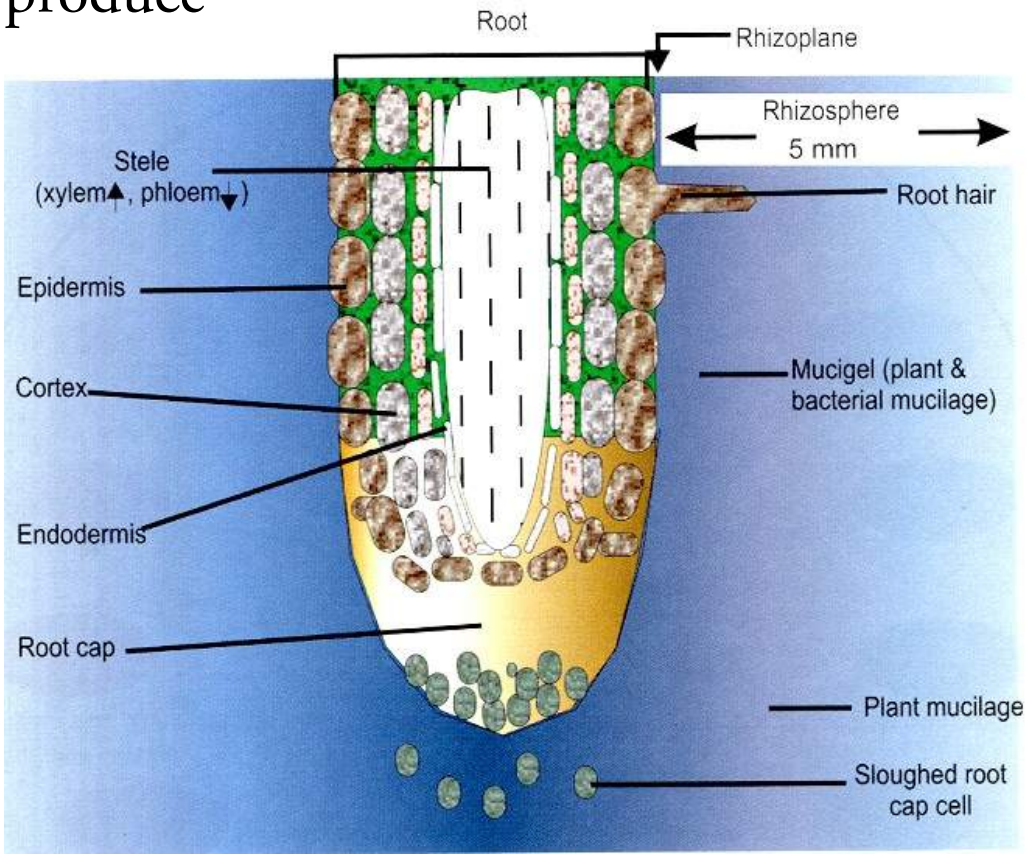
Atmospheric Foundation of Soil



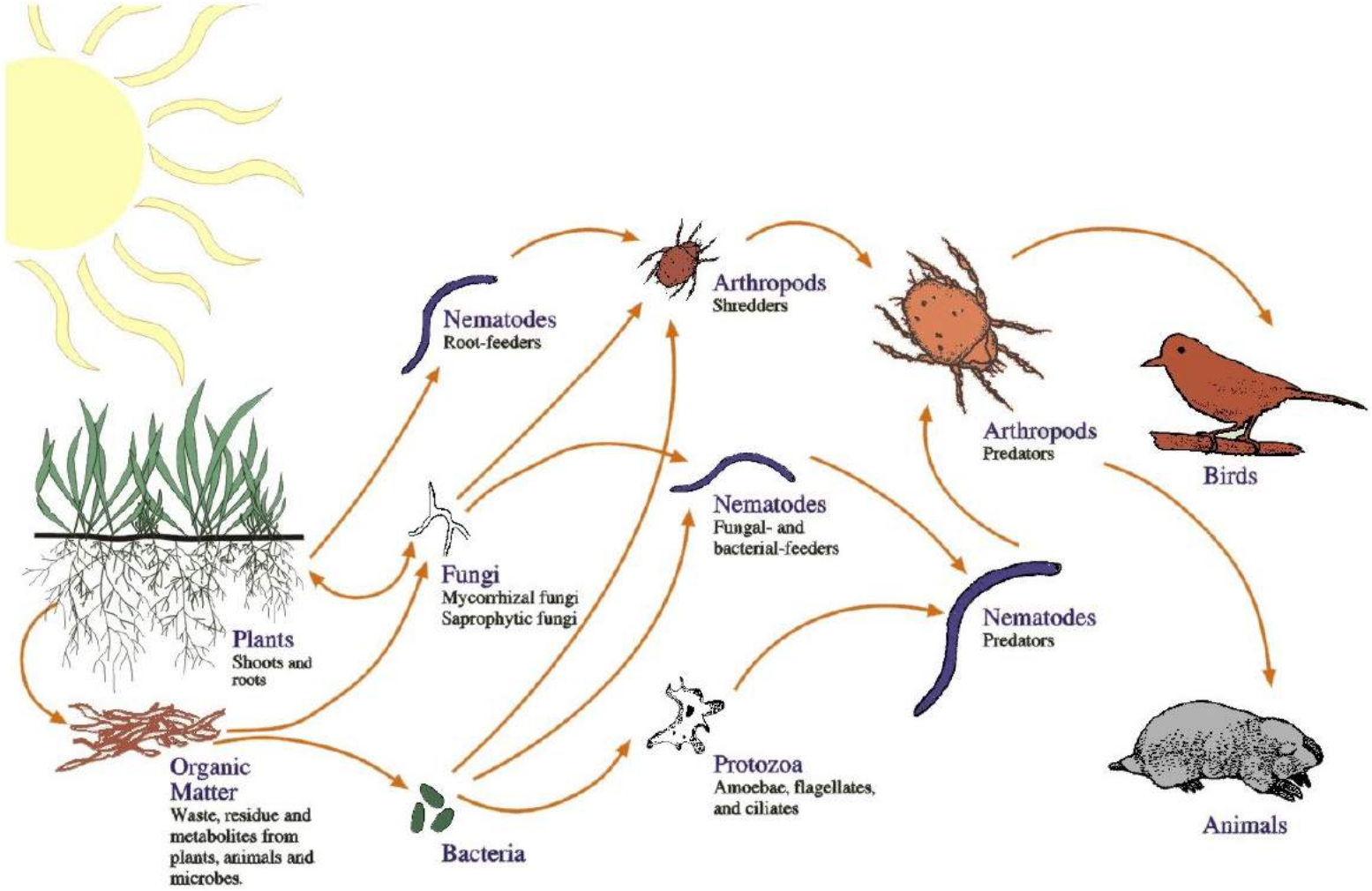
From the atmosphere natural soils receive hydrogen, nitrogen and oxygen from atmospheric water and carbon from carbon dioxide gas. These elements make up 93% of the plant mass.

- Microbes and plants are intimate partners

- In order to attract and feed necessary microbes, plants release through their roots one third of all the organic matter they produce



- The soil food web provides nutrients to roots in their rhizosphere.



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