Microorganisms in soil

Overview

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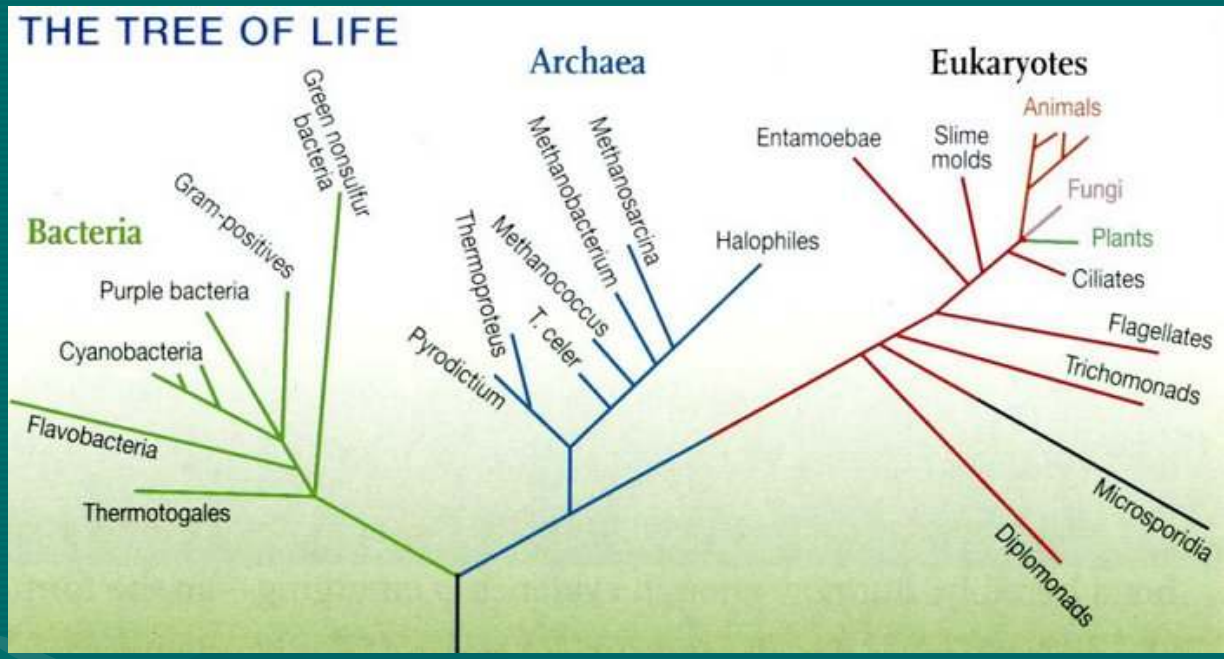
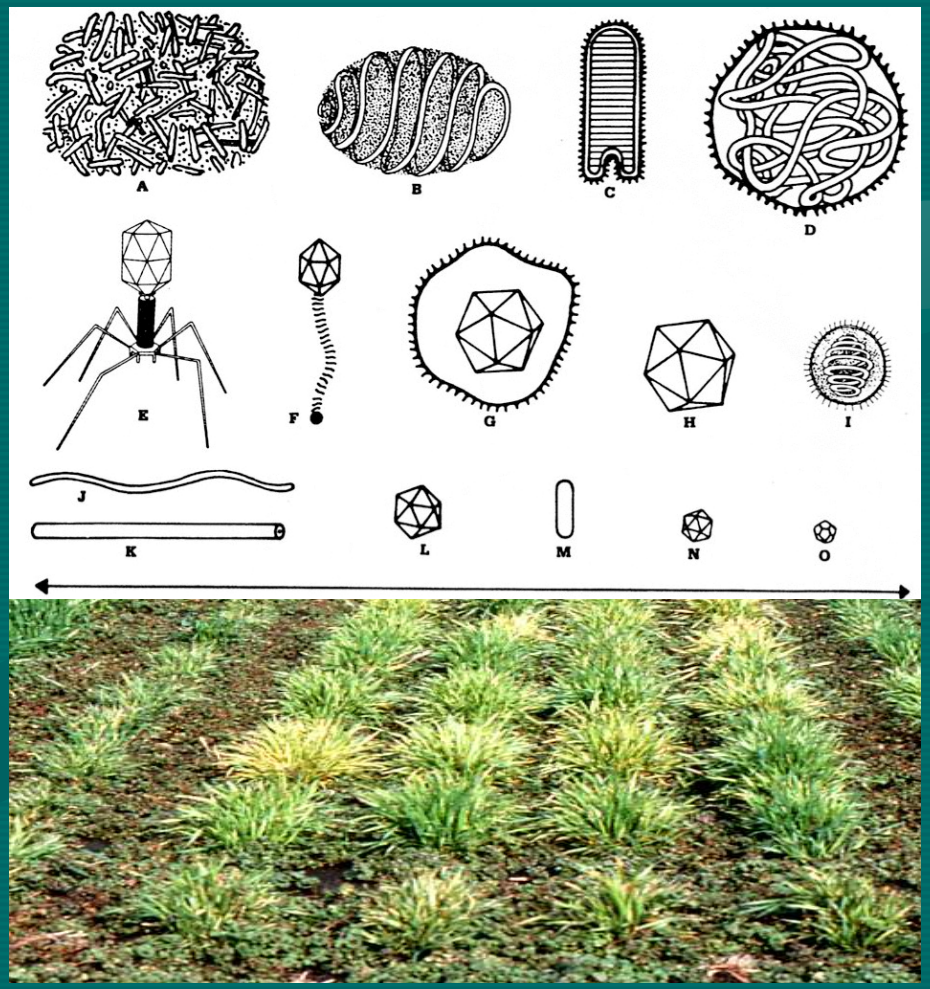
Classification

- Soil microorganisms include representatives of the three Domains
- Bacteria
- Archaea
- Eucarya



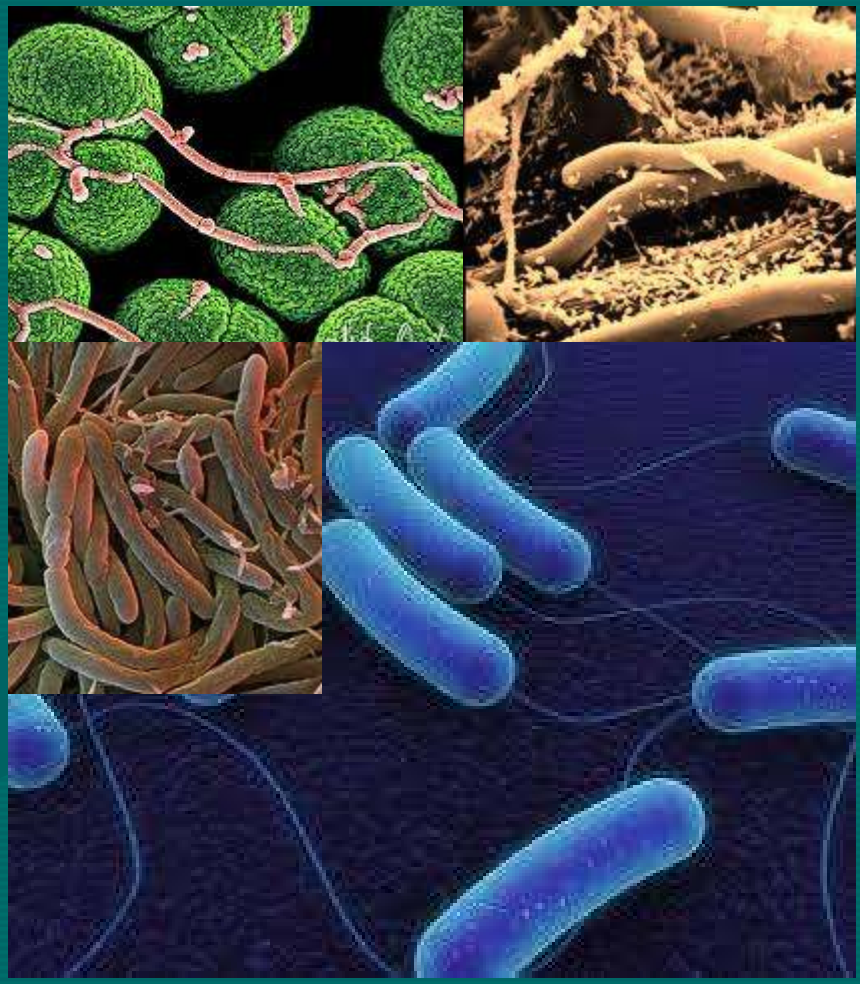
Soil Viruses

- Size range – 0.02-0.25 micrometers
- Obligate parasites
- Role in regulating microbial populations
- Vectors for the exchange of genetic material among prokaryotes



Soil bacteria

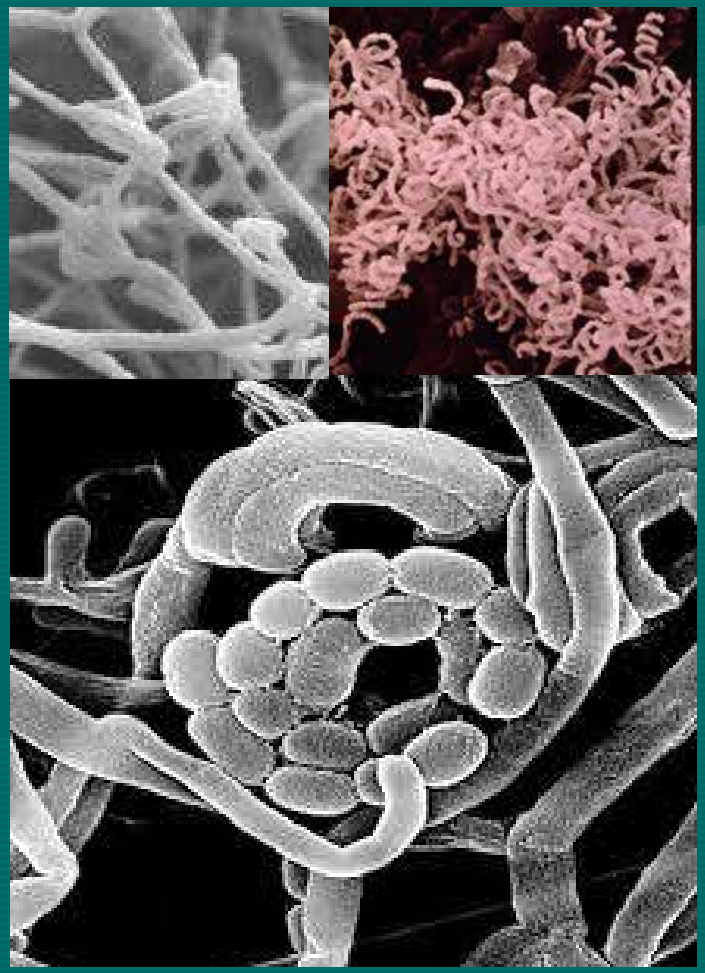
- Very diverse group of organisms – 13,000 species based on analysis of DNA
- Variety of morphologies - rods, cocci, filamentous forms



Soil bacteria

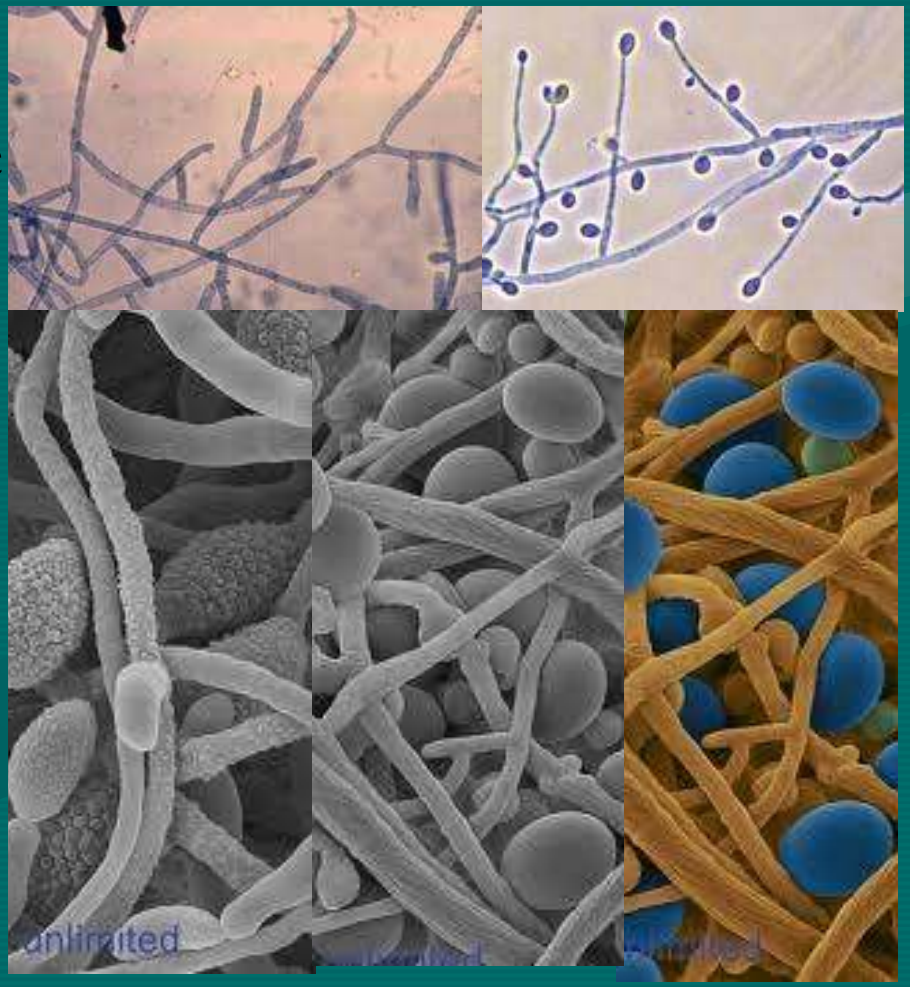
- Actinomycetes
- Filamentous forms – 0.3-1.0 um and 2-10 um long

- number of bacteria- from millions to billions of cells/g soil
- Biomass - 400-5000 kg/ha



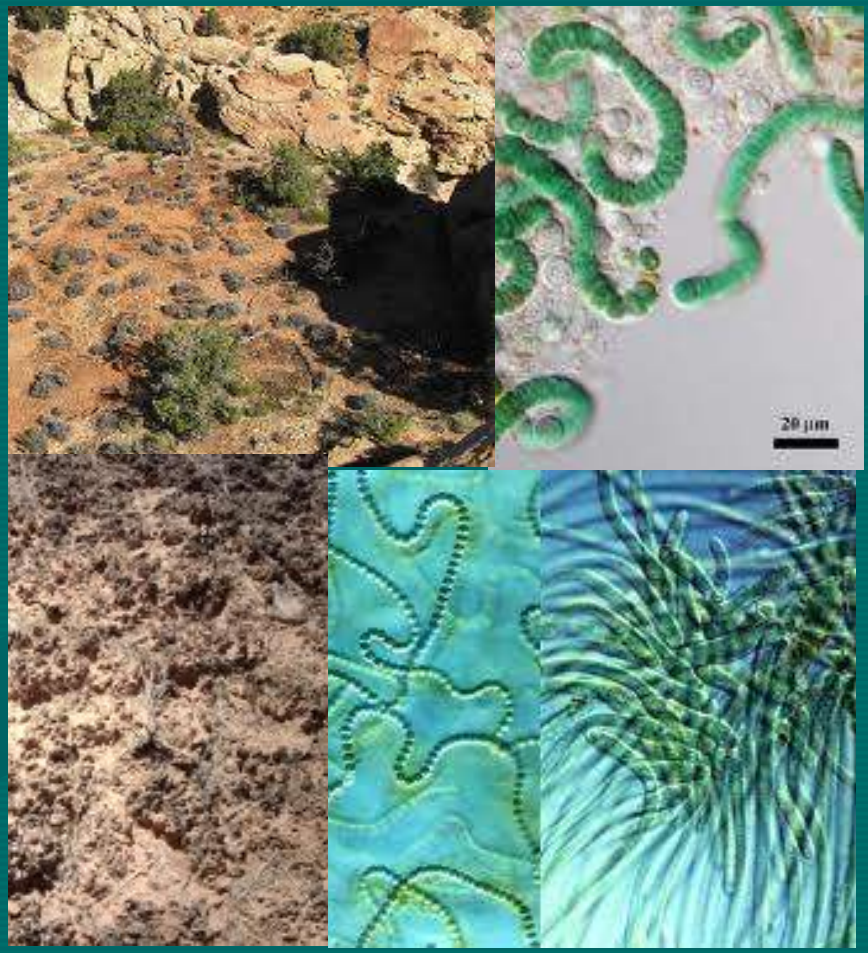
Soil fungi

- Diverse group (70,000 species) with broad range of morphologies and life cycles
- Most are organoheterotrophs
- Mycelial growth
- The largest biomass in some ecosystems



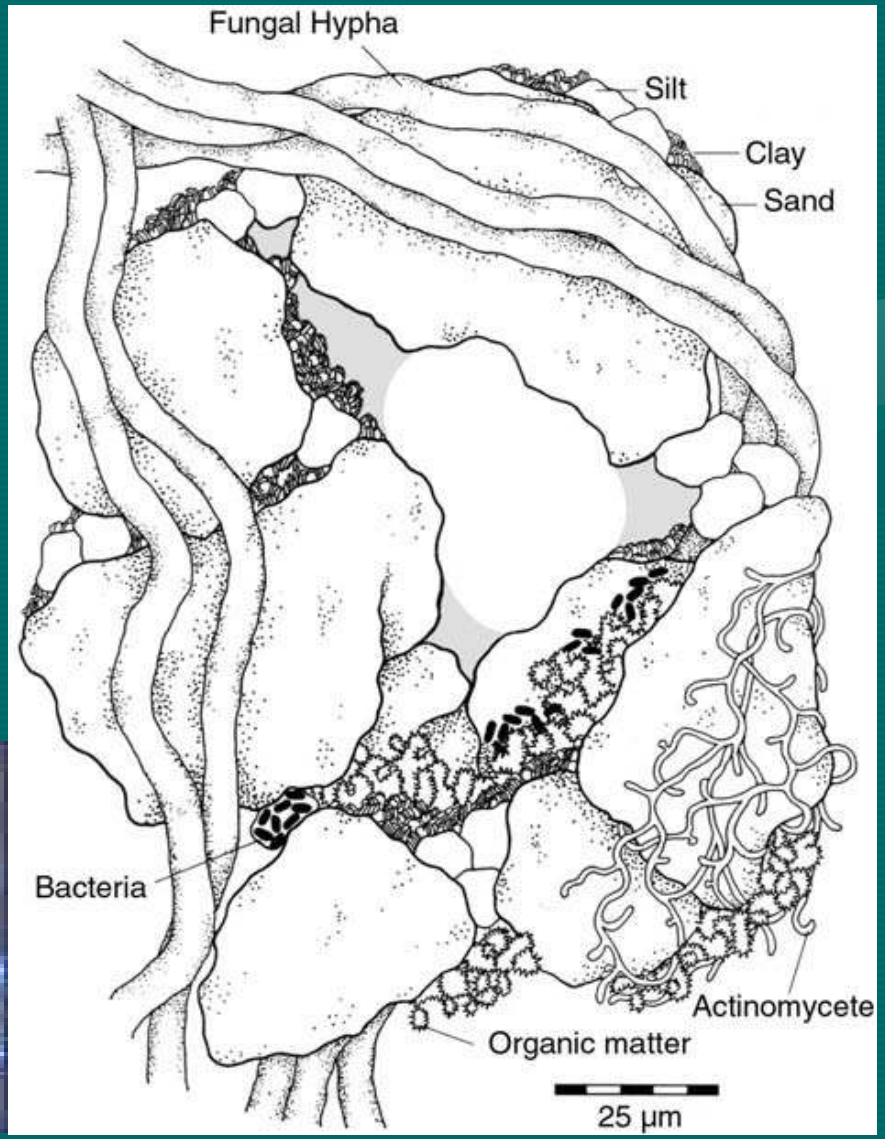
Soil cyanobacteria and algae

- Low densities, except of flooded or poorly drained soil
- Primary producers in ecosystem with low temperature or moisture



Microbial distribution

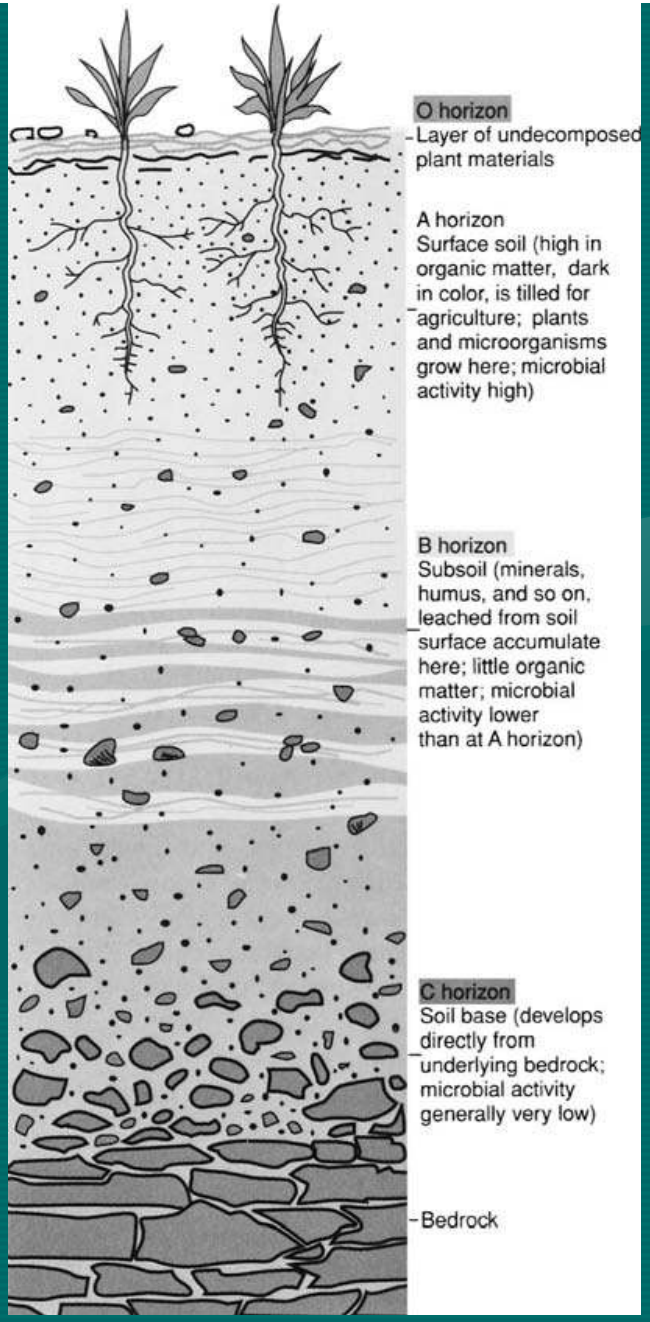
- Particle and aggregate scale (um to mm)
- Mineral particles complexed with organic substrates and pores
- A variety of microenvironments



Soil habitat
Profile scale

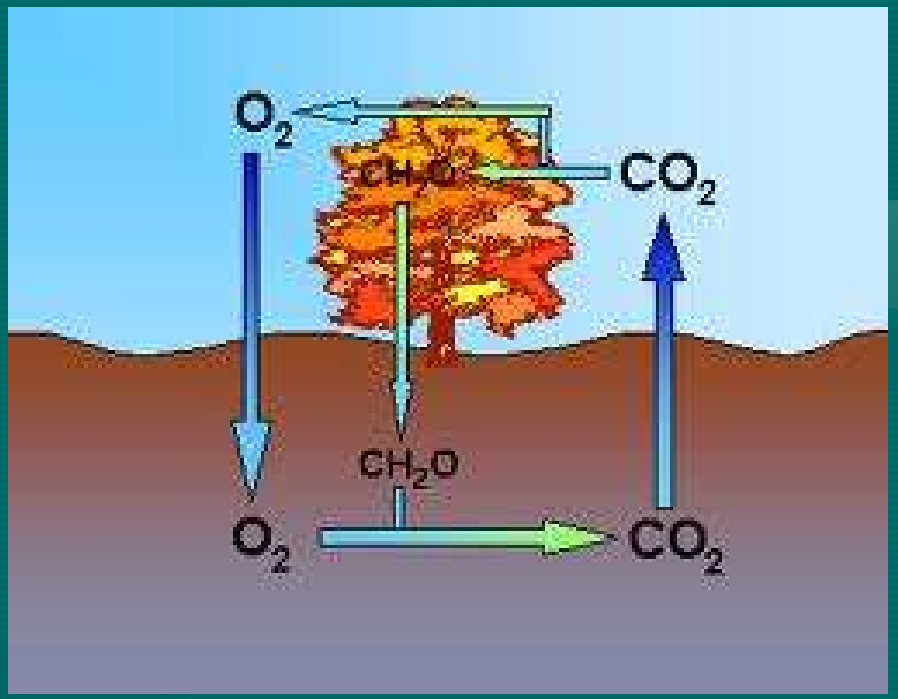
- Soil profile scale (mm to m)
- Vertical pattern
- Horizontal pattern

- Density of microbial populations declines with depth and varies with horizontal composition of soil



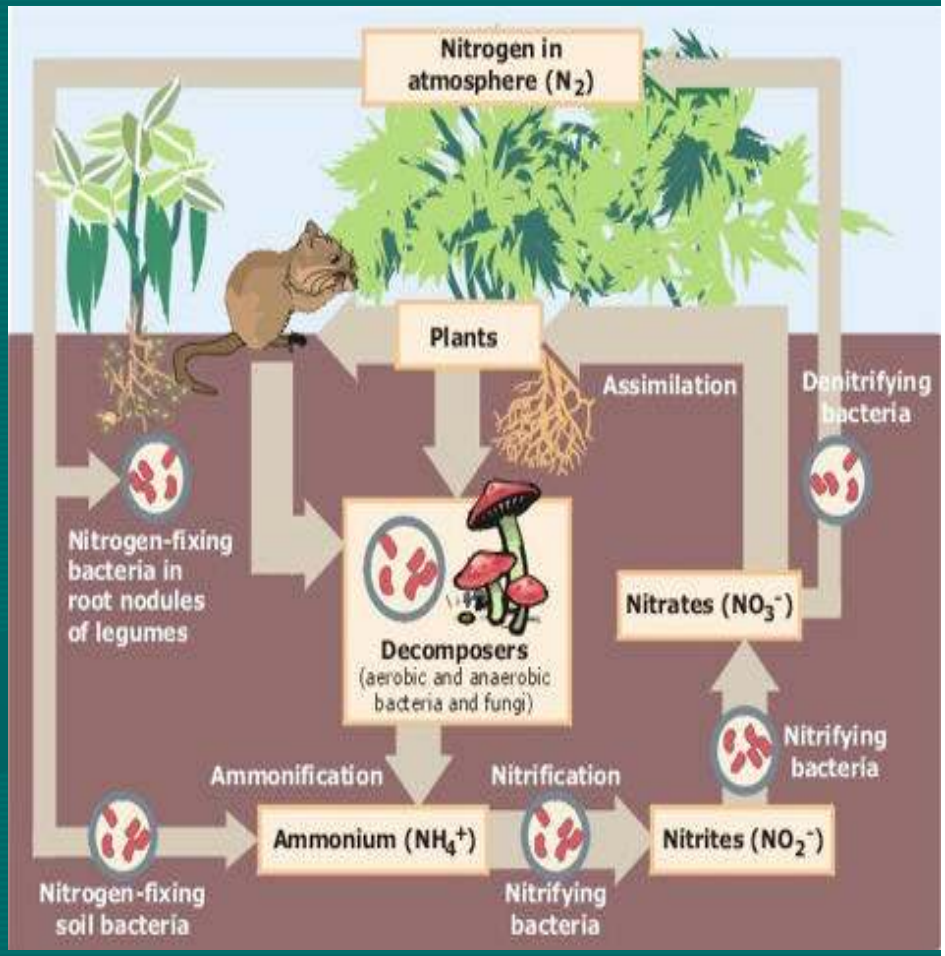
Microbial processes in soil

- Gas exchange
- Microorganisms produce and consume carbon dioxide, methane, dinitrogen, and hydrogen sulfide



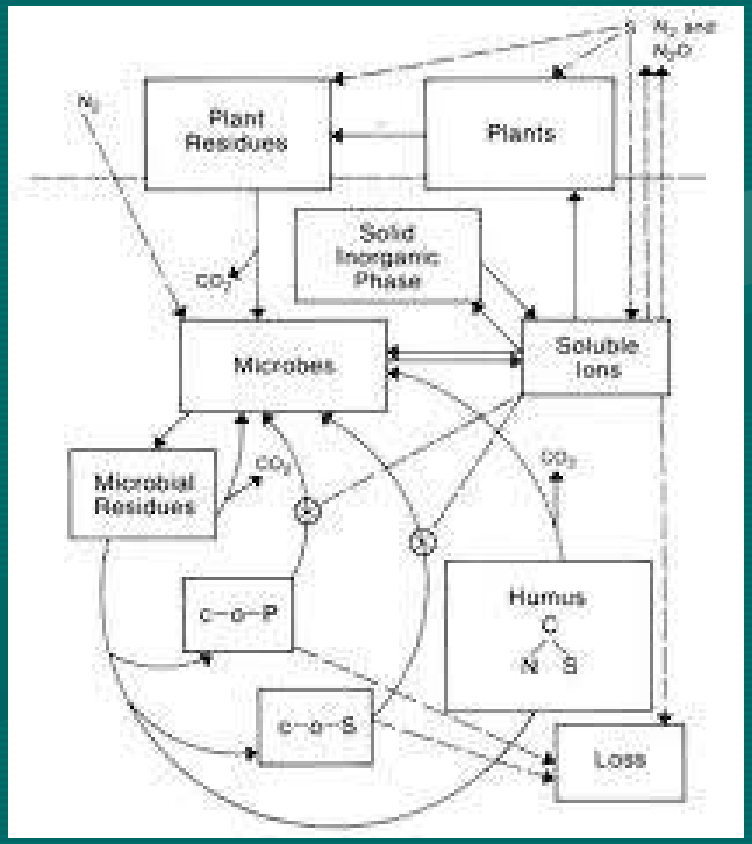
Microbial processes
Elemental cycling

- Elemental cycling
- Nitrogen cycle
- Nitrogen fixation – organic nitrogen
- Decomposition – ammonium -
- Ammonium – Nitrification- nitrit and nitrate
- Nitrate – denitrification- dinitrogen, nitric and nitrous oxides



Microbial processes

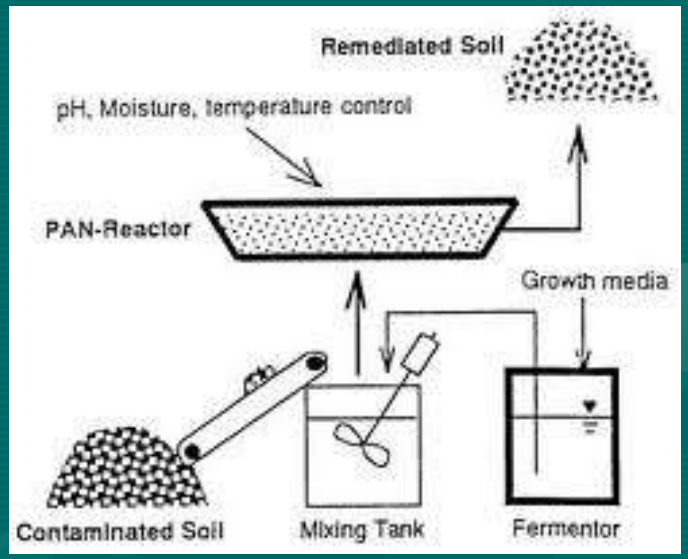
- Photosynthesis - organic compounds
- Decomposition – organic polymer – organic and mineral components
- Mineralization (soil fauna and microorganisms) - carbon dioxide, water and ammonium
- Immobilization - assimilation

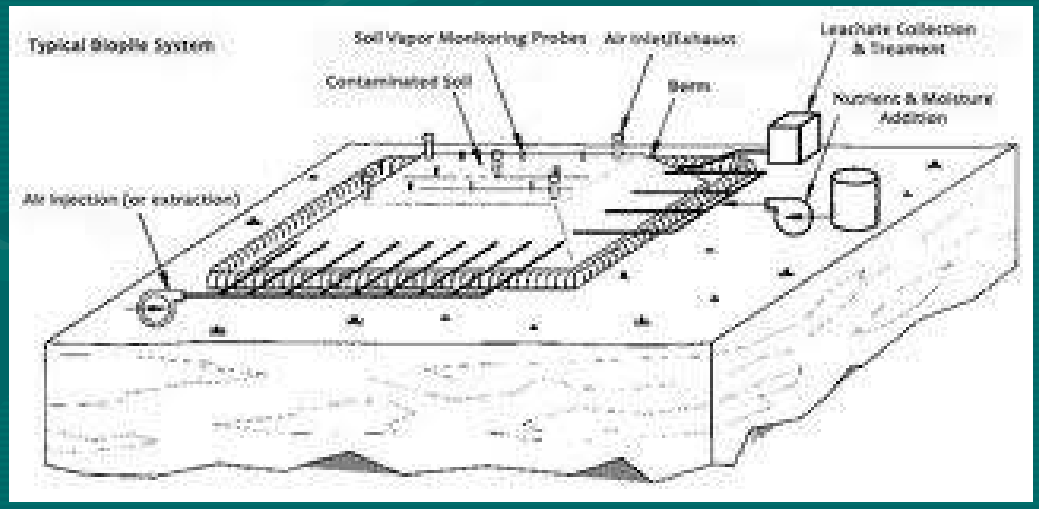


Microbial prossess

- Biodegradation and transformation

- Bioremediation -
- Intrinsic remediation – monitoring of natural processes
- Biostimulation – amendment of nutrients and electron acceptors
- Bioaugmentation – inoculations with specific microorganisms





- Thank you for attention!