Why Soil Health Matters to…**Recharge Quantity and Quality**

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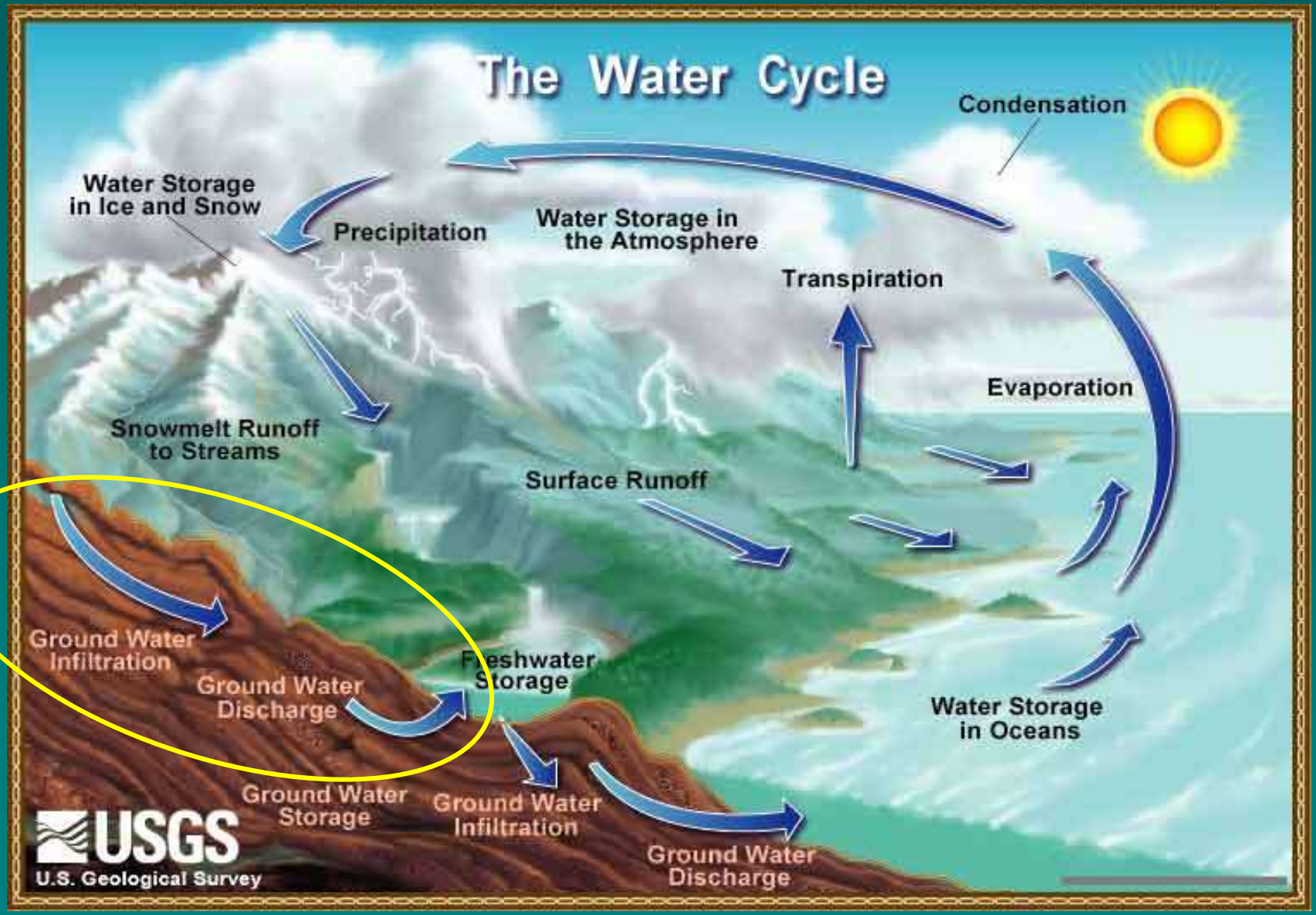
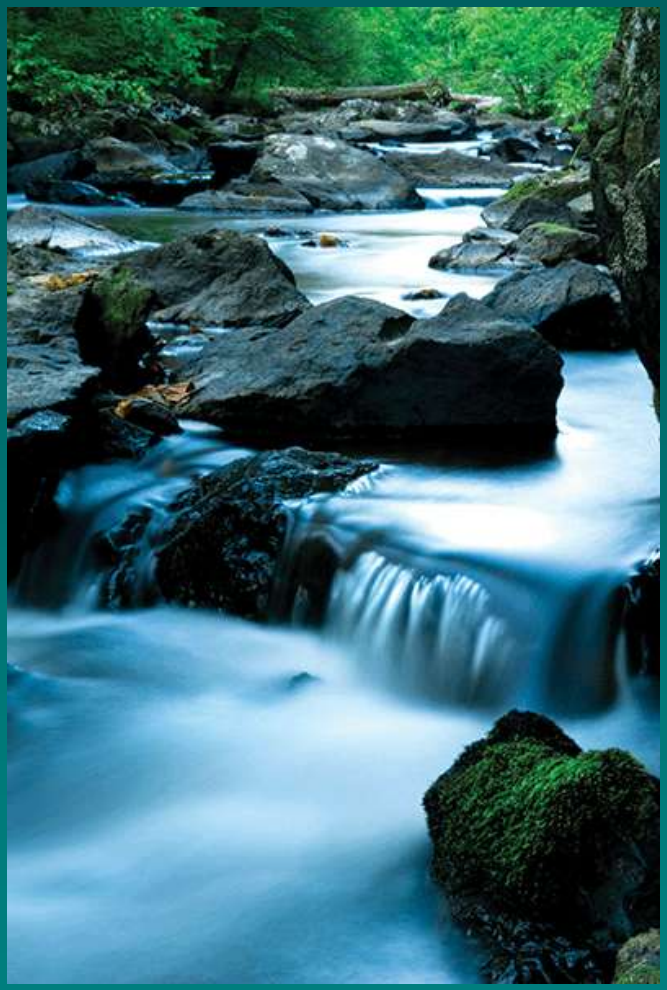
USGS
science for a changing world

What is recharge?



How do you make a stream flow?

- Runoff
- Direct Precipitation
- Tributaries
- Baseflow



Ken Lockwood Gorge , South Branch Raritan River
photo by Peter Murphy (www.njmonthy.com)

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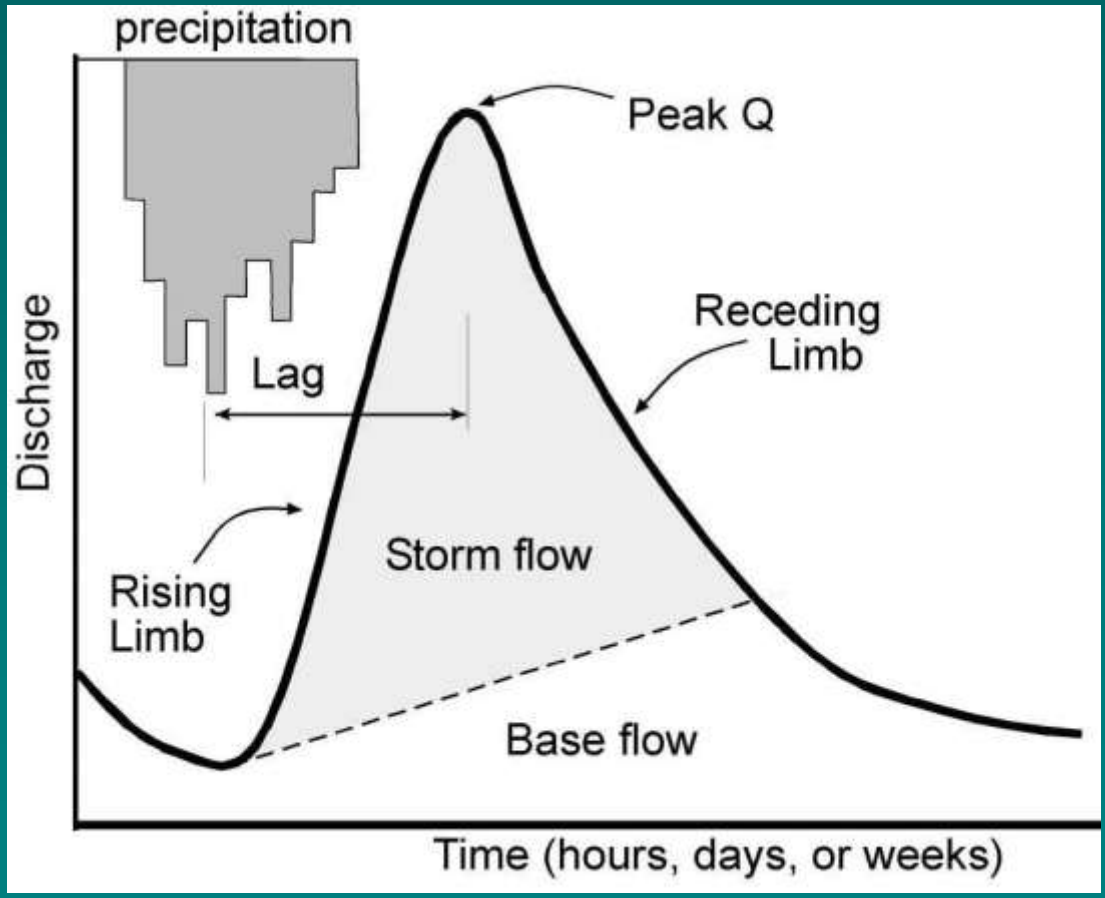
What is Baseflow?

Baseflow is the longer-term discharge into a stream from natural storages, notably sustaining flow between rainfall events.

Natural Sources

- Groundwater
- Bank Storage
- Wetlands
- Lakes
- Snow



http://www.connectedwater.gov.au/processes/baseflow.html

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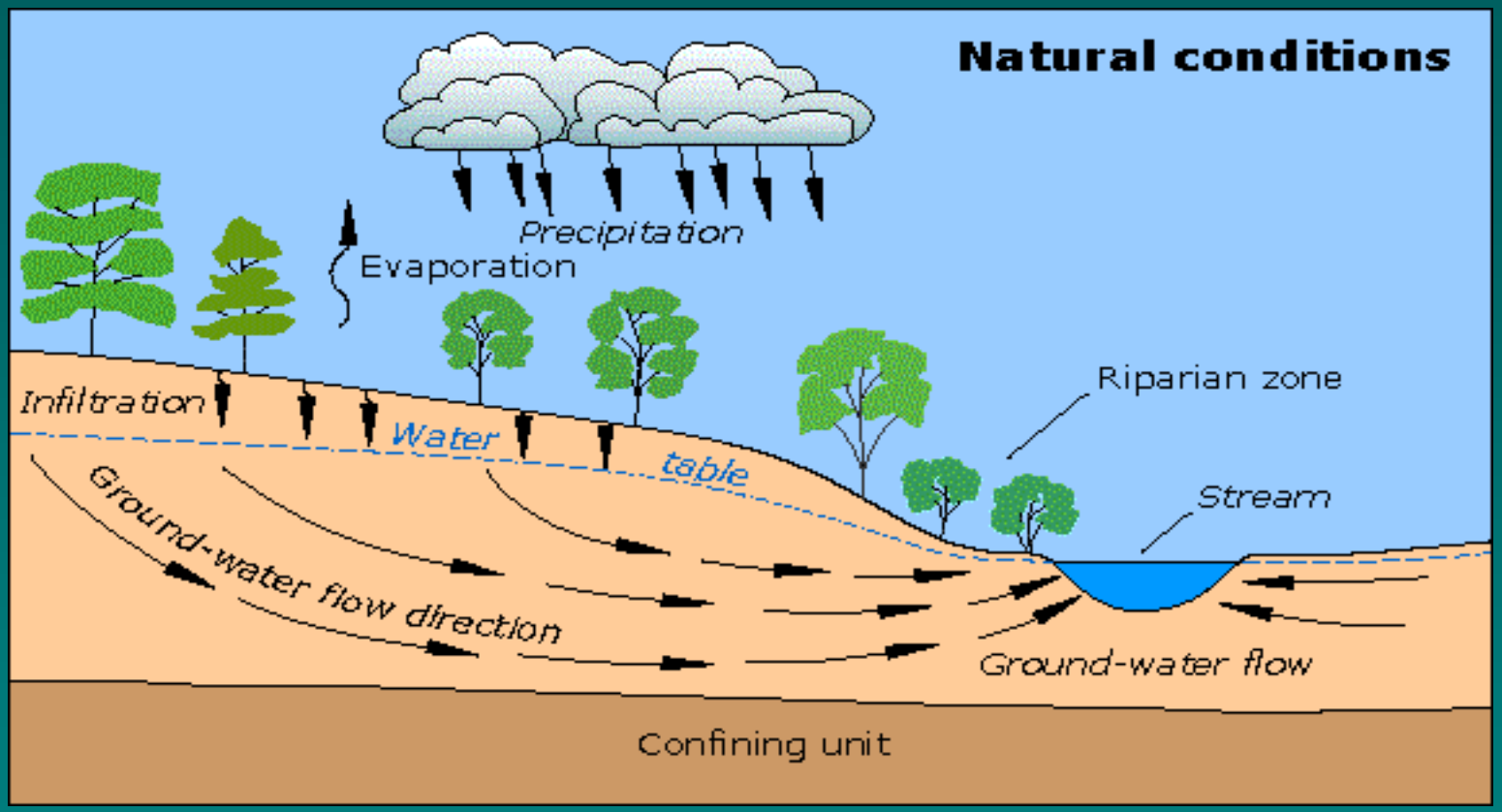
How does groundwater get into streams?



http://ga.water.usgs.gov/edu/earthgwdecline.html

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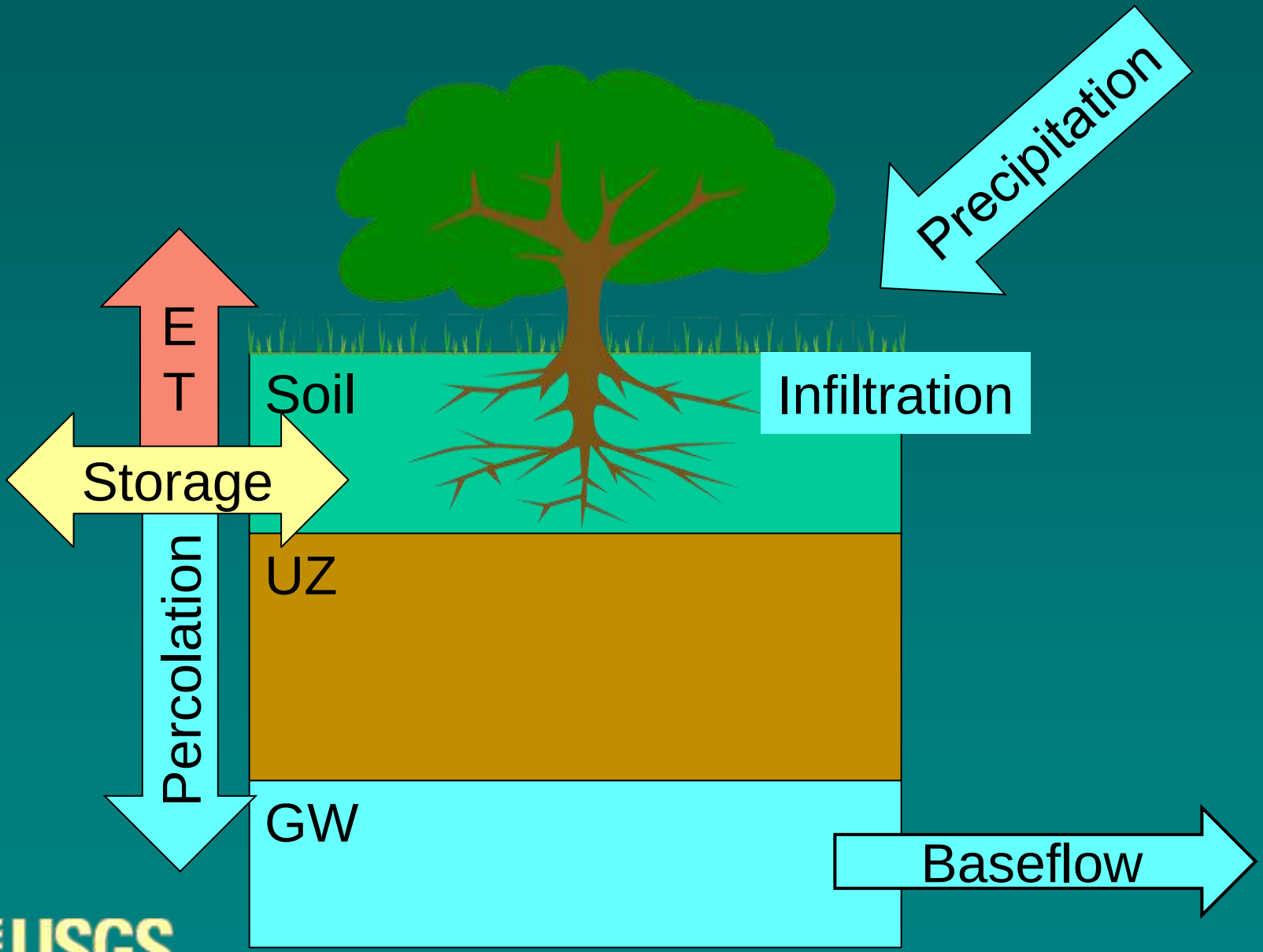
How does water get to the water table?



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When soil health is poor…

- Poor/no soil structure
- Reduced porosity
- Decreased infiltration and percolation rates

...recharge quantity declines!

- Declines in baseflow
  - Habitat loss
  - Water supply issues
- Declines in surficial aquifers

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What's in that water we're recharging with?

- Source of water
  - Precipitation/snowmelt
  - Irrigation/chemigation
  - Treated wastewater

- Land use
  - Undeveloped
  - Agriculture
  - Residential/industrial

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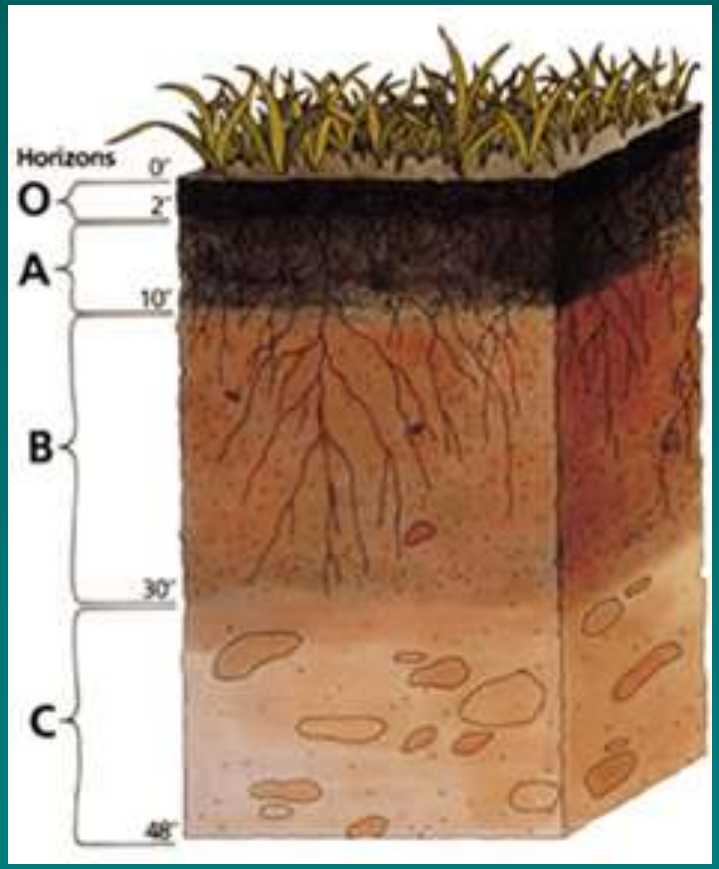
A healthy soil is a living filter!



- Uppermost layer (O horizon)
  - Mainly plant litter in various states of decay and humus
- Topsoil (A horizon)
  - Aggregates made of mineral particles and humus cement
- These layers are alive!
  - A teaspoon of healthy soil can contain 100 million to 1 billion bacteria!
  - That is the same mass as 2 cows/acre!

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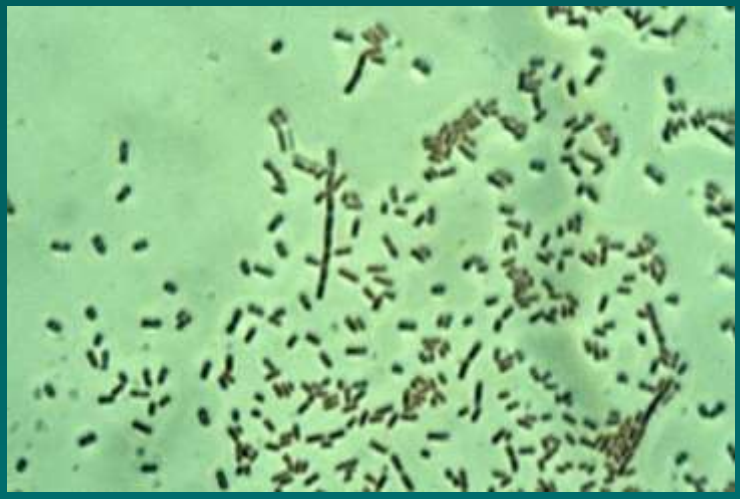
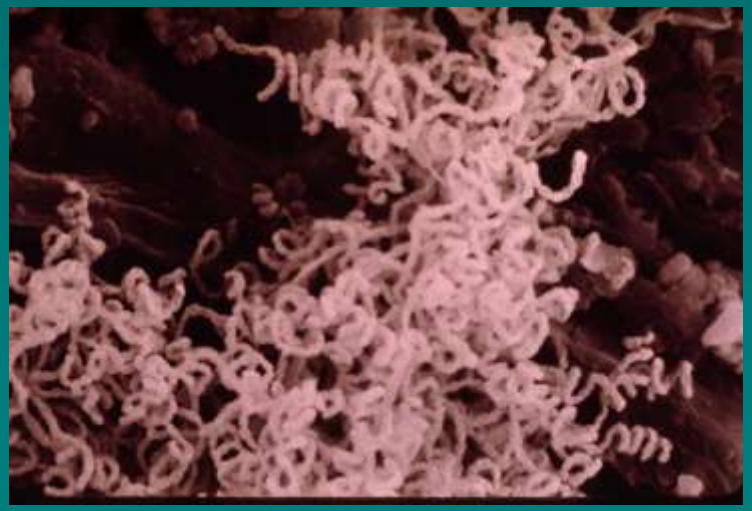
What do soil microbes do?

- Nutrient cycling
  - Fixing– convert nitrogen gas from the air to forms plants can use
  - Nitrifying – convert ammonia to nitrate
  - Denitrifying – convert excess nitrate to nitrogen gas
- Decompose organic material + compounds
- Disease suppression
- Provide the “glue” to stabilize aggregates



Bacteria, Michael T. Holmes, Oregon State University



Actinomycetes J.P. Martin et al., 1976 SSSA, Madison, WI

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Where are chemicals stored and transported in soil?

- Solid Phase
  - Organic matter
  - Charged minerals
- Liquid phase
  - Water films
  - Macropore flow
- Vapor phase
  - Very important for N_2 and VO's

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Soil is essential to recharge quality and quantity…

- A healthy soil will :
  - Allow water to infiltrate
  - Be porous enough to allow percolation
  - Store and moderate water creating steady baseflows
  - Filter water by storing or degrading chemicals

… which provides us with a supply of clean water essential to human life!

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