

SOIL



AGRICULTURE IN THE CLASSROOM
LESSON TO GROWN - 9/2011



Why are soils so amazing?

We depend on them for our survival

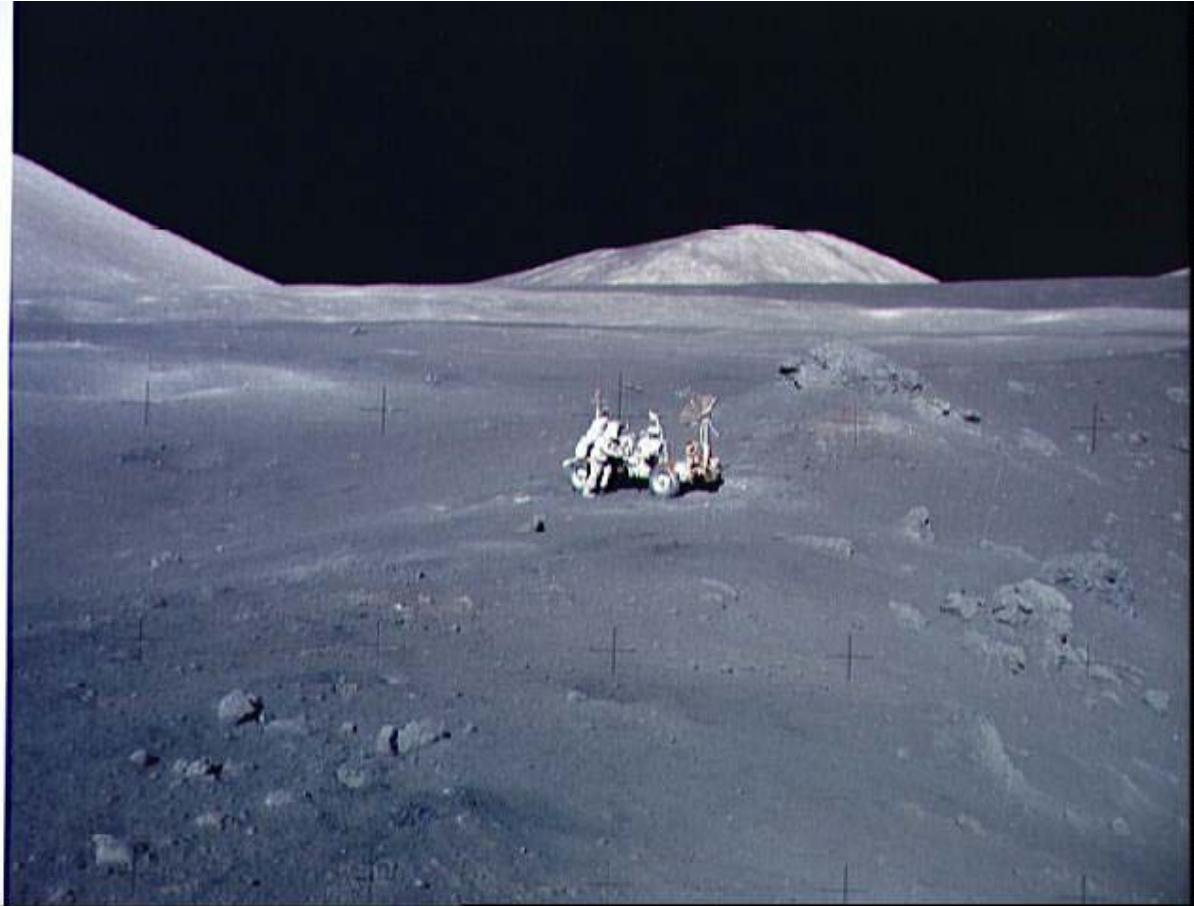
- Integral to ecosystems worldwide

Soil is fundamental to understanding life on earth

- The final frontier is right under our feet!

It's where we come from – our home



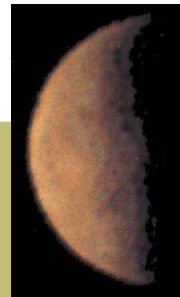


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Earth

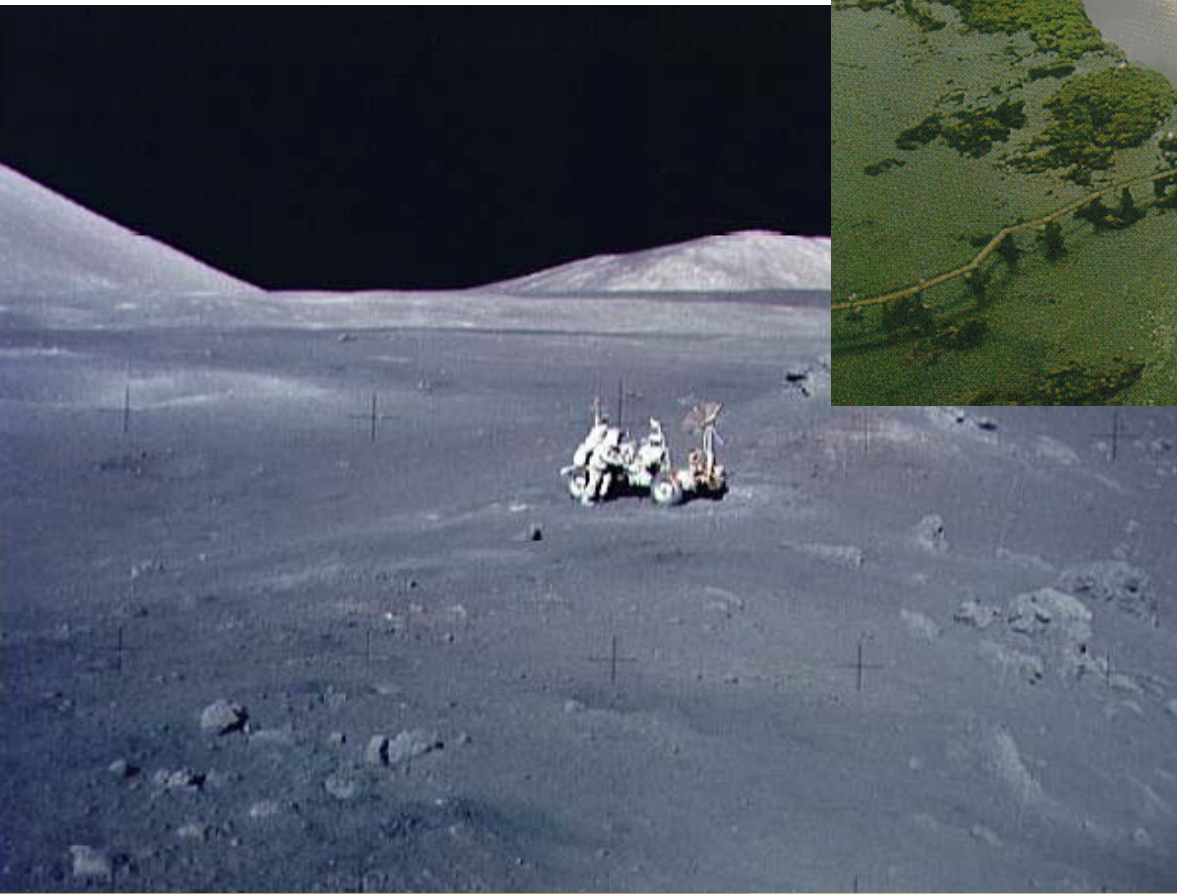


Moon

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Earth



The rest of the universe

SOIL DEFINED

soil/

Noun: The upper layer of earth in which plants grow, a black or dark brown material typically consisting of a mixture of organic remains, clay, and rock particles.

Verb: Make dirty: "a soiled T-shirt"



Soil is ALSO...

- Soil (along with air and water) is one of the three major natural resources on earth.
- Without soil there would be no life on earth.





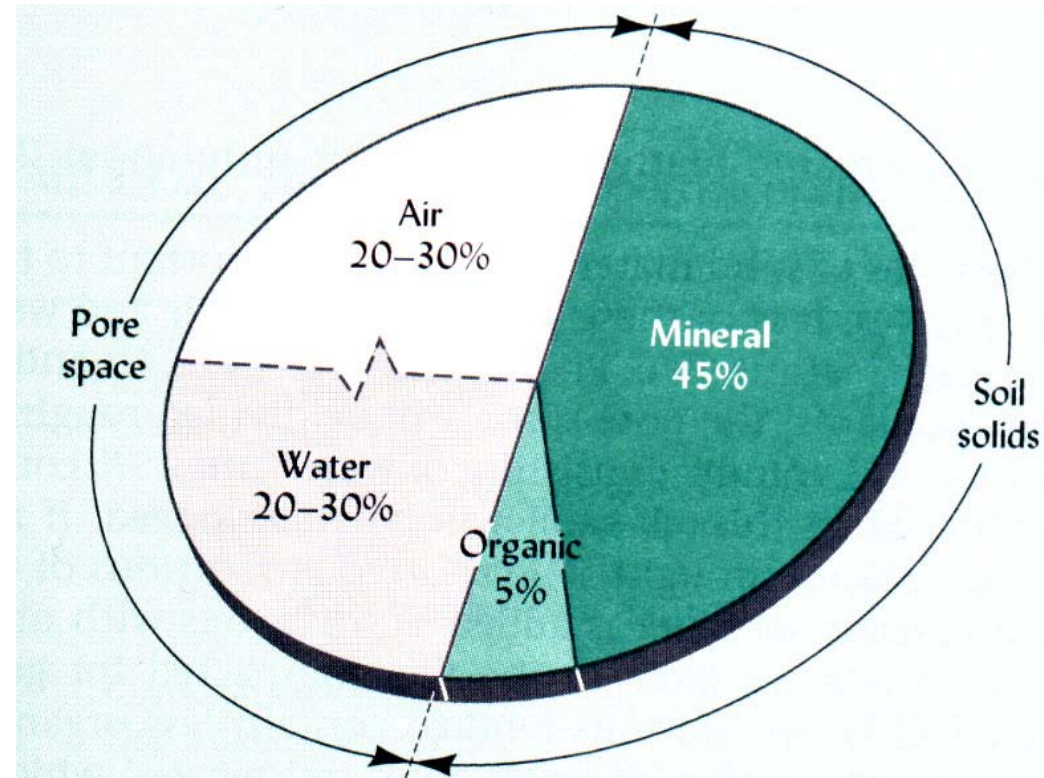
Why it is important to study soil

- World population is increasing
- Only a small fraction of the world's land is suitable for growing crops
- Quantity of farmland is getting smaller
- Soil quality for agriculture is degrading world-wide

What is soil made of?

The 4 Elements of Soil

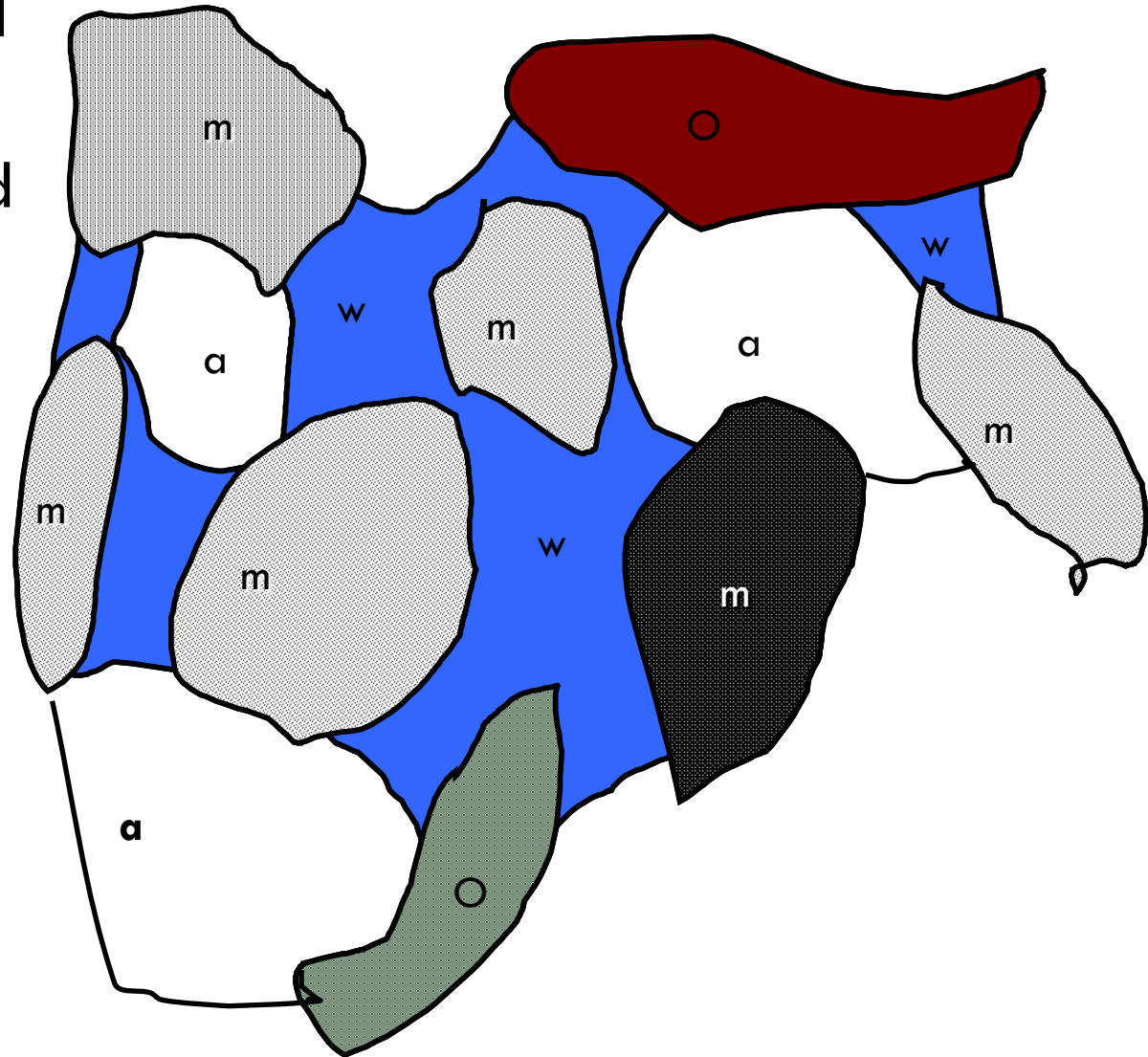
- Minerals - from rocks below or nearby
- Organic Matter - the remains of plants and animals
- Water
- Air



What is soil made of?

A clump of soil will have water, air, organic matter, and minerals.

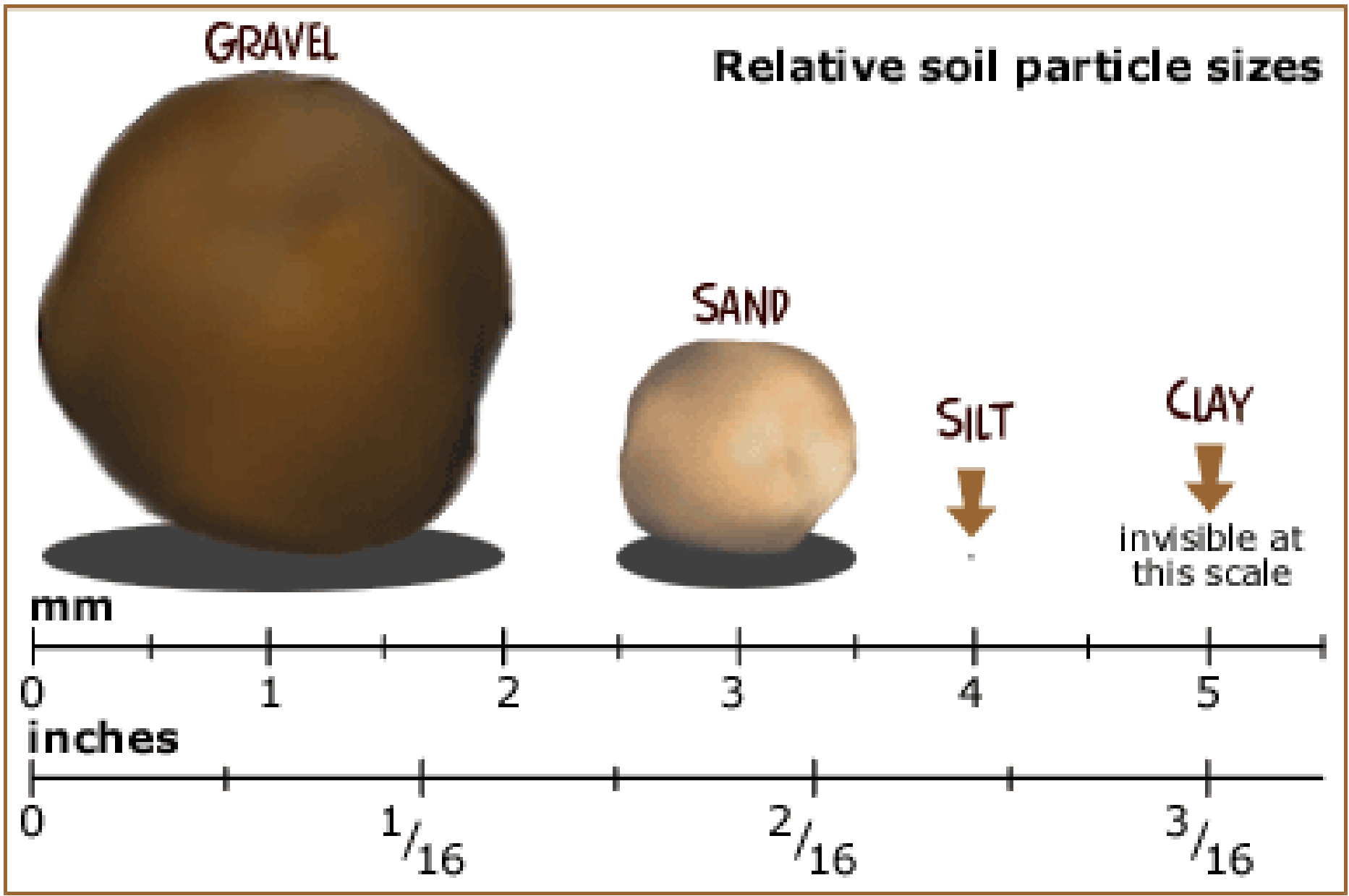
A = Air
W = Water
O = Organic Matter
M = Minerals



Minerals

- Makes up less than 50% of a “soil”
- Chemical composition varies
- Contains particles of several sizes (small to *really* small) i.e, Sand, Silt, Clay
- The minerals in a soil depend on the underlying geology/bedrock







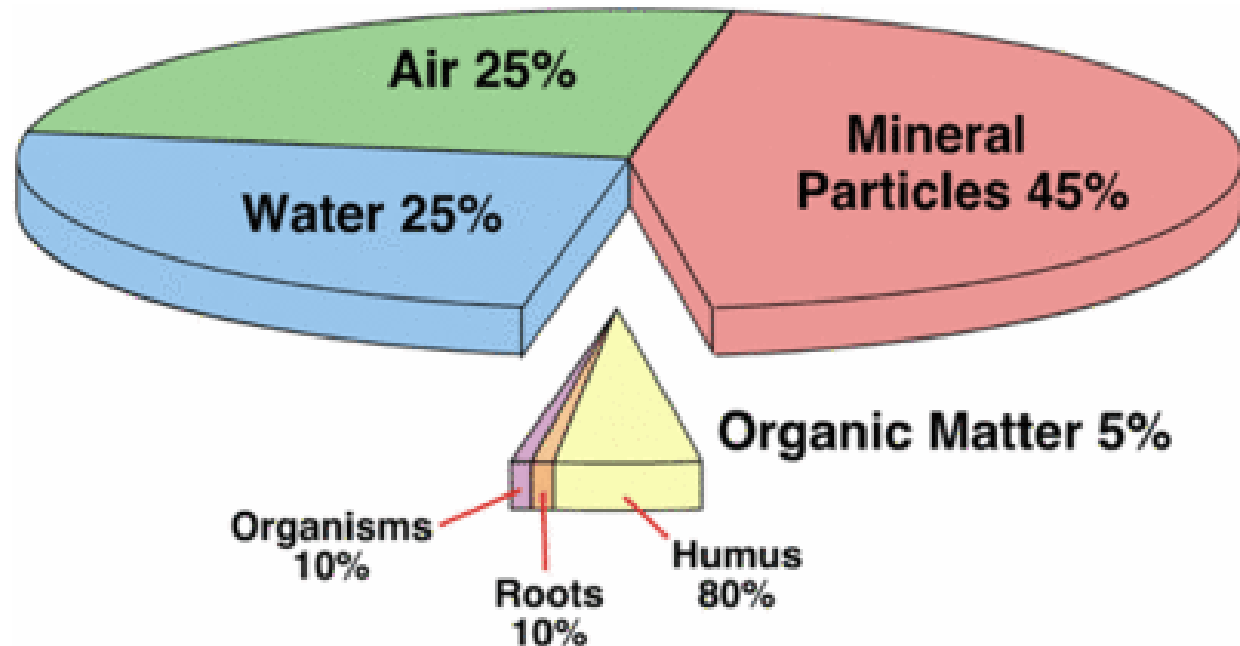
Loam – The perfect mix for agriculture.



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Organic Matter (OM)

- SOIL GLUE – it is small part of soil, but has a huge influence on soil properties.
- Made of decomposed plants and animals, roots and humus.



What does organic matter do?

1. Gives Soil Structure - Stabilizes soil, makes soil easily managed SOIL GLUE!
2. Holds Water - Increases the amount of water a soil can hold (and it's availability to plants)
3. Major source of nutrients for plants
4. Main food/energy for soil organisms



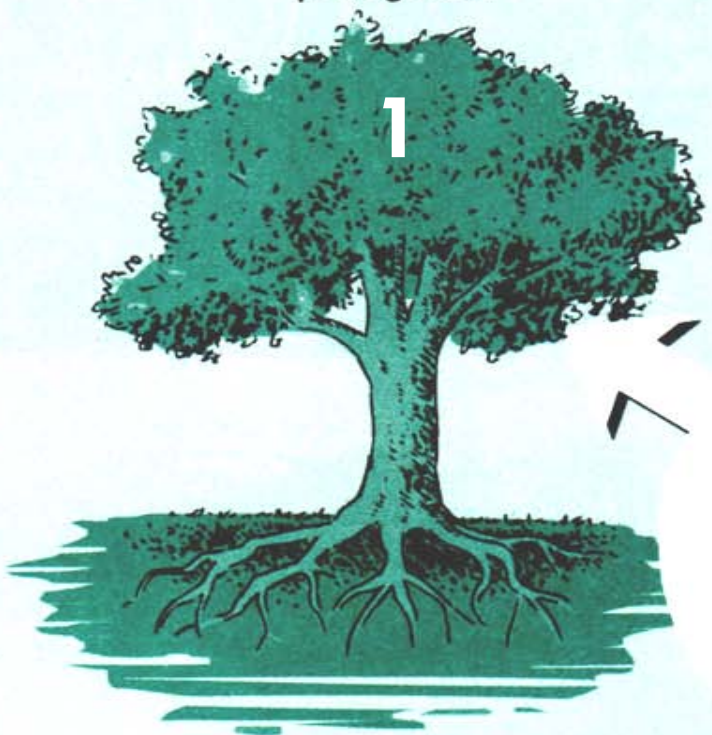
Soil Water

- Soil holds different amounts of water depending on soil pore size and water available.
- Water accumulates in empty pore spaces.
- Not all soil water is available to plants.

Soil Air

- Oxygen in soil is used by plant roots and soil microbes.
 - during respiration carbon dioxide is released.
- High CO₂ content
- Low O₂ content
- Soil air is very humid, close to 100%

Place for plants to grow



Recycles nutrients and Organic Material



Habitat for soil organisms

Water supply & purification



Human and Animals Build with it

5 Functions of Soil

#1 Supports plant growth and animal life below and above the surface.



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5 Functions of Soil

#2 Recycles nutrients and waste – DECOMPOSITION.



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5 Functions of Soil

#3 Controls the flow and purity of water!

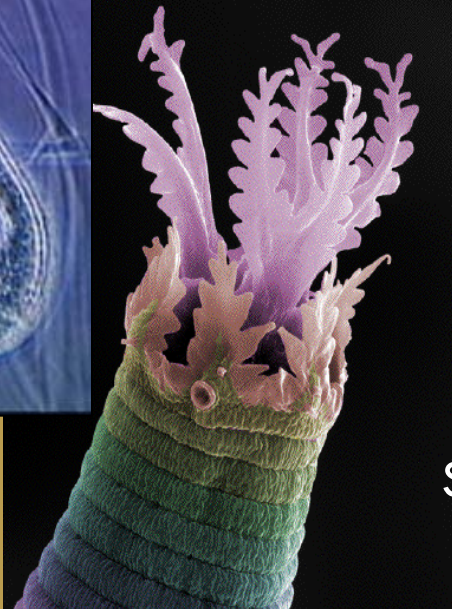


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5 Functions of Soil

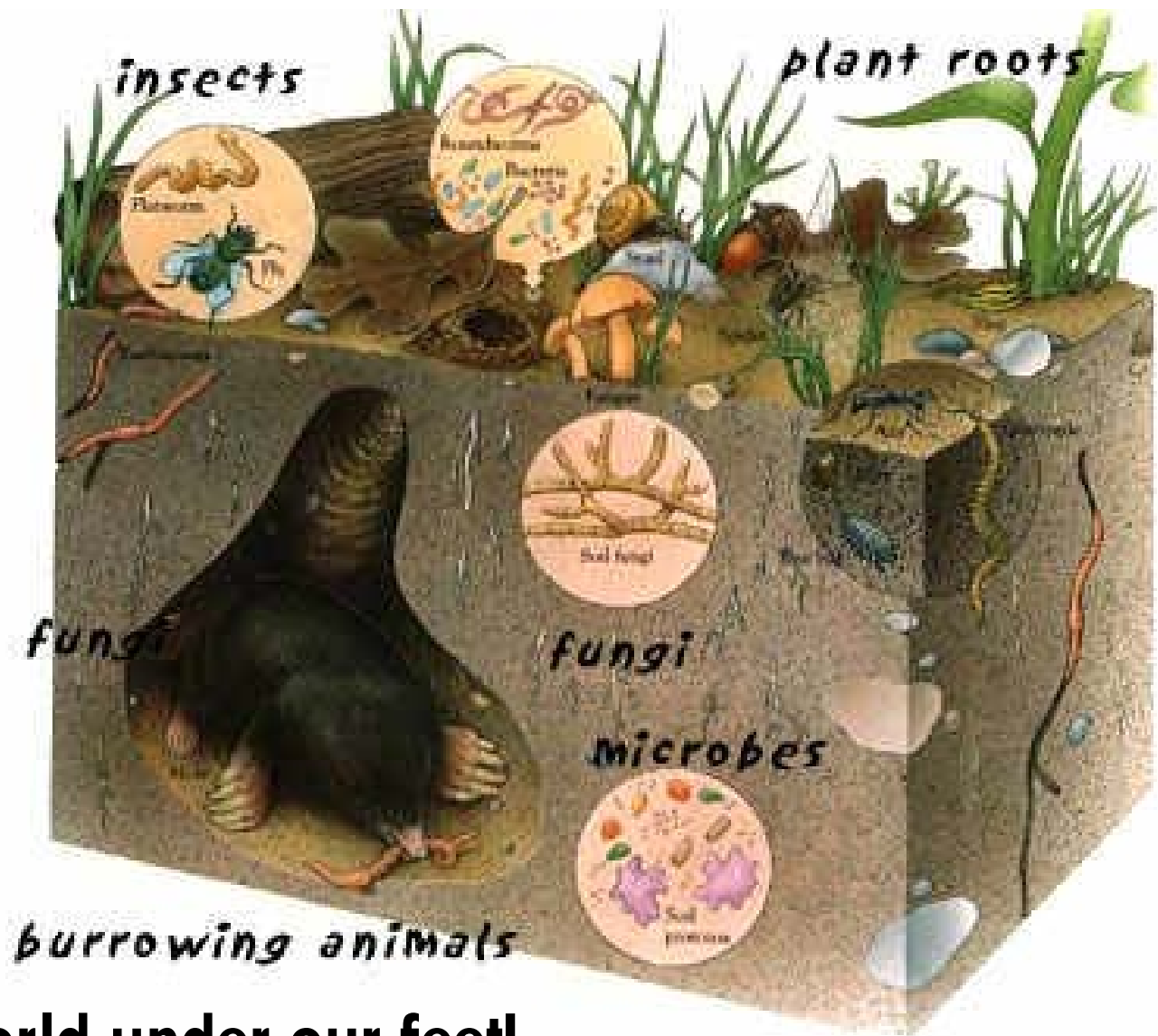
#4 Provides habitat for soil organisms.

- Billions of organisms per pinch of soil!



Soil Animals – micro, meso, macro

SOIL IS THE BASIS OF THE ECOSYSTEM



There is a world under our feet!

5 Functions of Soil

#5 The base for building materials.

Most of human history people live in earth buildings. Other animals use soil as a building material (ants, termites, mud doblers, et al)



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Cliff Swallow
Petrochelidon pyrronota



Soil Genesis

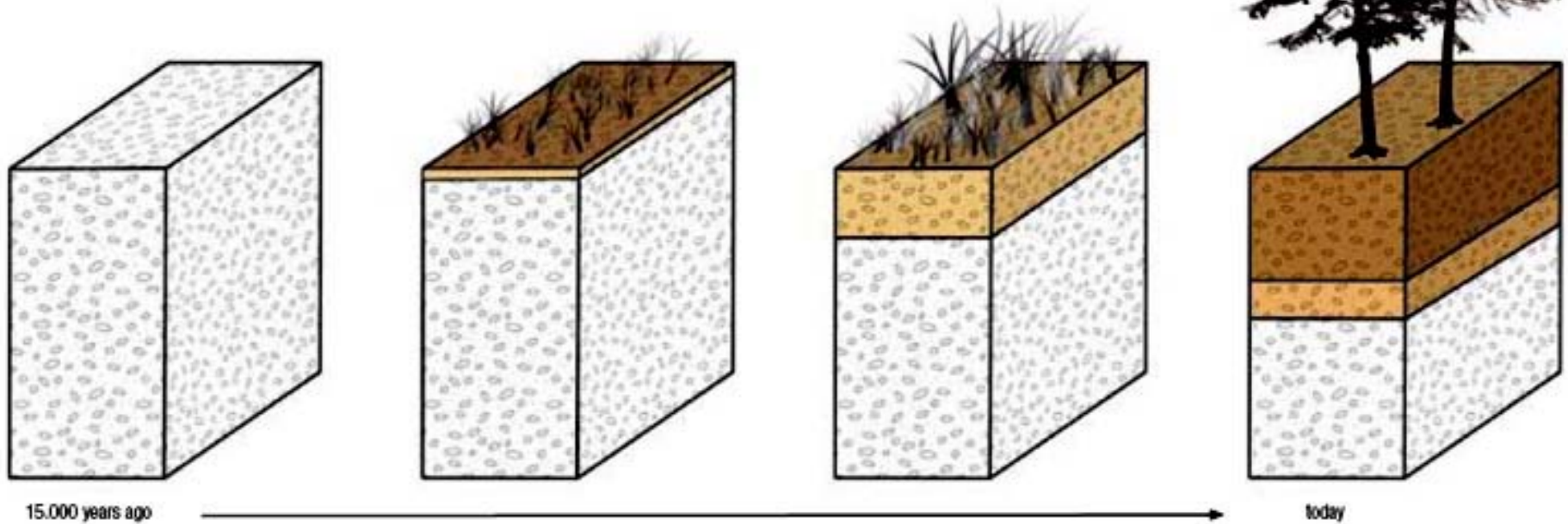
How is soil made?



How is Soil Made?

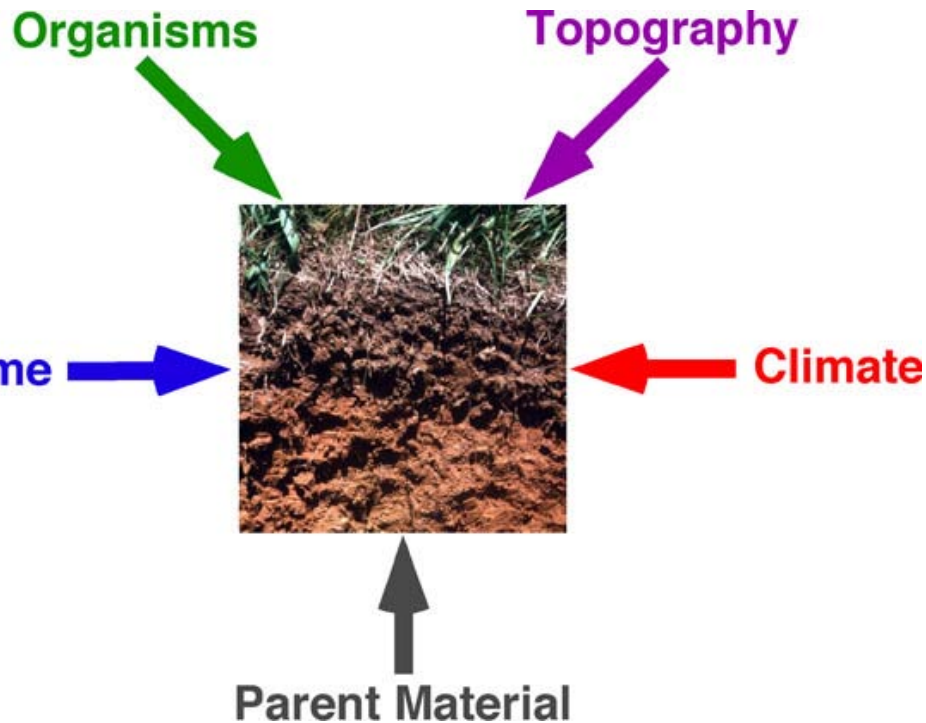
The process is called *pedogenesis*.

- Many processes working together lead to the formation of soil.



How is Soil Made?

Step 1: Physical and chemical weathering breaks rock down into smaller pieces.





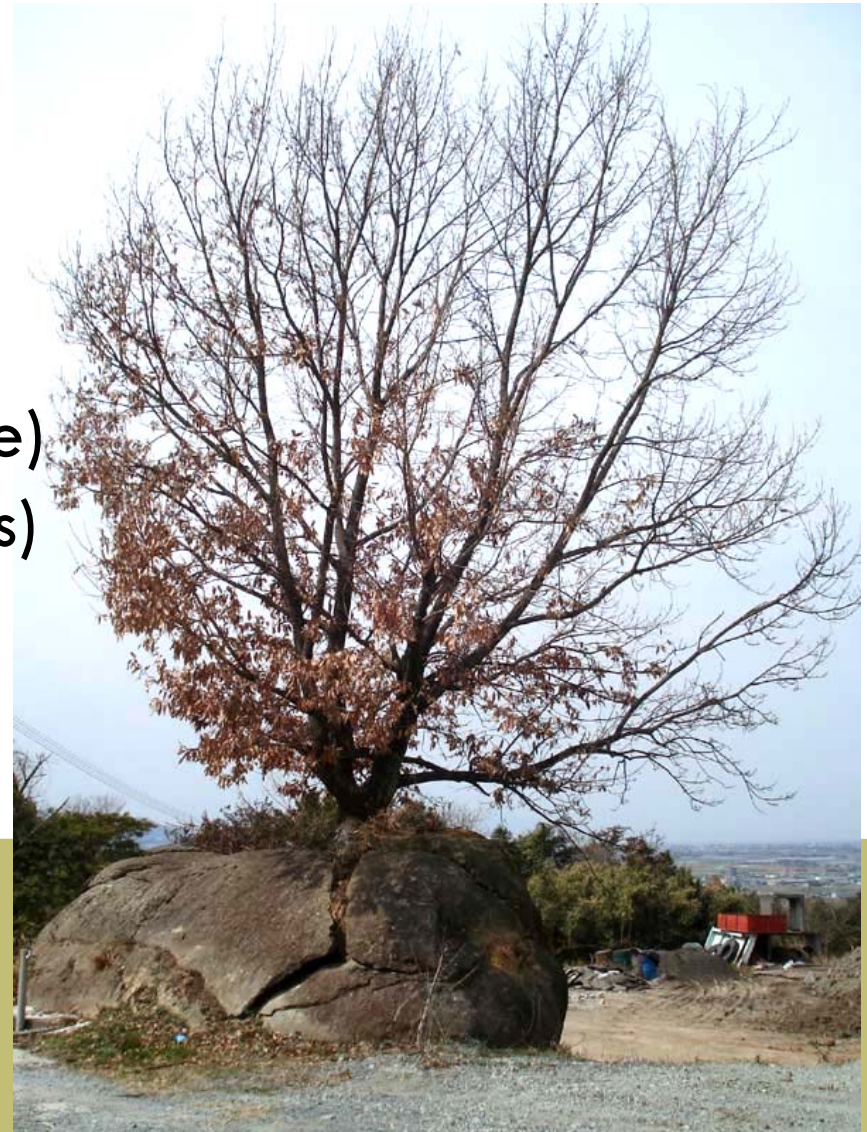
5 factors that effect soil formation

Cl, O, R, P, T

- Climate
 - Organisms
 - Relief/Topography
 - Parent Material
 - Time
- } Active Factors
- } Passive Factors

Rock Weathering – Physical Causes

- Freeze-thaw
- Uneven heating (exfoliation)
- Shrink-swell (dry-moist)
- Abrasion (water, wind, ice)
- Organisms (like tree roots)



Rock Weathering – Chemical Causes

- **Oxidation** - oxygen interacts chemically with minerals
- **Hydration** - water interacts chemically with minerals
- **Carbonation** - carbon dioxide interacts chemically with minerals

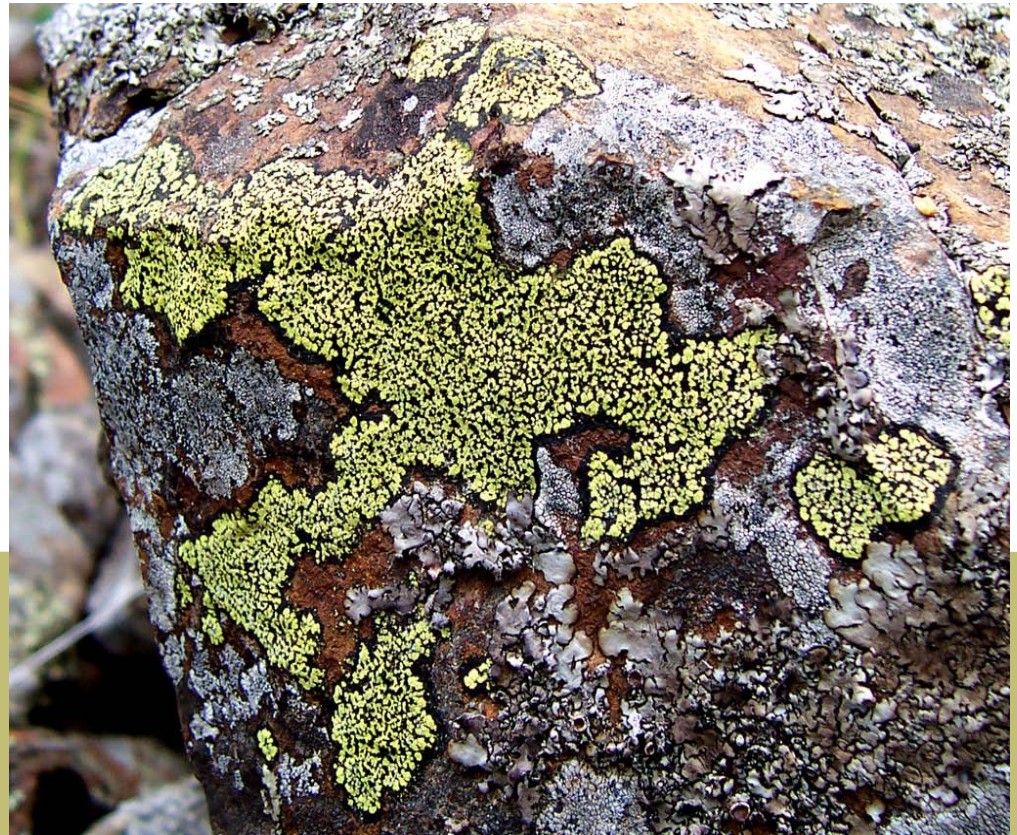
Carbonation at the Oregon Caves.



How is Soil Made?

Step 2: Pioneer species of plants can take root.

- Plants change the soil chemically.
- Adds organic matter when plant parts die and further break up rocks and form soils.





How is Soil Made?

Translocation:

Various soils, like clays, organic matter, salts, etc., are translocated (moved) to deeper soil horizons (layers), and further develop the soil.

A Soil Profile

Horizons

O

0"

2"

A

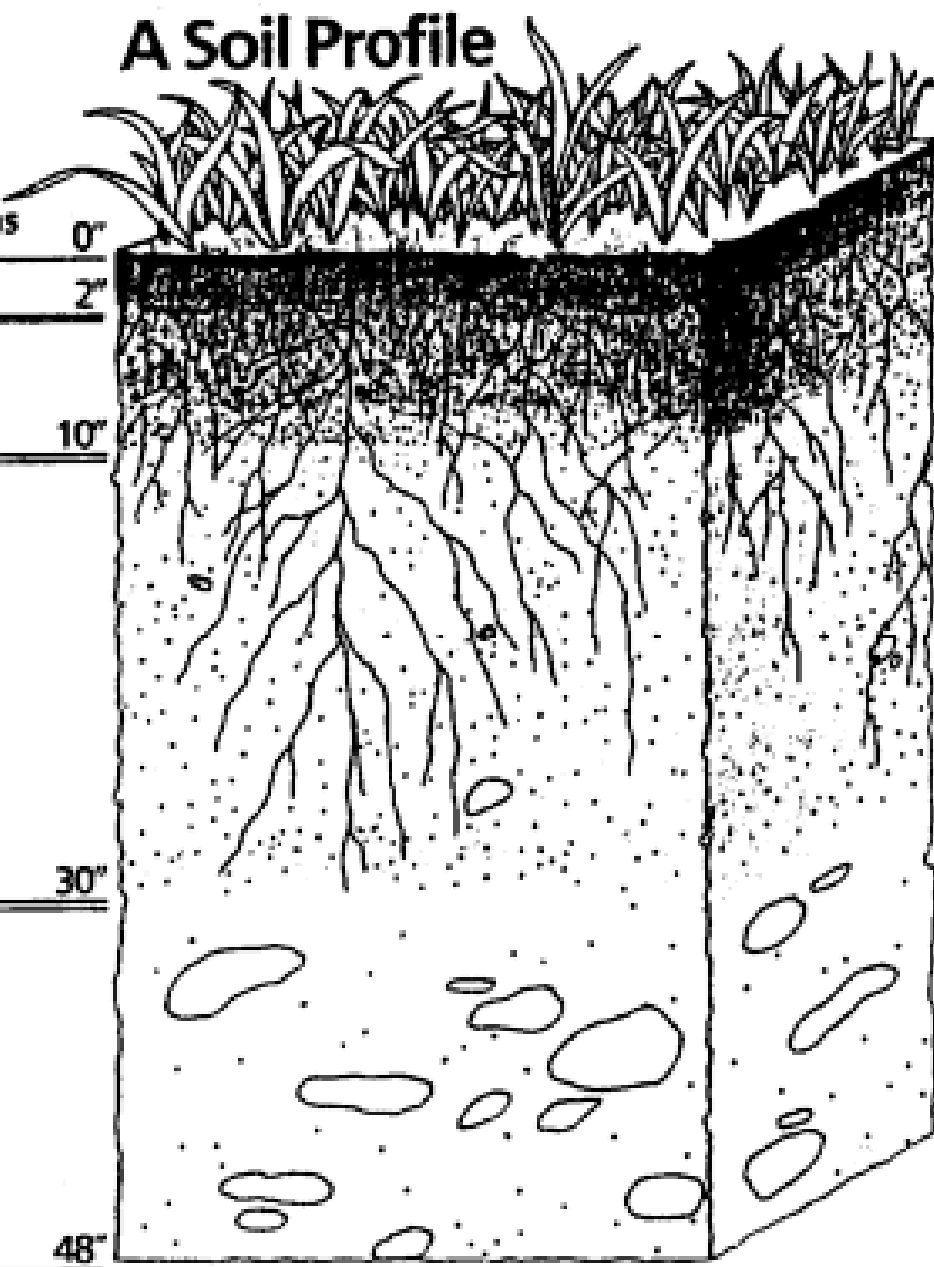
10"

B

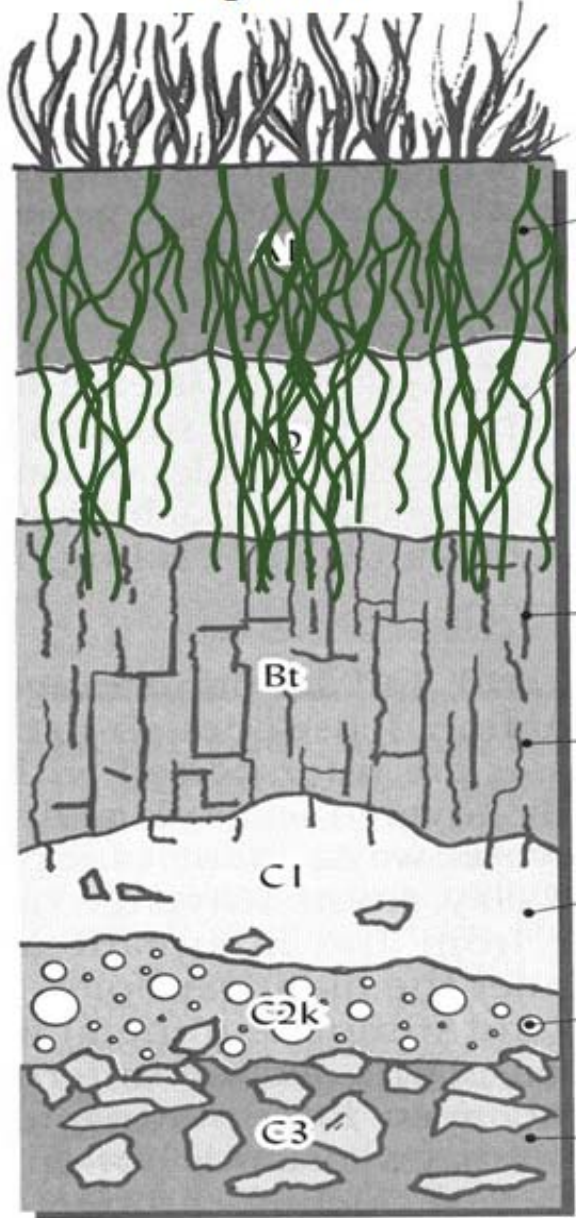
30"

C

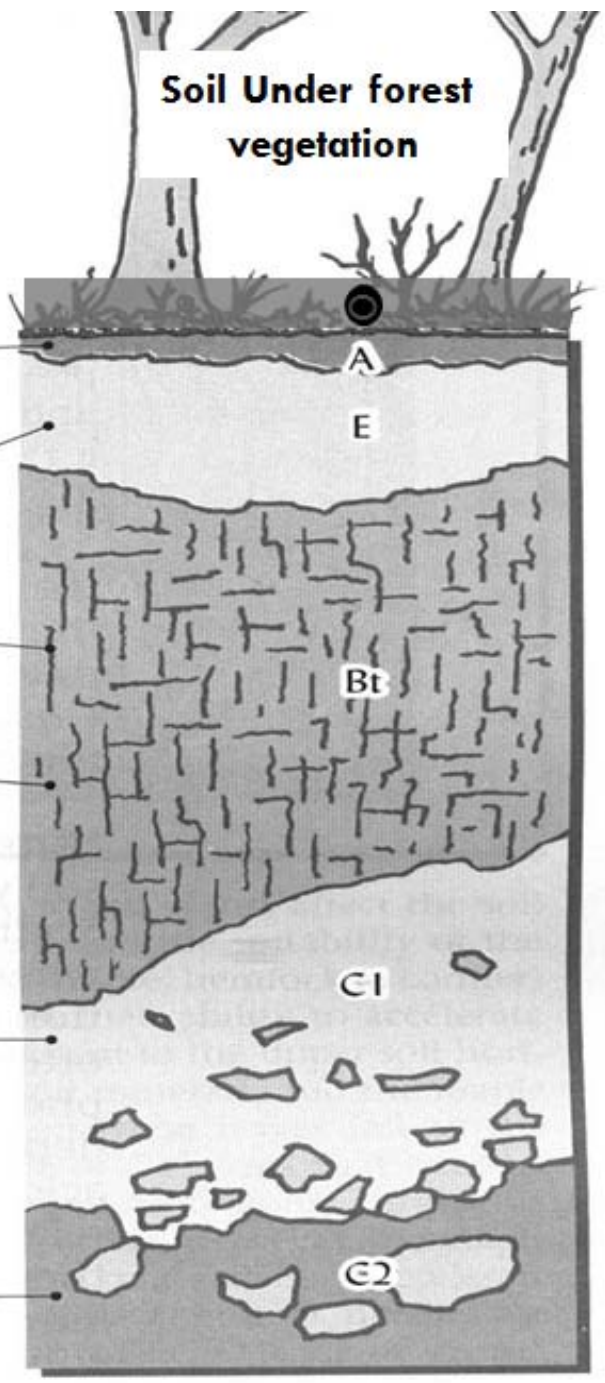
48"



Soil Under grassland vegetation



Soil Under forest vegetation



Organic matter accumulation

Zone of maximum loss of oxides and clay

Blocky structure development

Clay, hydrous oxide accumulation

Prismatic structure development

Disintegrated, weathered parent material

CaCO₃ and CaSO₄ accumulation

Relatively unweathered parent material

(similar for both)



3 Types of Rocks

- **Igneous** - Cooled magma (e.g., granite, basalt)
- **Sedimentary** - Formed from eroded materials compressed into a solid mass (e.g., limestone, sandstone, shale)
- **Metamorphic** - Igneous or sedimentary rock transformed by heat and pressure (e.g., marble, slate)
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Thanks to James Cassidy, at Oregon State University Soil Science Dept. for help with slides and information.

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