**SOIL NOTES**

**The Rock Cycle**

IGNEOUS

ROCK

SEDIMENTARY

ROCK

METAMORPHIC

ROCK

**What is soil?**

The relatively thin surface layer of the Earth’s crust consisting of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Soil is not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_!

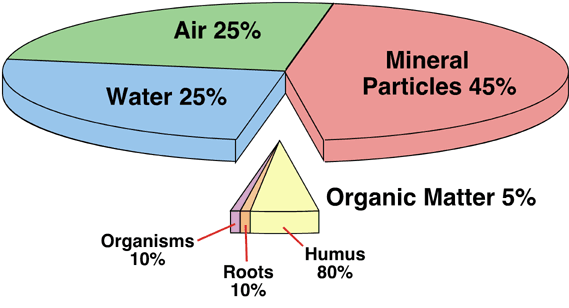
**5 Soil-Forming Factors**

*Formed from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (bedrock) that’s slowly broken down through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.*

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (precipitation and temperature)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (macro- and microorganisms and plants)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (topography)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (rocks/minerals)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Which is the most important? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Soil Composition**

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Mineral matter comes from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Air and water percents are interchangeable

Organic matter includes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (the stable, long-lasting remnant of decaying organic material)

Mineral Matter:

Provides nutrient minerals for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Provides pore space for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

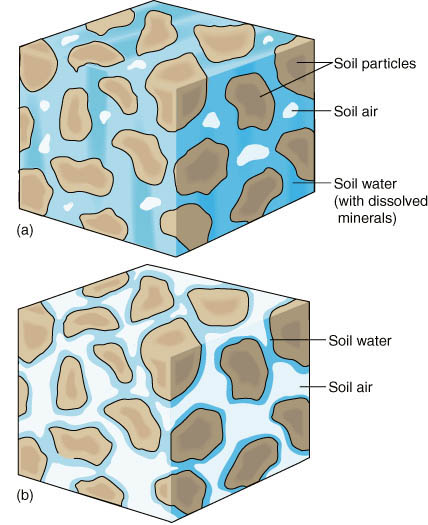
Older soils are:

More \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lower in certain essential \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Humus: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Increases the soil’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by acting like a sponge



**Porosity**

Porosity = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Pore spaces occupy \_\_\_\_\_% of a soil’s volume

Filled with varying proportions of \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_

Soil air contains the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ air, but in different proportions

* More \_\_\_\_\_and less \_\_\_\_\_ (from organism respiration)
* Some bacteria need \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The \_\_\_\_\_ can accelerate weathering (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(carbonic acid))

As \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ infiltrates the soil, it can carry \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with it

Leaching: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Illuviation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Some substances completely leach out of the soil because they are so \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that they migrate right down to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Soil Structure**

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**Soil Organisms**

Ex: bacteria, fungi, algae, microscopic worms, protozoa, plant roots, insects, earthworms, moles, snakes, groundhogs, etc.

Soil organisms provide several \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (important environmental functions).

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Earthworms & Ants:

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mycorrhizae

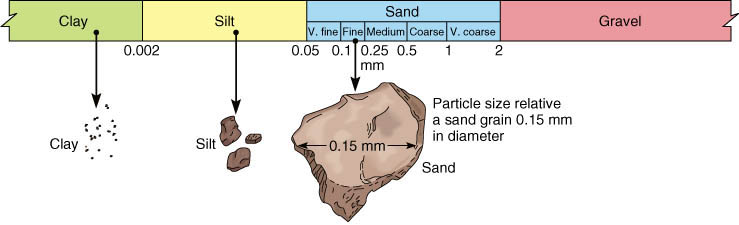
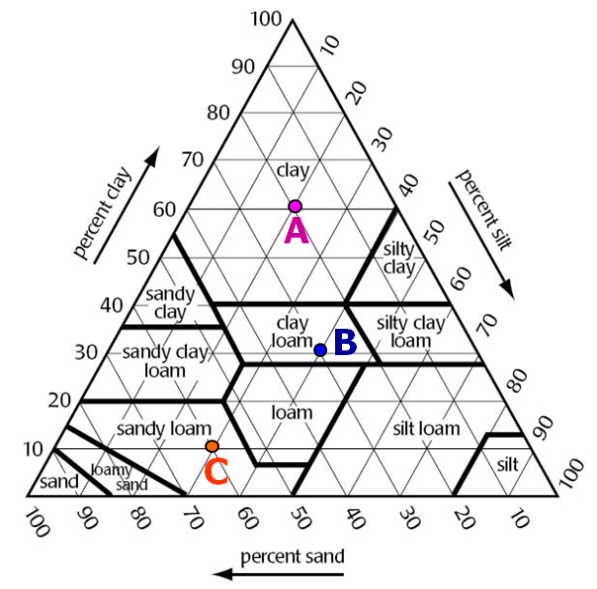
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between fungi and the roots of vascular plants
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the soil, and provides it for the plant.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (photosynthesis), and provides it for the fungus.

**Physical Soil Properties**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Texture**

* Determined by percent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Determines the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Sand: \_\_\_\_\_ - \_\_\_\_\_ mm

Silt: \_\_\_\_\_ - \_\_\_\_\_ mm

Clay: \_\_\_\_\_ mm

What type of soil has…? Find the percent of each particle at:

1. 20% clay, 40% silt, 40% sand \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1. A \_\_\_\_\_% clay, \_\_\_\_\_% silt, \_\_\_\_\_% sand

2. 40% clay, 10% silt, 50% sand \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. B \_\_\_\_\_% clay, \_\_\_\_\_% silt, \_\_\_\_\_% sand

3. 30% clay, 60% silt, 10% sand \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3. C \_\_\_\_\_% clay, \_\_\_\_\_% silt, \_\_\_\_\_% sand

**Importance of Soil Texture**

|  |  |  |  |
| --- | --- | --- | --- |
| **Property** | **Sand** | **Silt** | **Clay** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Texture Review**

Why is 100% sand undesirable for plants?

Why is 100% clay undesirable for plants?

Sand, Silt, or Clay?

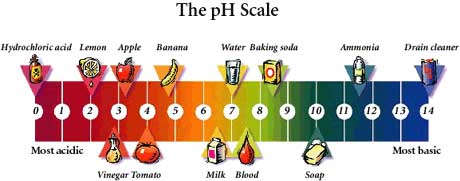
* A soil with a lot of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ would have good drainage, but poor nutrient-holding characteristics.
* A soil with a lot of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ would have poor drainage, but good nutrient-holding characteristics.
* A soil with a lot of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ would have low porosity.
* A soil with a lot of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ would have high permeability.

**Chemical Property: Acidity**

Most soil pH is \_\_\_\_\_\_\_\_\_\_. Plants are happiest at \_\_\_\_\_\_\_\_\_\_.

Plants are affected by soil pH.

1. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of certain nutrient minerals varies with differences in pH
   * Low pH = \_\_\_\_\_ and \_\_\_\_\_ are more soluble, and can be absorbed in toxic amounts
   * High pH = some \_\_\_\_\_\_\_\_\_\_ are less soluble, and are less available to the plants
2. Soil pH affects the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of nutrient minerals.
   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = positively charged ions are less soluble and are unavailable for plants



**Soil Amendments**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are materials added to soil to improve plant growth and health by correcting the soil’s deficiencies in structure and/or nutrients

**Soil Conditioner: Lime**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Important functions:

* Corrects \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Adds important plant nutrients - \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_
* Reduces \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of certain elements in the soil
  + \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
  + This toxicity could reduce plant growth under acid conditions
* Promotes availability of major plant nutrients.
  + \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
* Increases \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ activity and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relationships

**Soil Conditioner: Compost**

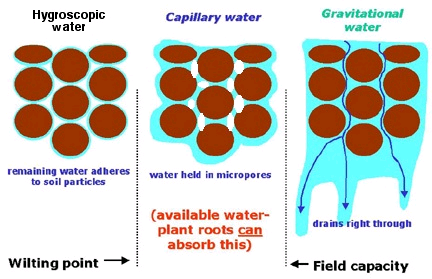
* Decayed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Replaces some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Improves \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + The soil becomes more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, increasing air circulation and the ability of the soil to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Makes the soil more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Why is soil important?**

Soil \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Soil stores \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_)

Soil \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



Soil provides support for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Soil \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Soil Pollution**

Soil pollution is any physical or chemical change in soil that adversely affects the health of plants and other organisms living in and on it.

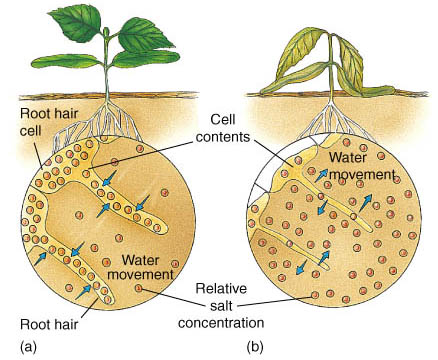
Many soil pollutants…

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + move into groundwater, surface water, or air
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + seep into tiny cracks called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and adhere to the soil particles
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Salinization of Irrigated Soil**

* Irrigation water soaks through the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ area where the plant roots grow, adding to the existing water.
* The additional irrigation water causes the underground \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to rise, bringing salt to the surface.
* When the irrigated area dries and the underground water table recedes, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is left on the surface soil.
* Each time the area is irrigated this \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ process is repeated.
* All irrigation water contains some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Effect of Salinized Soil on Plants**

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*Normally*, the water concentration inside plant cells is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than that in the soil resulting in a net movement of water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

When soil contains a high amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, its relative water concentration can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the water concentration inside cells. This causes water to move \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, even when the soil is wet.

**Soil Remediation**

* Until recently, the only way to remove soil contaminants was to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Why is this a **bad** thing to do??
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, kills all beneficial organisms, creates \_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Soil Remediation Techniques**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Add lots of water; leach out pollutants

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Inject air into soil to remove volatile organic compounds

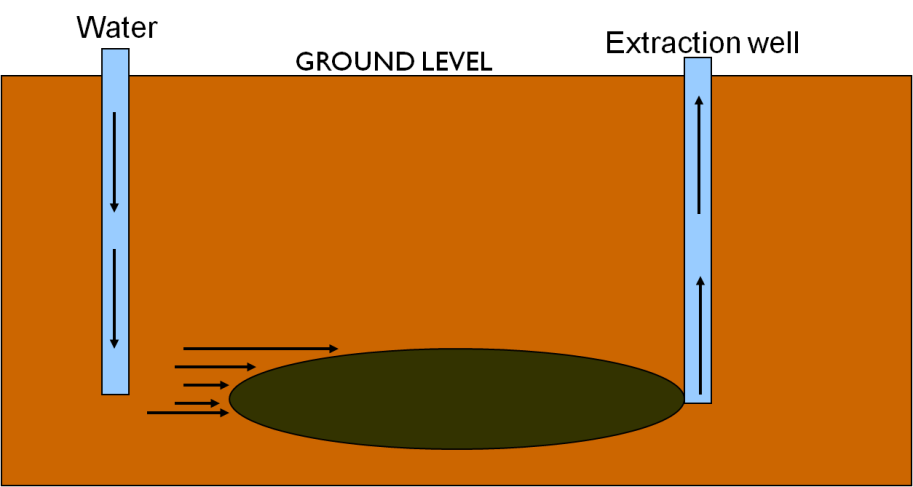
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Use microorganisms to degrade organic contaminants (oil, sludge)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Use plants to absorb contaminants such as salts or heavy metals.

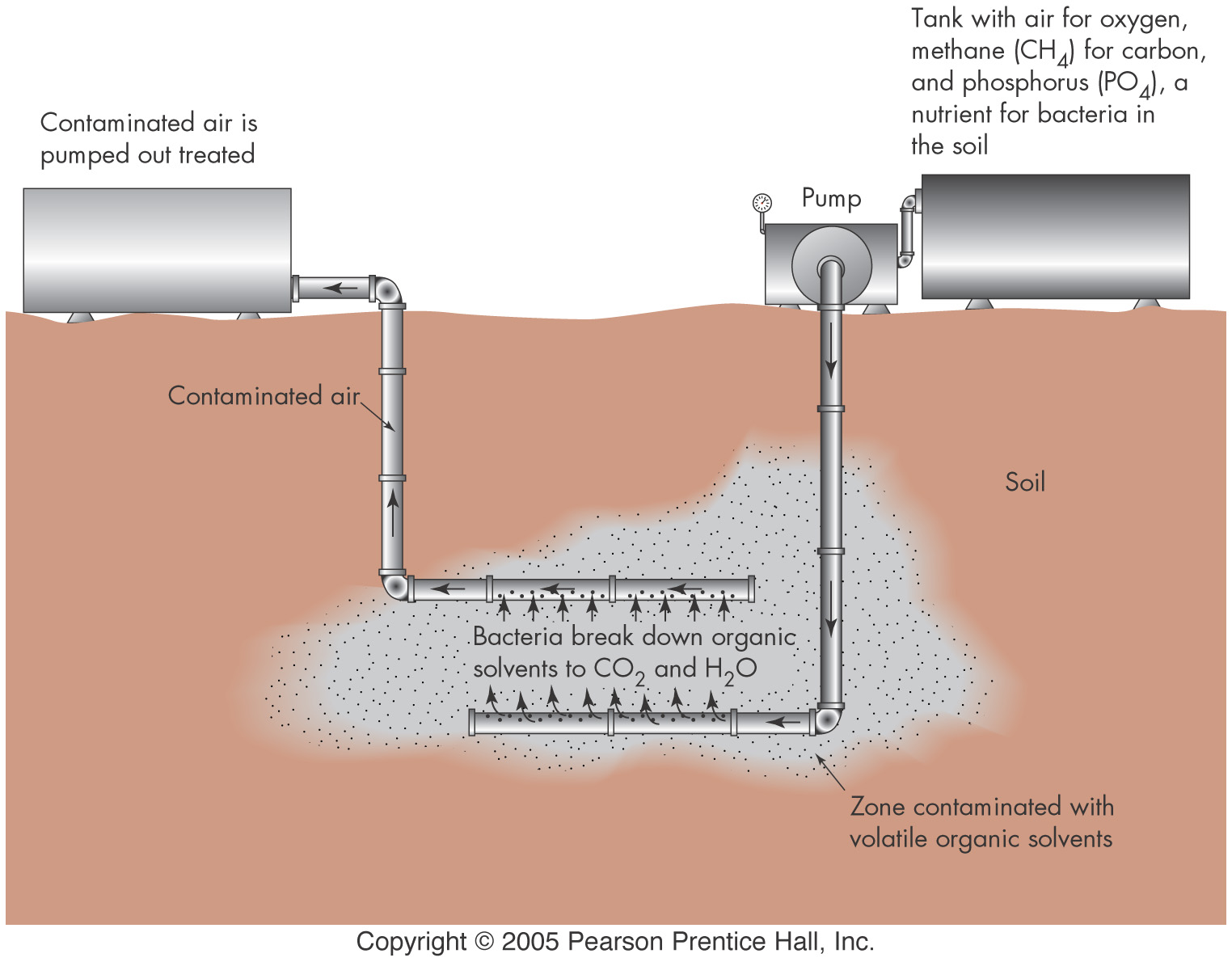
**Dilution**

Pollutants with low sorption potential are not attracted to soil particles and are easily \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Pollutants with high sorption potential are attracted to soil particles and are NOT easily \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**Bioremediation**

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**Activities that Threaten Soil**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Soil Erosion**

Agricultural: \_\_\_\_\_% of the world’s best agricultural land damaged due to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over last 50 years

**Prevention**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ We will cover this stuff in the land use unit.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_