

Bio 20

Soils Unit

What is soil?

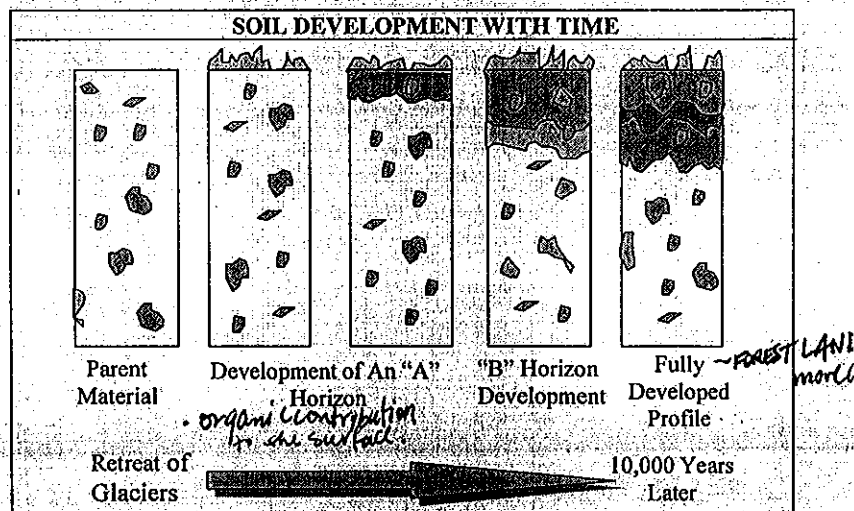
- the mineral material on the surface of the Earth that serves as a medium for the growth of plants.
- Soil is a vital link to continued life on the planet through its connection to the living and non-living worlds.

Geology of Prairie Soils

- the landforms of our region were greatly influenced by the effects of glaciation.
- The movement of the ice on top of parent material (rock) ground the rock down into a rough form of soil known as **glacial till deposits**, which had varying amounts of rock in it.
- **Glacial lacustrine deposits** – few stones, high quality soil (Melfort, Kindersley, Rosetown areas)
- **Alluvial deposits** – less clay / higher amounts of silt and sand.
- **Fluvial deposits** – very coarse material, high in rocks.

Process of Soil Formation

- creation of soil from parent material by the glaciers.



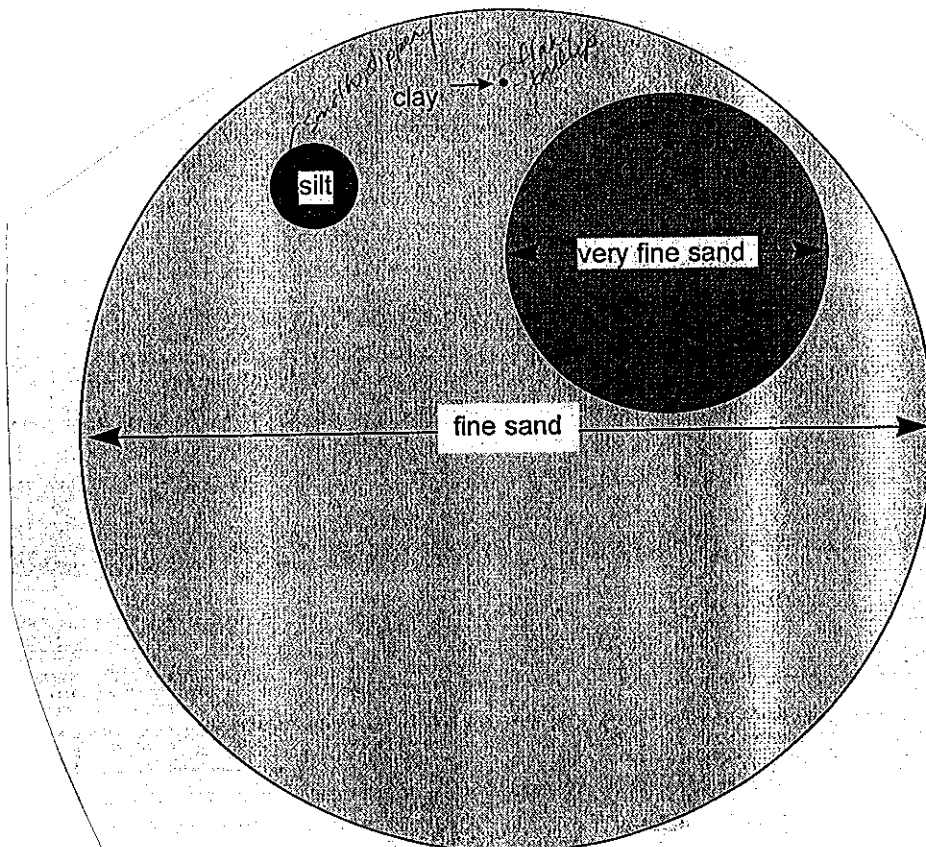
Soil Formation Determined by 5 Factors

1. **Parent Material** – the base rock material influences the type of soil. Ex./ oceanic shale bedrock creates soil that has a high salt content (alkaline).
2. **Climate** – the amount of precipitation, average temperature and the relative humidity influences the type of soil formed.
3. **Vegetative Cover** – the type and amount of vegetation affects the soil type. High amounts of vegetation will result in richer materials being deposited in the soil creating a dark colored soil.
4. **Topography** – the landscape affects the type of soil formation. Ex. / A rolling landscape has knolls with little soil on top of them due to drainage, low vegetative cover, higher temperatures and wind erosion.
5. **Time** – Soil development takes a great deal of time. The Prairies has an average of 6 inches of topsoil which has taken approximately 10,000 years to form.

Soil Components

- there are 3 main types of soil components – clay, silt and sand.
- They are determined by the size of particles and physical characteristics of each.

<u>Soil Type</u>	<u>Size</u>	<u>Texture</u>	<u>Water Holding</u>
Clay	small particles	sticky when wet Will turn hard when dry	holds water well
Silt	medium particles	smooth texture	mod. water capacity
Sand	large particles	coarse texture	poor water capacity



Soil Horizons

- the soil is divided into 3 'layers' or horizons.

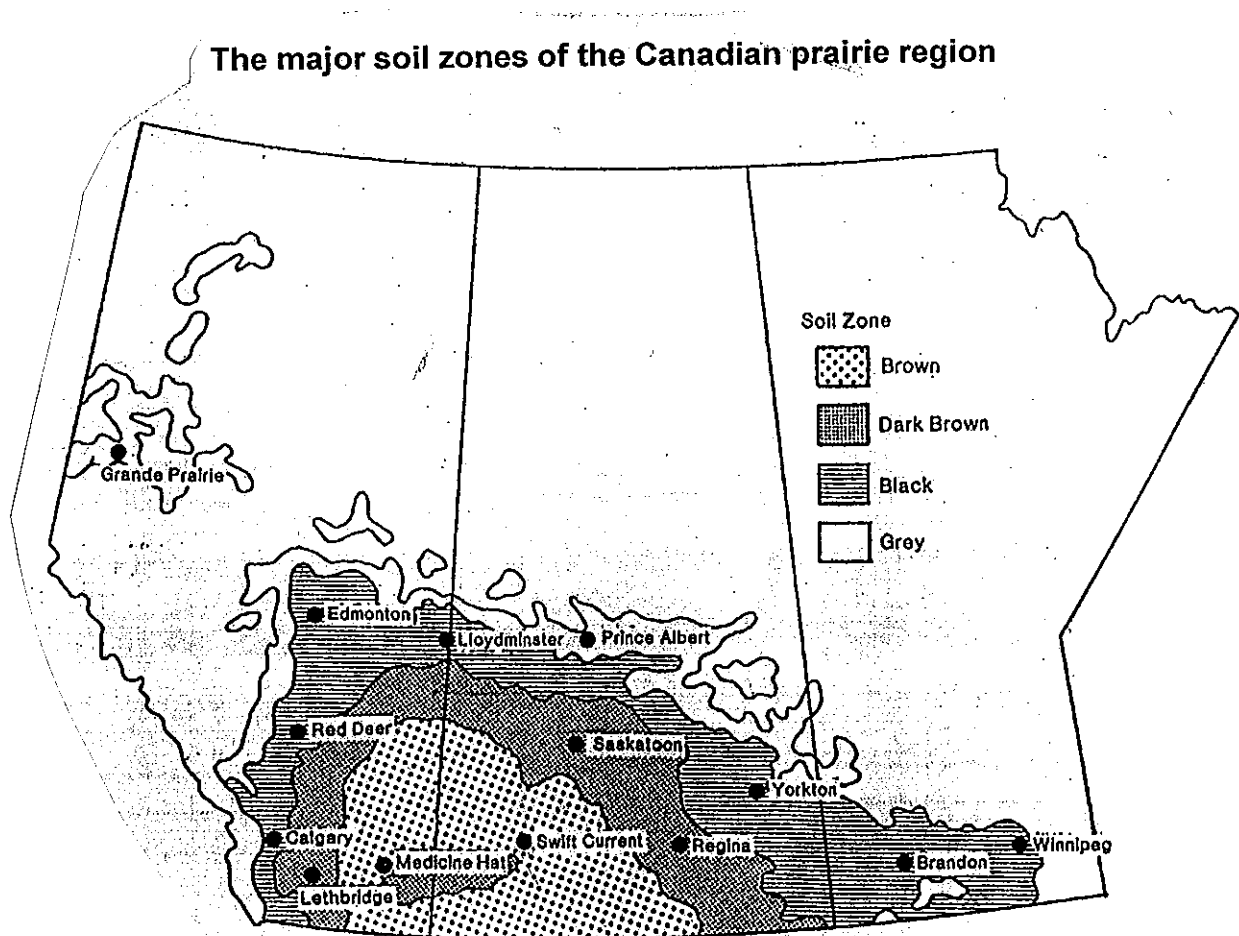
A) Top soil layer / contains the most organic matter and biological activity.

B) Sub soil / contains some nutrients / transition zone between the topsoil and parent material.

C) Parent material / mainly rock formation with little nutrients

Soil Zones

- the geographical areas with similar soil types determined mainly by the climate and vegetation.
- The color of the soil is determined by the amount of organic matter in it.



Brown Soil

- shallow A horizon and lowest organic matter levels
- developed mainly in the grassland areas of the province

Dark Brown Soil

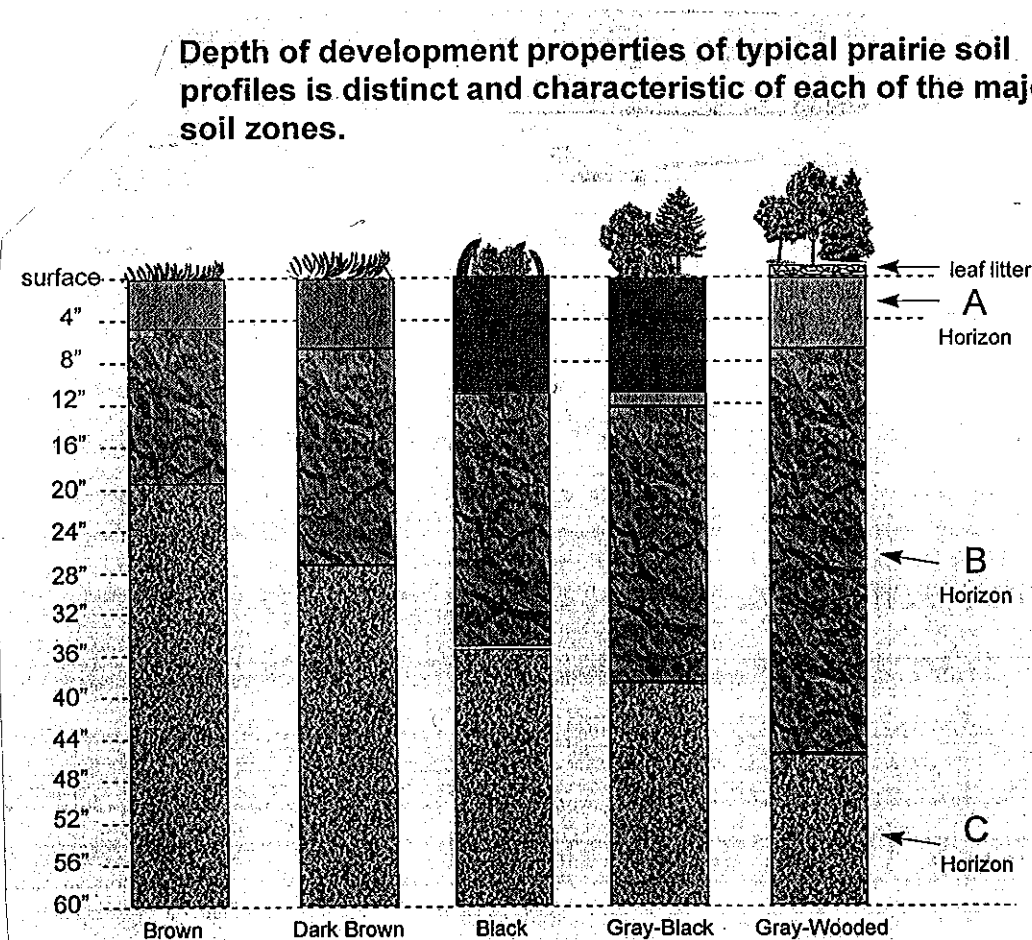
- slightly deeper A horizon and higher levels of organic matter
- this zone has slightly higher average rainfall resulting in more vegetative cover and thus more organic matter and a darker color.

Black Soil

- fairly deep topsoil layer, relatively higher precipitation area resulting in grass and shrubs cover and very high organic matter.
- This is the most productive soil zone in the Prairies.

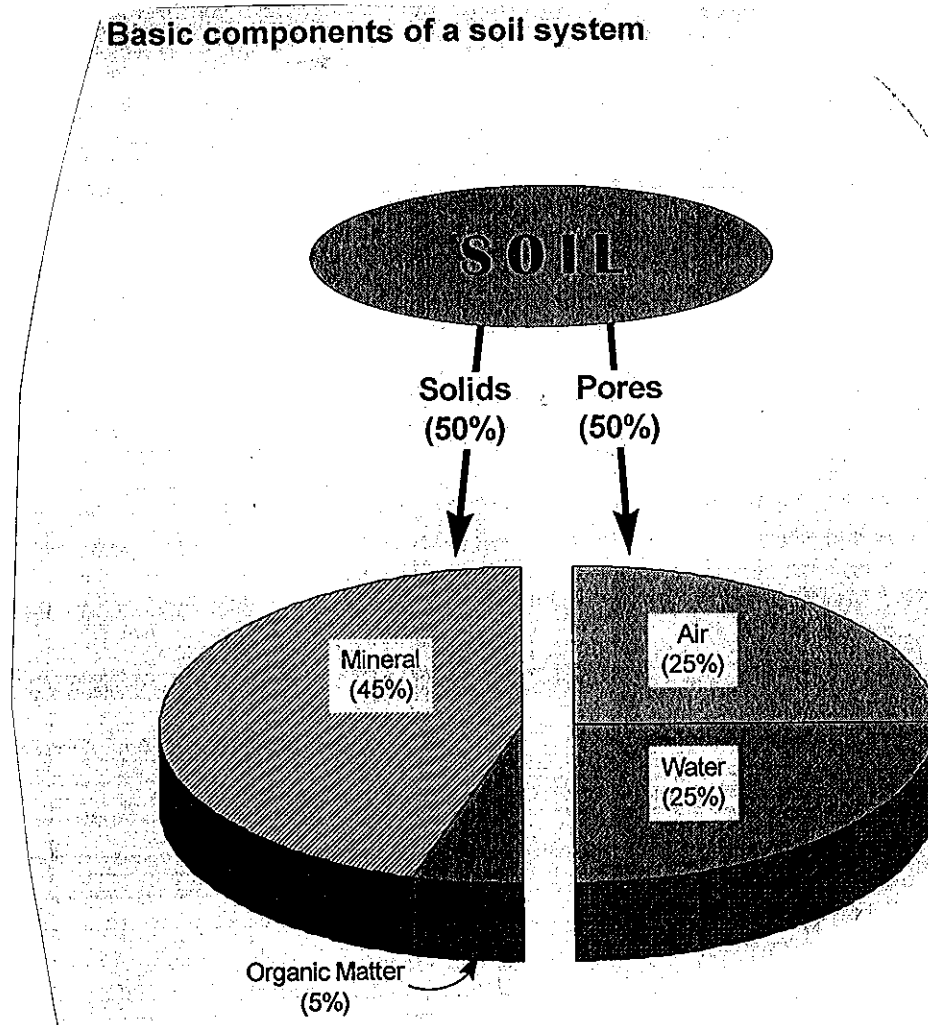
Gray Wooded Soils

- this soil formed under forest cover and decomposing leaf litter.
- The acidic nature of decomposing leaves causes a high amount of leeching (downward movement of nutrients)
- Difficult to farm this soil without altering its acidic nature through the use of lime.



Basic Soil System

- a typical soil system has 4 basic components
 1. Mineral fraction – 45%
 2. Organic fraction 2-10% (depending on soil type)
 3. Pore spaces filled with water
 4. Pore spaces filled with air



- good plant growth requires enough large pore spaces to hold air and enough small pores to hold sufficient water to satisfy plant requirements between cycles of rainfall.
- The mineral fraction consists of particles of various sizes – clay, silt and sand.
- The soil texture is determined by the proportions of these 3 particles.
- The organic fraction consists of plant and animal residues in various stages of decay. Sources of organic matter include plant residue, manures, soil micro-organisms and dead animals.

- Organic matter benefits the soil by:
 1. improving physical condition
 2. increasing water infiltration
 3. improving air / water relationship
 4. decreasing erosion loss to wind and water
 5. supplying plant nutrients as they are decomposed

**** Organic matter is critical in binding soil particles and retaining nutrients against leaching.**

Soil pH

- the measure of acidity or alkalinity of a soil.
- Important in terms of nutrient availability and general plant growth
Materials can be added to the soil to correct undesirable pH levels.

Farming and Soil – A Dynamic System

- in agriculture, soil is undergoing continuous change
 1. nutrients are added in the form of plant and animal products, as well as fertilizer.
 2. nutrients lost by crop removal, leaching or erosion.
 3. some nutrients like potassium are ‘tied up’ by certain soil components.
 4. soil organic matter and micro-organisms immobilize, then release nutrients in an on-going cycle.

**** It is very important to monitor the condition and status of the soil to maintain it in a productive state. Fertilizers are essential to replace nutrients removed by crops to keep the soil productive. A regular rotation of crops can also help the soil, as different plants have different nutrient requirements.**

Soil Fertility

- determined by the amount of chemical nutrients in the soil
- 16 chemical elements are essential for plant growth. The soil provides 13 of these, while air and water provide the other 3 – carbon, hydrogen and oxygen – these three form 94% of the plants mass.
- Of the 13 elements provided by the soil, the 3 main elements are nitrogen, phosphorous and potassium. In lesser amounts are sulphur, calcium and magnesium. The remaining elements required in very small amounts are: boron, chlorine, copper, iron, manganese, molybdenum and zinc.

