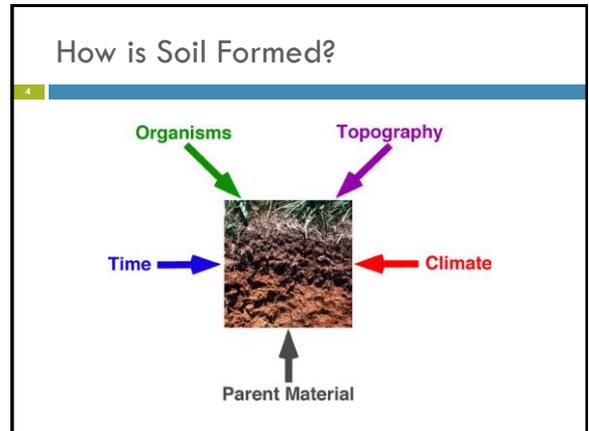


### What is Soil?

- the unconsolidated material on Earth's surface that serves as a medium for plant growth
- It facilitates the relationship between biotic and abiotic components of terrestrial ecosystems.

### How is Soil Formed?



### How is Soil Formed?

- It forms when bedrock is broken down into smaller pieces by physical, chemical and biological processes called weathering.

### How is Soil Formed?

- Physical Weathering:** Caused by wind, rain, freezing, and temperature fluctuations.
- Chemical Weathering:** Caused by water, oxygen, carbon dioxide, and soil acidity.

## How is Soil Formed?

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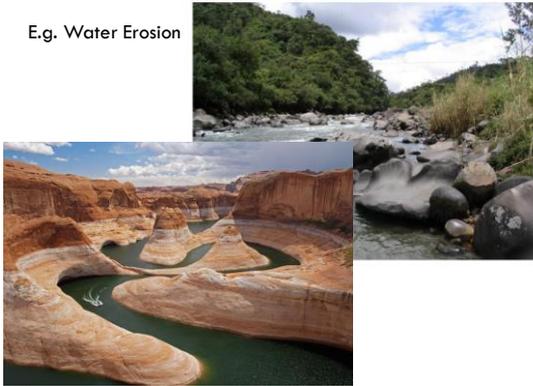
- Following weathering, the small rock particles are transported from one place to another in a process known as erosion.
- Erosion is the displacement of soil, sediment, and rock fragments, in addition to a loss of nutrients, due to:
  - Abiotic Factors – Wind, Ice, Flowing water.
  - Human Activities – Poor farming practices, Overgrazing, Deforestation.

E.g. Water Erosion



8

E.g. Water Erosion



9

E.g. Wind Erosion



10

E.g. Wind Erosion



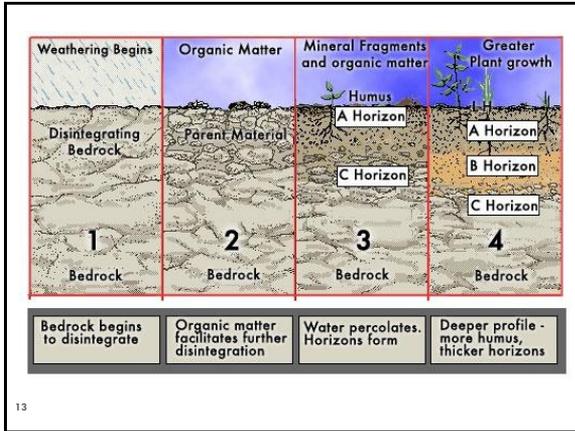
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## How is Soil Formed?

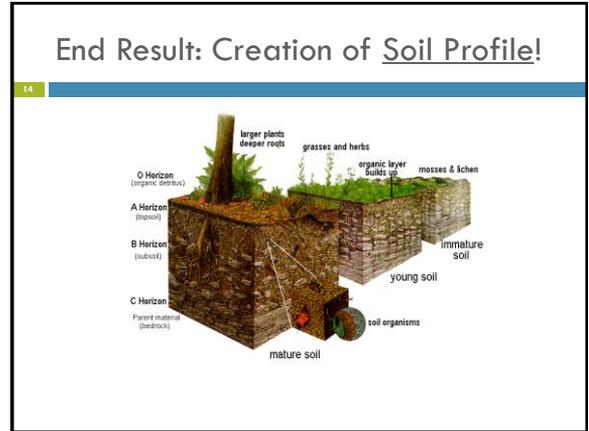
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- With time, decomposition (the breakdown of complex organic matter into its more basic elements) adds nutrients.





13



14

### Soil Profile

Horizons

- Shows that soil exists in distinct horizontal layers – called horizons
- ✓ O Horizon: Litter layer
- ✓ A Horizon: Topsoil
- ✓ B Horizon: Leaching or accumulation Layer
- ✓ C Horizon: Subsoil
- ✓ D Horizon: Bedrock

### Soil Profile

**O Horizon: Litter Layer**

- Organic matter – Loose leaves & organic debris that are beginning to decompose.
- Relatively thin in prairie and agricultural soils, significantly thicker in forest soils.

Photo provided by the Plant and Soil Science eLibrary: <http://soilandwater.org.au/>

### Soil Profile

**A Horizon: Topsoil**

Organic matter mixed with minerals, often referred to as topsoil.

- Relatively thicker in grassland soil.
- Highest nutrient availability.
- Abundant biological activity.

Photos provided by the Plant and Soil Science eLibrary: <http://soilandwater.org.au/>

### Soil Profile

**B Horizon: Leaching or Accumulation Layer**

Movement of minerals and organic matter both into and out of this layer, depending on climate and vegetation.

- Can result in a horizon of various colours, texture, and nutrient levels.

Photos provided by the Plant and Soil Science eLibrary: <http://soilandwater.org.au/>

## Soil Profile



### C Horizon: Subsoil

Also referred to as parent material, which may have originated from glaciers, rivers, volcanic deposits, or weathered bedrock.

- Higher concentration of clay.
- Accumulation of leached matter.

Photos provided by the Plant and Soil Science eLibrary: <http://pswell.ualberta.ca/pages/>

## Soil Profile



### D Horizon: Bedrock

In Canada, the majority of our soils originate from past glacier activity. Therefore, bedrock is not commonly found in southern Saskatchewan, but is present in forest soils in northern Saskatchewan

- Consolidated rock.
- Layer is too hard to dig with spade even when moist.

Photos provided by the Plant and Soil Science eLibrary: <http://pswell.ualberta.ca/pages/>

## What is Soil Made of?

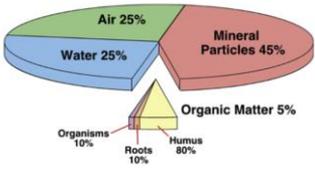
21

## What is Soil Made of?

22

5 Components:

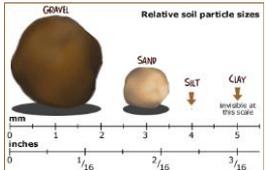
1. Mineral matter (sand, silt, and clay particles)
2. Organic matter (decaying plants/animals)
3. Air
4. Water
5. Organisms



## 1. Mineral Matter

23

- The type and amount of particles that make up a soil is referred to as soil texture.
- Soil particles are classified as sand, silt, and clay.



## 1. Mineral Matter

24

- Most soil contains particles of each size.
- A Soil Texture Triangle gives names to various combinations of clay, silt, and sand.



## Sandy Soils

25

- Consist mainly of sand particles
- Feel gritty and have little structure
- These soils dry out fast because water drains through them fast



## Silt Soils

26

- Consist mostly of silt particles
- They feel silky or floury when dry and are a bit sticky when wet



## Clay Soils

27

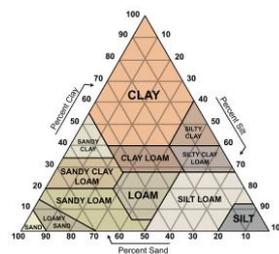
- Contain a high % of clay particles.
- Clay particles are packed very tightly:
  - causes water to drain slowly (maintains soil moisture)
  - hard to penetrate for plant roots.



## Loam Soils

28

- Refer to soils containing equal parts sand, silt, and clay
- are ideal for crops because they usually hold plenty of water but allow for proper drying



## Soil Type & General Characteristics

29

Property/Behavior	Sand	Silt	Clay
Water holding	Low	Med-high	high
Aeration	Good	Med	Poor
OM decomposition	Fast	Med	Slow
Water erosion pot.	Low	High	Low
Compact-ability	Low	Med	High
Sealing (ponds)	Poor	Poor	Good
Nutrient supplying	Poor	Med-high	High
Pollutant leaching	High	Med	Low

## 2. Organic Matter

30

- Refers to plant and animal matter in various states of decomposition

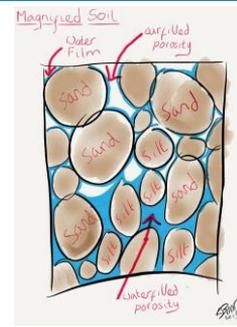


### Importance of Organic Matter

- 31  provides many nutrients that plants need
- absorbs and holds water
- loosens up and aerates some soils
- is home for organisms such as bacteria, fungi, worms, and small mammals

### 3. & 4. Soil Air & Water

- 32  The porosity of the soil refers to the size and number of spaces (called pores) among soil particles.
- These spaces are important because they allow air and water to move through the soil.



### 3. & 4. Soil Air & Water

33

Clay      Silt      Sand

Porosity is important for:

- proper aeration of the soil
- plant roots, which need both air and water
- the types and amount of organisms that can live in the soil.

### Soil Porosity and Characteristics

34

<p><b>Sandy Soils</b></p> <ul style="list-style-type: none"> <li>&gt; Large pores (macropores)</li> <li>&gt; Drains quickly after rain or watering</li> <li>&gt; Dries out quickly</li> </ul>	<p><b>Silt Soils</b></p> <ul style="list-style-type: none"> <li>&gt; Medium Pores</li> <li>&gt; Drains fairly well</li> <li>&gt; Holds more moisture than sandy soils</li> <li>&gt; Easily compacted</li> </ul>	<p><b>Clay Soils</b></p> <ul style="list-style-type: none"> <li>&gt; Small pores (micropores)</li> <li>&gt; Drains slowly</li> </ul>
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Agriculture in the Classroom

### 5. Soil Organisms

35

In one square meter of soil....

Organisms decrease in size and increase in number

### 5. Soil Organisms

- 36  The soil is home to millions of bacteria, numerous fungi, insects, worms, and small mammals.
- These species are crucial to healthy food webs, nutrient cycling, and soil structure.



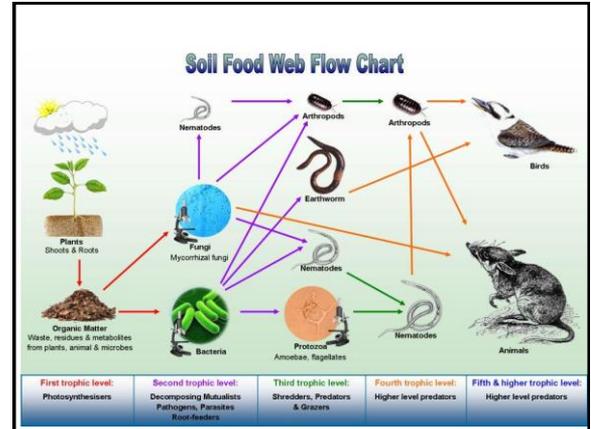
## 5. Soil Organisms

37



- **Rhizobia:** Soil bacteria that helps legumes use nitrogen from the atmosphere. (e.g. beans, lentils, etc.)

- **Mycorrhiza:** Fungi that form a symbiotic relationship with plant roots to get nutrients, but also acts as a root extension to promote plant growth and protection against stress.



## Conclusions

39

- Soil is the mixture of mineral particles, organic matter, air, water, and organisms that together support the growth of plants.
- It keeps terrestrial ecosystems in balance!