Ecology: Biomes

Lesson 17, Chapter 3

Text Book Reference, Section 3.1, page 86 - 93

Video: Where Plants and Animals Live

The concept of '**sustainable development**' first emerged in the early 1980's as the believe that the developmental goals of society could be reconciled with the long-term environmental limits of the planet Earth.

It is necessary to make the changes that will allow the worlds rapidly increasing population to sustain itself within the carrying capacity of the Earth.

Definitions:

sustainability: is the ability to meet the needs of the present generation without compromising the ability of future generations to meet their needs

sustainable system: is one that survives and functions over time

Canadian Biomes

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Biome: (i.e. a large geographical area with a typical type of climate, plant and animal life.) A collection of ecosystems related to each other, with climatic similarities and characteristic plants and animals.

Biomes are generally named after the dominant type of plant community found in them. For example, the boreal coniferous forest is named after its dominant conifer trees.

Since biomes generally represent a large ecosystem, and although the species found in them are similar, but they may vary from one part to another.

Certain abiotic factors such as amount of sunlight, temperature, rainfall, and soil conditions influence what plants dominate a biome.

In turn, the plants influence what kind of animals live in the biome.

Abiotic factors influence the type of plants that grow in an area and the plants that grow in an area influence the type of animals that live in the area.

Abiotic Factors ⟶ **Plants** ⟶ **Animals**

A biome has well-defined boundaries, determined by global climate patterns.

Globally, there are 6 abiotic and temperature terrestrial biomes, 5 exist in Canada.

The four major biomes in Canada are:

1. Tundra
2. The Boreal Forest [a.k.a. Taiga]
3. The Temperate Deciduous Forest
4. The Grassland Biome

The 5th is the Desert Biome, consisting of dry, cool climate and sparse vegetation such as cactus and sage bush are found in a very small area of the rain shadows of the Rocky Mountains.

The 6th type of temperate terrestrial biome (Tropical Rainforest), not found in Canada is the CHAPARRAL Biome, found in Southwestern USA, and Baja California in Mexico. It has the must uniform conditions of any terrestrial biome. Temperature varies little and rainfall is frequent. The dominant plants are broad-leafed evergreen trees.

The Tundra Biome

The tundra biome is extensive extending southward from the North Pole across the width of the continent, occurs in arctic regions where the subsoil is frozen.

It shows little biodiversity and is vulnerable to damage, being slow to recover because of the low temperatures. Winters are long and cold, whilst the summers are short.

The growing season is very short (~ 2 months of the year), and low precipitation(~10-12 cm per year), thus limiting the types of plants that can survive.
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The soil is made up of a permanently frozen layer, called the **PERMAFROST**: a layer of soil that never thaws.

Above the permafrost layer is a thin layer of soil called the **ACTIVE** layer. The active layer thaws in summer allowing the uptake of water and minerals by the roots of the plants that grow in the active layer.

Because of the thin soil, limited biomass is available to decay and mix with the base soil, thus only a few trees grow. Large trees can not grow in the Tundra biome, because these require roots that can go deep in the ground, but this can not happen because of the permafrost layer.

Special adaptations that allow plants to grow quickly in the tundra, flower quickly and seed before winter returns. The plants grow close to the ground, small leaves and root systems that can absorb scarce water; thus plants tend to be small and stunted.

Therefore, mosses, lichens, and rapid flavoring plants and low-growing woody plants dominate the tundra.

Cold temperatures limits the number of decomposers present in the soil to decompose organic matter.
Its animal population is also limited in diversity, consisting of caribou, musk ox, polar bears, arctic foxes, wolverines and several species of birds, many of which migrate south to avoid the winter. To survive, animals have adapted, example: thick fur and protective colouration.

The Boreal (Coniferous) Forest Biome

[Trees at the northern edge are stunted by poor growing conditions, and this belt is known as the TAIGA]

This is the largest terrestrial biome on Earth, south of the tundra biome, covers almost 50% of Canada's land area.

The climate here is harsh, it experiences long cold winters and short summers with occasional warm and wet periods, the temperature changing rapidly. As a result of this mixing of warm and cold air, the boreal forest receives more rain: > 40 cm/year precipitation.

See Table 2 Page 90

The thin soil, on top of solid bedrock is acidic (because the decay of cornifer needles produces an acid) and is poor in nutrients.

The variety of tree species is limited: mainly **conifer** trees due to climate suitability. **Special adaptations of the conifer trees**:

- the thin conifer needles have a small surface area: the leaves do not lose moisture in winter,
- they are covered by a thick cuticle of wax, this reduces water loss and protects against frost damage.
- The pyramid shape of conifers supports the weight of a heavy snowfall and the branches point downward, the seeds inside cones do not dry out, from the harsh elements until they are mature and are ready to be disposed.

Shade loving plants, mosses and ferns grow on the forest floor. Because of the conifer trees, the primary consumers must be able to survive on a diet of needle, bark and seeds from cones. The needles remain on the trees over winter and do not have to regrow before the tree can begin to carry on photosynthesis in spring.

Animals grow thick fur in winter and adapt to the cold winters, these include, deer, moose, squirrels, voles, snowshoe hares, bears, herbivore insects. Predators include bears, wolves lynx, wolverines, snakes, frogs.

The Temperature Deciduous Forest Biome

1. South of the boreal forest, in Eastern and Central Canada. Largest biomass of Canadian biomes due to richer soil resulting from the decomposition of litter, (FYI: this is the upper layer of the soil, made up mostly of partially decomposed leaves and grasses).

2. Shows significant biodiversity containing deciduous trees(i.e. trees that lose their leaves in fall), e.g. maple, oak, beech, hickory, birch, poplar.

3. The broad leaves of the deciduous trees maximize light capture for photosynthesis

4. Long growing season (~200 days in the extreme south)

5. There are four well-defined seasons, plenty of sunlight and rainfall is not confined to a specific time of the year, ~ 100 cm/year

6. The soil is fertile, because of higher temperatures, this allows a faster decomposition of organic matter from decayed leaves, resulting in a large variety of plants and animal life.

7. Because light can reach the forest floor, more plants can grow on the forest floor.

8. The presence of so many different kinds of plants allows for a greater biodiversity among animals: bear, deer, bobcats raccoons, squirrels and many varieties of birds share the forest with small ground-dwelling mammals, snakes, frogs and invertebrates

9. The thick litter of the **forest floor**, made up of fallen leaves provides an ideal environment for many different types of insects.

10. Large herbivores such as deer and moose thrive on the rich vegetation of the **understorey** (i.e. the undergrowth).

11. The **canopy** (i.e. the upper levels of the trees), supports many species of birds and some mammals

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The Grassland Biome

1. Grasslands have been changed extensively through human intervention.

2. The southern part of Canada's prairie provinces and the central United States consists of grasslands, moderate amount of biomass; greater biodiversity than the tundra.

3. Annual periods of droughts and the temperature vary considerably during the year, ~ 25-75 cm of precipitation yearly.

4. Most grassland have thick, fertile soil (aka: black earth), ideal for agriculture activities, grasses are the predominant vegetation and food for a large number of herbivores. Topsoil is quite deep and rich in organic matter to support extensive root growth.

5. Although large herbivore, e.g, bison, antelope and wild horses are the obvious animals, but most grazing is actually done by underground invertebrates whose consumption exceeds that of the above ground species.

6. The day season, periodic prairie fires combined with the activities of the grazing species ensures that the area remains a grassland.

See Table 4 Page 93

The grasslands are important to man because they support livestock and wheat stock.
The biodiversity is low in the grasslands since there is only one layer to support animals.; there is moderate amount of biomass.

Homework

1. Worksheet on Video: Where Plants and Animals Live
2. Read Pages 86-93
3. Answer Page 93# 1,3,5-8
4. Worksheet: Biomes