Unit B: Ecosystems and Populaon Change

General Outcomes: There are two major outcomes in this unit.

Students will:

1. explain that the biosphere is composed of ecosystems, each with distinctive biotic and abiotic characteristics
2. explain the mechanisms involved in the change of populations over time.

Key Concepts: The following concepts are developed in this unit and may also be addressed in other units or in other courses. The intended level and scope of treatment is defined by the outcomes.

- ecosystem
- niche
- biotic/abiotic characteristics
- limiting factors
- binomial nomenclature
- adaptation and variation
- population
- natural selection
- species
- evidence for evolution

Main Ideas

Lesson 1: Ecosystem Terminology and Niches

- Ecosystems contain abioc and bioc components. The bioc components can be grouped into populaons and communies
- Each species has a different niche or role to play in an ecosystem. This helps reduce compeon between species for the same territory and resources.

Lesson 2: Terrestrial and Aquac Ecosystems

- What factors are present in terrestrial and aquac ecosystems?

Lesson 3 – Limits on Populaon Growth in ecosystems

- What factors in an ecosystem prevent populaons from geng too large?

Lesson 4 – Changes in ecosystems

- When bioc and abioc factors in an ecosystem change, the whole ecosystem can change.

Lesson 1: Ecosystem Terminology and Niches

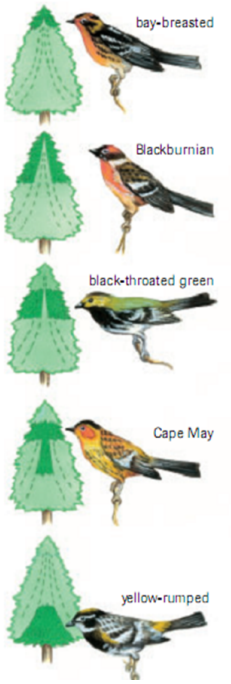
Students will:

20–B1.1k define species, population, community and ecosystem and explain the interrelationships among them

- **Ecology** is the study of how living things interact with each other
- A **population** is a group of individuals from the same **species**
- A **community** is the interaction of different **populations**
- An **ecosystem** is a community and its physical and chemical environment

- **Abiotic** factors - Non-living factors or influences on organisms, such as;
  - amount of sunlight
  - temperature
  - wind speed
  - water availability
  - soil/water pH
  - soil moisture
- **Biotic** factors - Factors caused by the presence and roles of other living things
  - predator density
  - food supply
  - disease
  - human influence

Niches - Roles in ecosystems



- An organism's place in the food web, its habitat, breeding area, and the time of day that it is most active makes up its **ecological niche**

- The niche that an organism fills in an ecosystem includes everything it does to survive and reproduce

- Each species in an ecosystem tends to have a different niche, or a different role to play.
    - This helps reduce competition between species for the same territory and resources.

- Ex. The grey owl and the red-tailed hawk both occupy the same ecosystems and eat similar foods but they occupy different niches

Read pg 90 and list 3 different ways that the niche of the hawk and owl are different

1. Owl hunts in forest, but hawk hunts in open areas

2. Owls hunt at dusk and night, hawk hunts during the day

3. Nest in different areas

Competition for Niches

- When a new species enters an ecosystem, it causes a disturbance

- The new species comes into competition for a niche with one or more of the species already in the ecosystem

Read pg 91 and describe how the European starling competes with the mountain bluebird for its niche

Case Study

Natural and Artificial Ecosystems

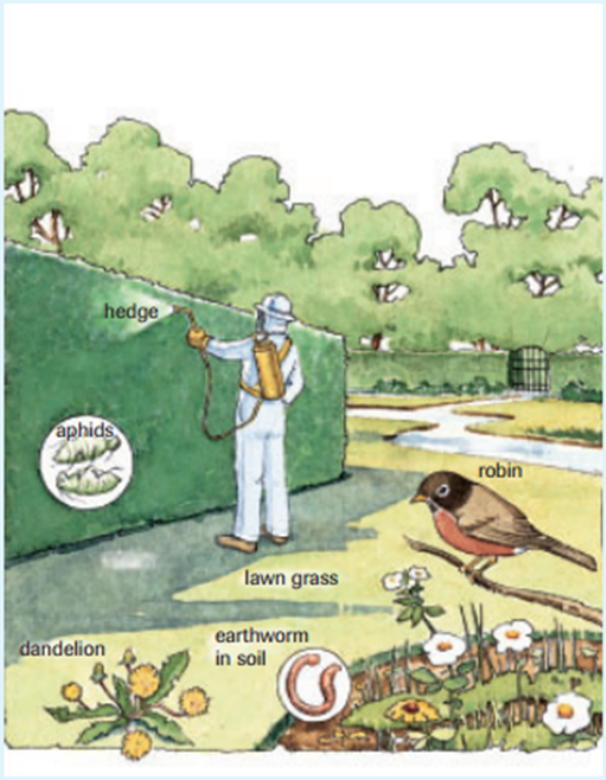


Figure 3
A park ecosystem

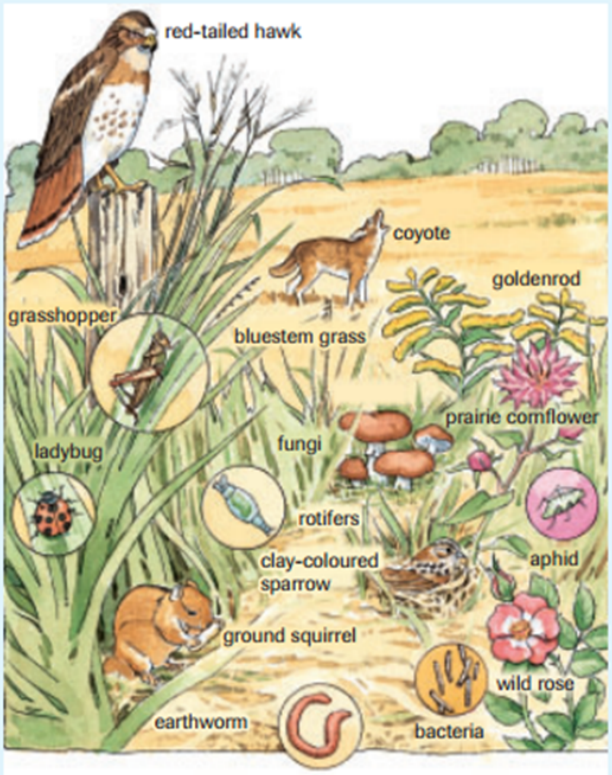


Figure 4
A prairie ecosystem

Your schoolyard, local parks, farms, and managed forests are artificial ecosystems. An **artificial ecosystem** is planned or maintained by humans. Lakes, rivers, forests, deserts, and meadows can all be classified as natural ecosystems. In a **natural ecosystem**, the living community is free to interact with the physical and chemical environment (see **Figure 4**). However, this does not mean that the area is untouched by humans: humans are a natural part of many ecosystems. Natural ecosystems haven't been planned or maintained by humans. In this case study, you will compare a prairie grassland (natural) and a park (artificial).

Change within a park is limited because of human interference. Although the trees grow, most parks look somewhat the same from year to year (**Figure 3**). Humans manage change. Natural ecosystems undergo subtle changes as one plant or animal species gradually replaces another. In natural ecosystems, only plants suited for the environment flourish. In an artificial ecosystem, plants selected by humans have an advantage.

Case Study Questions
Study **Figures 3** and **4**.

1. What human activities prevent the artificial ecosystem of the city park from changing?
2. Which ecosystem demonstrates the greater biodiversity? Explain your conclusion.
3. Speculate about why clay-coloured sparrows, found in the prairie, are less likely to be found in a city park.
4. Speculate about why coyotes are not common in city parks.

Table 1, on the next page, provides data collected from a city park and a prairie ecosystem. All measurements were taken on the same day at the same times. Relative humidity is the percentage of the amount of water vapour in a mass of air compared with the maximum amount of vapour that could be held at that temperature. Evaporation rate measures the volume of water lost from soil in one day. "Soil litter" is a

Table 1 Abiotic and Biotic Factors in Two Ecosystems

Abiotic factors	City park	Prairie
temperature (maximum)	28 °C	26 °C
temperature (minimum)	12 °C	10 °C
wind speed at ground	22 km/h	15 km/h
evaporation rate	10 L/day	3.5 L/day
relative humidity	85 %	64 %
light at ground (% of sunlight available)	95 %	91 %
soil nitrogen rating	very high	low
soil phosphorus rating	high	low
Biotic factors		
soil litter	56 g/m^2	275 g/m^2
robin density	3/100 m^2	1/100 m^2
ground squirrel density	0/100 m^2	14/100 m^2

measure of the mass of decomposing organic matter found above the soil.

5. Why is it important to take measurements on the same day and at the same time?
6. Why might the wind velocity at ground level differ in the two ecosystems?
7. Why might you expect the temperature to be higher in the park than in the prairie?
8. Explain the differences in the evaporation rate in the two ecosystems.

Table 2 provides detailed counts for some species in the two ecosystems.

9. Suggest reasons why goldenrod is found in the prairie but not the city park.
10. Provide a hypothesis that explains why more earthworms are in the prairie than the park.
11. Why are more spiders found in the prairie?
12. List abiotic factors of the city park and prairie.
13. Explain how human interference influences each of the factors you listed in question 12.
14. Which of the two ecosystems, the prairie or the park, would provide a better habitat for a fox? Give reasons for your answer.
15. Not all natural ecosystems have more biodiversity than all artificial ecosystems. Give two examples of an artificial ecosystem that might have more biodiversity than a natural ecosystem. Provide an explanation of each example.
16. **Tables 1** and **2** provide some data on two ecosystems. What additional data would be useful in making a comparison of an artificial and a natural ecosystem?
17. Some animals, such as the raccoon and the tree squirrel, do very well in artificial ecosystems. What special adaptations or behaviours make these two animals successful in human-dominated environments? Report on the results of your research.

Table 2 Inventory of Species in 10 m × 10 m Study Areas

	City park		Prairie	
Types of organism	Number of species	Population of all species	Number of species	Population of all species
grass	1	100 000/m^2	3	40 000/m^2
goldenrod	0	0	1	51
plants considered weeds	3	6	17	459
earthworms	1	25	8	210
beetles	4	7	22	39
spiders	1	2	2	13
birds	3	10	11	39
rodents	0	0	3	45