

The Urban Ecosystem

Cities are major sources of air and water pollution. This is not surprising—the population of some cities reaches into the millions (Figure 1). Air pollution is caused by car exhaust, burning of fuels, and gases from industry. Water pollution comes from biological, commercial, and industrial wastes. The ecological footprint of cities reaches well beyond their boundaries. Highways radiate outward from cities like a web. People who live in cities rely on forestry and mining for a variety of materials, on agroecosystems for food, and on natural ecosystems for recreation.



Figure 1 Close to 85 % of Ontarians live in urban settings such as Toronto, Ottawa, and Hamilton. This situation is not unique to Ontario. More than 50 % of the world's population now lives in cities.

An aerial view of an urban ecosystem is very different from a natural ecosystem (Figure 2). In a large city, natural vegetation is replaced by human structures such as buildings, roads, and sidewalks. The remaining vegetation is often lawns that are monocultures of non-native grasses. Table 1 (next page) shows the key differences between natural ecosystems and urban environments.



Figure 2 (a) A natural ecosystem and (b) an urban ecosystem are in stark contrast to one another. The former is dominated by a living carpet of trees and the latter by a layer of concrete and asphalt.

Table 1 Comparison of Urban and Natural Ecosystems

Feature	Urban ecosystem	Natural terrestrial ecosystems
surface features	<ul style="list-style-type: none"> dominated by buildings, paved roadways, and parking areas 	<ul style="list-style-type: none"> dominated by plants
plant species	<ul style="list-style-type: none"> low density of plants mostly non-native species such as grasses, ornamental trees, shrubs, and small flowering plants 	<ul style="list-style-type: none"> high density and diversity of native species
common non-human animal species	<ul style="list-style-type: none"> low diversity and abundance common species include dogs, cats, house mice, Norway rats, pigeons, starlings, and house sparrows—all are non-native 	<ul style="list-style-type: none"> high density and diversity of native species
water cycle	<ul style="list-style-type: none"> surface water rapidly enters sewers and drainage systems most of the surface impenetrable to water human population consumes large quantity of water obtained from surface or groundwater supplies waste water returned to surface water 	<ul style="list-style-type: none"> surface water in ponds, streams, rivers, and lakes most rainfall absorbed at surface water moves through soil and enters groundwater
flow of materials	<ul style="list-style-type: none"> massive influx of materials to support human demand for consumer goods human body wastes collected, treated, and disposed of in surrounding environment household and commercial wastes disposed of in surrounding environments usually minimal recycling and composting 	<ul style="list-style-type: none"> natural nutrient cycles occur throughout ecosystem
food webs	<ul style="list-style-type: none"> dependent on importing food from outside agroecosystems 	<ul style="list-style-type: none"> complex natural food webs
sustainability	<ul style="list-style-type: none"> cannot be sustained without inputs from and outputs to other ecosystems 	<ul style="list-style-type: none"> independently sustainable

After studying Table 1, you can see that humans cannot survive in an isolated urban environment. Unlike organisms living in a natural ecosystem, humans in an urban setting rely on outside ecosystems.



RESEARCH THIS CONSERVING THE OAK RIDGES MORAINE

SKILLS: Researching, Analyzing the Issue, Defending a Decision

SKILLS HANDBOOK
4.B., 4.C.

Located in south central Ontario, the Oak Ridges Moraine (Figure 3) is an important ecological feature. A moraine is a large deposit of soil and rock left behind by a glacier. The Oak Ridges Moraine is a major source of surface water and groundwater and is home to many ecosystems. It is valued for its attractive landscape and contains prime farmland.

The Oak Ridges Moraine is experiencing pressure from new residential, commercial, industrial, and recreational uses that threaten its sustainability. In this activity, you will research the moraine and the conservation plan that is being implemented to protect this valuable region.



Figure 3 The Oak Ridges Moraine

1. Use the Internet and other resources to investigate the Oak Ridges Moraine and the Ontario government's conservation plan for the moraine.



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- A. The moraine has been called a “water barrel” for much of southern Ontario. How does the moraine act as a source of clean and abundant water? **T/I**
- B. Describe present-day human and natural communities that occupy the moraine. **T/I**

- C. Why does the moraine need protection? What activities threaten the sustainability of the region? **T/I**
- D. What are the objectives of the Ontario government's conservation plan? **T/I**
- E. What are “land use designations,” and what purpose do they serve? **T/I**
- F. (i) Do you think a conservation plan for the Oak Ridges Moraine is a good idea? Explain your reasoning. **T/I C A**
(ii) Propose changes or suggestions to improve on the plan.

Urban planners must understand how to design sustainable cities. To learn more about becoming an urban planner,



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DID YOU KNOW?

Green Buildings Are LEEDing the Way

The LEED (Leadership in Energy and Environmental Design) standards have been developed to promote the construction of energy-efficient buildings using environmentally friendly building materials. The city of Kingston is using the LEED standards to construct a four-rink arena and a 5000-seat sports and entertainment complex.



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Greener Cities

Humans are becoming more concerned about how we impact the environment. City planners and politicians have developed strategies to make cities more sustainable. They must consider the impact of human actions in cities, as well as in the surrounding ecosystems. This makes planning challenging because it crosses political boundaries, but it also encourages innovation.

Cities also differ in their planning requirements. Iqaluit, a city on Baffin Island, Nunavut, is working on a plan to ban plastic bags. The Greater Toronto Area government has passed a bylaw requiring retail outlets and coffee shops to give customers a discount if they bring their own bags or coffee mugs. Table 2 shows some ways that cities are becoming more sustainable.

Table 2 Examples of How Some Cities Are Working to Reduce Their Ecological Footprint

Community action	Benefits
use community composting programs to collect food and yard wastes	<ul style="list-style-type: none"> reduces need for landfills produces valuable fertilizer
use light-emitting diodes (LEDs) in traffic lights	<ul style="list-style-type: none"> reduces energy consumption saves on bulb replacement costs
promote green roofs on flat-topped commercial buildings	<ul style="list-style-type: none"> improves air quality reduces building heating and cooling costs
enhance and promote public transit	<ul style="list-style-type: none"> reduces air pollution and energy costs
ban the cosmetic use of pesticides	<ul style="list-style-type: none"> reduces air and water pollution reduces health risks associated with exposure to pesticides
enhance green spaces within cities	<ul style="list-style-type: none"> improves air quality encourages participation in healthy outdoor activities
promote shop locally campaigns	<ul style="list-style-type: none"> reduces transportation costs

On a larger scale, the United Kingdom plans to give every home in the country a “green makeover” by 2030. The program will include energy-saving measures such as adding insulation, switching to more efficient appliances, and using alternative energy technologies. Close to 30 million homes will receive the makeover. These changes will lower their energy costs and reduce their ecological footprint.

Urban settings also offer environmental benefits. By living close together, we can save energy, resources, and space. Large apartment buildings occupy less space. They also use fewer raw materials and less energy per person than single-family homes. Transportation is more energy efficient when people travel shorter distances and when they have access to large public transportation systems. New green housing developments can benefit from new heating and cooling systems that reduce energy demand.

One promising option is to make public transit free. If successful, such an approach would reduce traffic congestion, pollution, and accidents, lower road maintenance costs, and free up valuable space being used for parking lots.

TRY THIS DO YOU SUFFER FROM NDD?

SKILLS: Planning, Analyzing, Evaluating

NDD or *nature deficit disorder* is not a recognized medical condition, but people use the term to describe a negative trend in the well-being of children. NDD is the social cost of not spending enough time in nature. Children who do not experience nature are more prone to behaviour and social problems. Think about your own lifestyle and how you interact with natural ecosystems (Figure 4).



Figure 4 How much time do you spend in natural environments?

1. Prepare a survey to determine how familiar your fellow students are with the natural world. Your survey should include 10 questions. They can be yes-or-no, multiple-choice, or numerical-answer questions. **T/I C**

A few sample questions are below:

- When was the last time you went for a walk through a natural habitat?
 - Do you know where the closest natural setting is to your home or school?
 - How many kinds of amphibians (or reptiles, fish, or birds) can you name that are native or even non-native to Ontario?
2. Give the survey to at least five students. Compare their answers with your own. **T/I**
 - A. Did most students have about the same familiarity with nature as you do? **C**
 - B. Many people believe that we are spending less and less time in natural settings. Do your results support this belief? **T/I**
 - C. Make a list of some of the indoor activities that students do in their leisure time. Estimate the time spent on these activities in comparison with time spent outside. Compare inside activities with outside activities. **T/I C**
 - D. How might enhancing people's experiences with nature influence how they value natural ecosystems? **A**

IN SUMMARY

- Cities are major sources of air and water pollution.
- Urban ecosystems are different from natural ecosystems.
- People living in urban settings rely on outside ecosystems for food, resources, and waste disposal.
- Urban ecosystems impact the surrounding ecosystems that supply them with services.
- Living in urban ecosystems can benefit the environment because high-density housing reduces our consumption of energy, resources, and space.
- There are many ways to enhance urban living spaces and reduce their negative impacts on the environment.

CHECK YOUR LEARNING

1. Ontario is largely an urban population. Explain what this means. **K/U**
2. Contrast how urban settings differ from natural ecosystems in terms of **K/U**
 - (a) land surface types
 - (b) the diversity and origin (native versus non-native) of species
 - (c) the water cycle
 - (d) cycling of nutrients
3. Describe how a large population living in a large city can actually benefit the environment. **T/I**
4. How might living in a large city enable a person to be more aware of some environmental issues such as air pollution? Explain. **A**
5. In what ways might living in a large city make it more difficult for a person to be aware of other environmental issues such as habitat loss? Explain. **A**
6. Human populations living in cities would never be sustainable if they were isolated from their surrounding ecosystems. Explain this statement. **K/U**
7. List five actions cities can take to reduce their ecological footprint and become more sustainable. **K/U A**