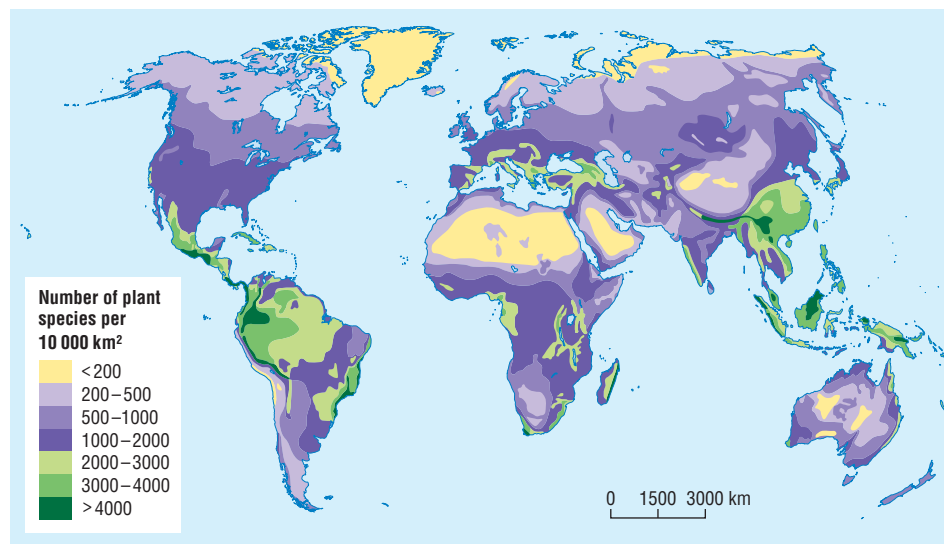# The Importance of Biodiversity

Scientists have only begun to understand the variety of life that exists on Earth. Approximately 1.5 million species have been studied, but this is only a fraction of species that are currently alive. Biologists estimate the total number of living species to be more than 5 million and perhaps as high as 50 million! There is little doubt that most living species have yet to be identified. Canada is home to about 140 000 to 200 000 species of plants and animals. Only 71 000 have been identified.

Biological diversity, or **biodiversity**, is the variety of life found in an area. It is often measured by counting the number of species in a specific habitat or ecosystem. This measurement of species numbers is called **species richness**. A diverse ecosystem will have high species richness.

In general, species richness tends to be higher close to the equator (Figure 1). Tropical rainforests have the highest biodiversity of any ecosystem. In a Peruvian rainforest, scientists identified 283 tree species in a single hectare. A similar-sized deciduous forest in Ontario would have fewer than 15 tree species. The Amazon rainforest is home to more than 200 species of hummingbirds, whereas Ontario has only a single species.

biodiversity the variety of life in a particular ecosystem; also known as biological diversity

species richness the number of species in an area

Number of plant species per 10 000 km²

- <200
- 200–500
- 500–1000
- 1000–2000
- 2000–3000
- 3000–4000
- >4000

0   1500 3000 km

Figure 1 Biodiversity map showing the number of species of plants per 10 000 km²

DID YOU **KNOW?**

Insects in Extraordinary Numbers
Over half of all known living species are insects. Of Canada's approximately 71 000 identified species, about 30 000 are insects. In Algonquin Park alone, more than 40 species of black flies have been identified, only a few of which feed on humans.

Biodiversity under Attack

Imagine you are watching the burning of the world's greatest library. The building contains a copy of every book ever written. The fire is rapidly destroying the books. Now imagine you are told that most of these books have never been read and that no other copies exist. Such a fire would be a tragic loss of human knowledge.

This scenario can be compared to the current destruction of Earth's biodiversity. Many species are dying out, or going **extinct**. Their habitats are being destroyed through deforestation, urban and agricultural expansion, pollution, and climate change (Figure 2). Like the books in the burning library, most of these species have not been studied. Humans are rapidly destroying Earth's ecosystems without even knowing their biological contents.

extinct refers to a species that has died out and no longer occurs on Earth

**Figure 2** Urbanization is a major cause of habitat loss.

Extinction is a natural process. Over thousands and millions of years, some species become extinct, while new species arise. There have been at least five major extinction events in the past 1 billion years. Extinction events are usually caused by a catastrophic event such as an asteroid impact or massive volcanic eruption. Between such rare events, extinction rates are very low.

Unfortunately, human activity has drastically increased the rate of extinction. When humans first encounter new species, they often overexploit them. Within 200 years of their arrival in New Zealand, humans had caused the extinction of 30 species of large bird, including 26 species of giant moas (Figure 3(a)). About 80 species of mammals and birds went extinct shortly after humans reached North America 10 000 years ago. The extinctions included sabre-toothed tigers, mammoths, camels, and horses. Some ocean species fared no better. The Stellar's sea cow, an unusual marine mammal weighing more than 3 tonnes, was discovered in 1741 and was extinct by 1768 (Figure 3(b))!
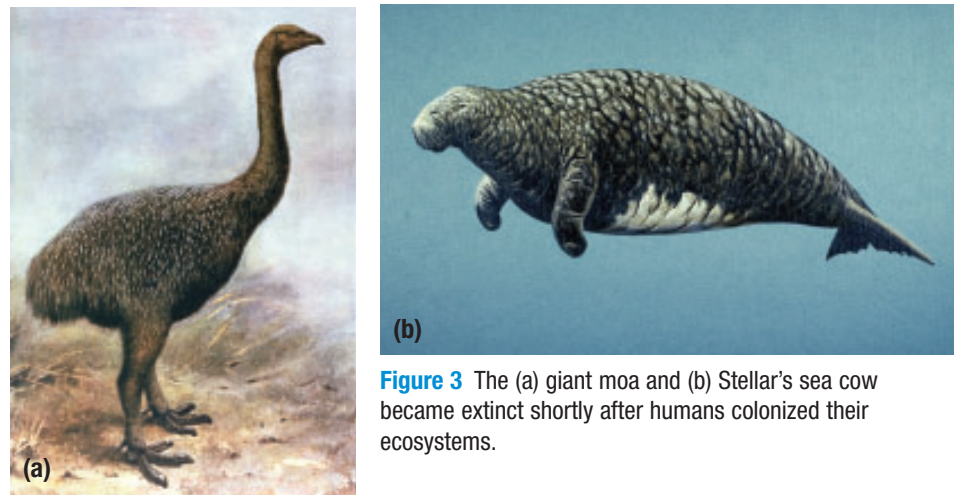
Figure 3 The (a) giant moa and (b) Stellar's sea cow became extinct shortly after humans colonized their ecosystems.

In the past 400 years, over 700 species of vertebrates have become extinct. Twelve species have become extinct in Canada in the past 170 years (Figure 4). Unfortunately, the rate of human-caused extinction is increasing.
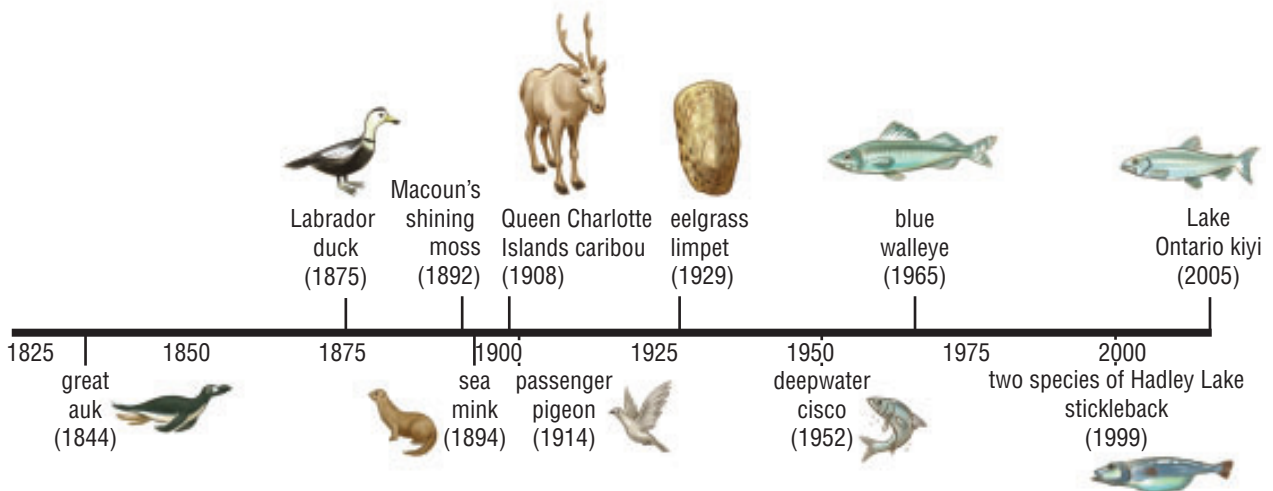
Figure 4 Timeline of recent species extinctions in Canada

Species at Risk

Species do not have to be driven to extinction for there to be ecological consequences. When a population's size declines below a critical level, the species will no longer be able to fill its ecological niche. This has consequences for the biotic and abiotic features of the ecosystem. For example, the loss of most, but not all, large sharks from a coral reef ecosystem changes the food web and damages the reef.

In Canada, the status of species is monitored by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The committee has members from governments, universities, other agencies, and Aboriginal peoples. Experts on COSEWIC use the data of species at risk to categorize them in one of four categories. Species are classified as **extirpated** when they no longer exist in the wild in a specific area but still live elsewhere. **Endangered** species are in imminent danger of going extinct or becoming extirpated. **Threatened** species are likely to become endangered if current trends and conditions continue. Species of **special concern** may become threatened or endangered because of a combination of factors. Table 1 lists numbers and examples of Canadian species in each COSEWIC classification.

extirpated a species that no longer exists in a specific area

endangered a species facing imminent extirpation or extinction

threatened a species that is likely to become endangered if factors reducing its survival are not changed

special concern a species that may become threatened or endangered because of a combination of factors

Table 1 Examples of Canadian Extinct Species and Species at Risk

Classification	Number of Canadian species (2008)	Examples
extinct	13	• great auk • passenger pigeon • sea mink
extirpated	23	• paddlefish (from all of Canada) • Atlantic walrus (from the Northwest Atlantic)
endangered	238	• barn owl (in some regions) • swift fox • northern cricket frog
threatened	146	• humpback whale • wood bison • Kentucky coffee tree
special concern	157	• polar bear • red-headed woodpecker • Atlantic cod

When a species is placed in the endangered or threatened category, another agency, RENEW (REcovery of Nationally Endangered Wildlife), prepares an action plan to ensure the recovery of the species. As of 2008, 564 plant and animal species are considered at risk in Canada. RENEW has developed recovery plans for more than 300 species.

We must act now to reduce habitat loss, urban expansion, and pollution to protect Earth's biodiversity. In the following sections, you will learn about specific threats to biodiversity. You will also learn what actions are being taken by individuals, organizations, and government agencies to eliminate these threats.

To learn more about Canada's and Ontario's species at risk,
GO TO NELSON SCIENCE

NatureWatch

Concern about the environment and taking action are the responsibility of the government, businesses, and individuals. Everyone should help keep our environment healthy and protect species at risk.

NatureWatch is a community-based "citizen science" monitoring program. It encourages schools, community groups, and individuals to help monitor important species and environmental indicators (Figure 5). The current program includes FrogWatch, IceWatch, PlantWatch, and even WormWatch!

Consider how you and your class might get involved.
• Research one of the NatureWatch programs.
• Write a short description of the program. Explain why you think it is worthwhile and the steps needed to participate in the program.
• Share your ideas with your classmates.
• Decide if you or your class want to participate in one of the programs.

GO TO NELSON SCIENCE

NatureWatch programs require teamwork, organization, and commitment, but they can be very rewarding!

Figure 5 Individuals can take action to protect Earth's biodiversity.

UNIT TASK Bookmark

You can apply what you learned in this section about biodiversity and the classifications of species at risk to the Unit Task described on page 156.

IN SUMMARY

• Most species have not been identified or studied.
• Biodiversity tends to be higher near the equator.
• Human activities threaten biodiversity.
• Extinction is a natural process, but human activities have greatly increased the rate of extinction.

• The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) categorizes at-risk species as extirpated, endangered, threatened, or of special concern.
• The Recovery of Nationally Endangered Wildlife (RENEW) agency prepares action plans for endangered or threatened species.

✓ CHECK YOUR LEARNING

1. Explain what is meant by the term *species richness*. K/U

2. What ecosystems would you expect to have high species richness and low species richness? Explain your reasoning. K/U

3. Why are scientists concerned about species loss if extinction is a natural process? K/U

4. (a) List some of the main human activities that contribute to species extinction. T/I

   (b) Do you think such activities can be justified? A

5. Suggest reasons for the acceleration in extinction rates in recent decades. T/I

6. List the four *at-risk* classifications and give an example of one Ontario species in each class. K/U

7. Describe what actions are taken in Canada once a species in placed in the endangered or threatened category. K/U

8. (a) Brainstorm to create a list of actions an individual could take to help protect at-risk species.

   (b) Which action are you most likely to complete? Explain why. A C