

Key Terms

sustainable use
doubling time
ecological footprint
unsustainable
sustainability

2.3 Human Niches and Population

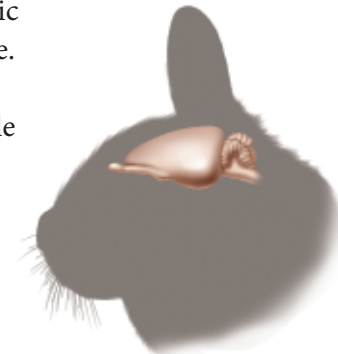
Recall, from Section 2.2, that carnivorous plants are well-adapted for living in a bog. If they were moved to a habitat with different conditions, they might not survive. The fact that most organisms are limited to particular niches is partly why different species are only found in particular types of ecosystems in particular parts of the world. But what about the human ecological niche?

The Human Niche

Humans cannot run as fast as pronghorn antelopes or move through water as efficiently as dolphins. Humans do not have big teeth or big claws, like those of the black bear shown in **Figure 2.17**, or the poisonous venom of a snake. What humans do have is a brain that has allowed us to move out of the narrow niche that was inhabited by our ancient ancestors. By building complex tools, controlling external forms of energy, and expanding our use of resources, humans have been able to live successfully in many different ecosystems, including desert and arctic ecosystems. Unlike other organisms, we have constructed our own niche.

For humans to continue to occupy such a broad niche, we must use the ecosystems we inhabit and the resources they contain in a sustainable way. **Sustainable use** of a resource is use that does not cause long-term depletion of the resource or affect the diversity of the ecosystem from which the resource is obtained. Sustainable use of a resource, whether it is water or an entire ecosystem, allows the resource to meet the needs of present and future generations. If humans do not use resources in a sustainable way, our niche may shrink again over time.

sustainable use use that does not lead to long-term depletion of a resource or affect the diversity of the ecosystem from which the resource is obtained



Cat Brain



Bear Paw



Human Hand



Human Brain

Figure 2.17 Unlike other organisms, the human brain has allowed us to construct our own niche and live successfully in many different ecosystems.



Humans and Carrying Capacity

The populations of most species are regulated by the carrying capacity of the ecosystems that the species occupy. Early humans were regulated by the carrying capacity of their ecosystems. More recently, however, the intellectual abilities of humans have allowed us to create our own niche, as well as increase the carrying capacity of the biosphere for our population. From early developments, such as using fire and making simple tools and weapons, humans have progressed to exploiting huge amounts of energy and resources to run complex, modern societies.

Recall that the populations of all species, including humans, tend to increase exponentially until their carrying capacity is reached. Human exploitation of natural resources has produced improvements in public health, education, agriculture, medicine, and technology. Because these improvements have increased the carrying capacity for humans, the human population has increased, as shown in **Figure 2.18**.

Until about 400 years ago, human population growth had been steady but not explosive. At that time, the population was about half a billion people. It had taken about 650 years for the population to double from a quarter-billion. In the early 1800s, the human population reached one billion—a **doubling time** of only 200 years. The present doubling time is about 60 years.

Earth's human population currently stands at more than 6.7 billion. No one knows what the sustainable carrying capacity is for humans, but it is closely linked to energy. This is because highly productive agriculture requires large expenditures of energy. Many scientists believe that the biosphere's carrying capacity is unlikely to be able to sustain the 9 or 10 billion people expected by the end of the century.

doubling time the period of time that is required for a population to double in size

Study Toolkit

Interpreting Graphs

How does the graph in **Figure 2.18** help you understand how the human population has grown?

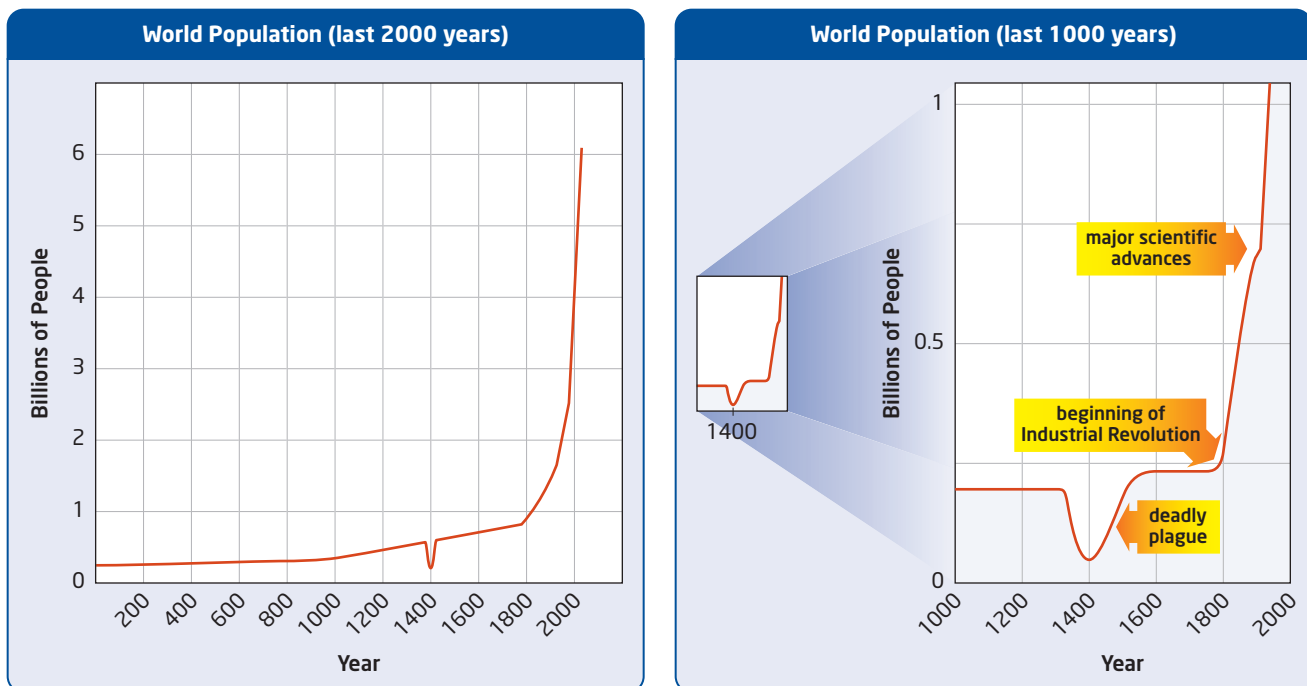


Figure 2.18 Earth's human population has been slowly growing for thousands of years. Since the Industrial Revolution, however, the rate of growth has increased dramatically.

Learning Check

1. How have humans been able to occupy a broad niche?
2. What is sustainable use?
3. What is the current doubling time of the human population?
4. What is the sustainable carrying capacity for humans?

Ecological Footprints and Carrying Capacity

Altering an ecosystem so that more energy and resources can be consumed is only one way to increase the carrying capacity of the ecosystem. The second way to increase its carrying capacity involves altering behaviour, rather than the ecosystem itself.

An **ecological footprint** is a measure of the impact of an individual or a population on the environment. Data used to measure an ecological footprint include energy consumption, land use, and waste production. An ecological footprint reflects the behaviour of individuals and the communities they live in. It is a measure of the productive land and water that are needed to support an individual's standard of living forever.

The average person in developed countries, which includes Canada, has one of the largest ecological footprints in the world, as shown in **Figure 2.19**. Ecological footprints this large in a world that has finite resources and is dependent on non-renewable fossil fuels are likely to be **unsustainable**. The increasing world population is putting stresses on ecological support systems. As the ecological footprints of people in developing nations also increase in size, these stresses will be multiplied. Modern societies must seek to establish ecological footprints that reflect the principles of **sustainability**—use of Earth's land and water at levels that can continue forever. Ways that individuals can reduce their ecological footprint include consuming fewer resources or using existing resources more efficiently through technological innovation, energy efficiency, and recycling.

ecological footprint a measure of the impact of an individual or a population on the environment in terms of energy consumption, land use, and waste production

unsustainable a pattern of activity that leads to a decline in the function of an ecosystem

sustainability use of Earth's resources, including land and water, at levels that can continue forever

Suggested Investigation

Data Analysis Investigation
2-C, Putting Your Foot in Your
Mouth, on page 82

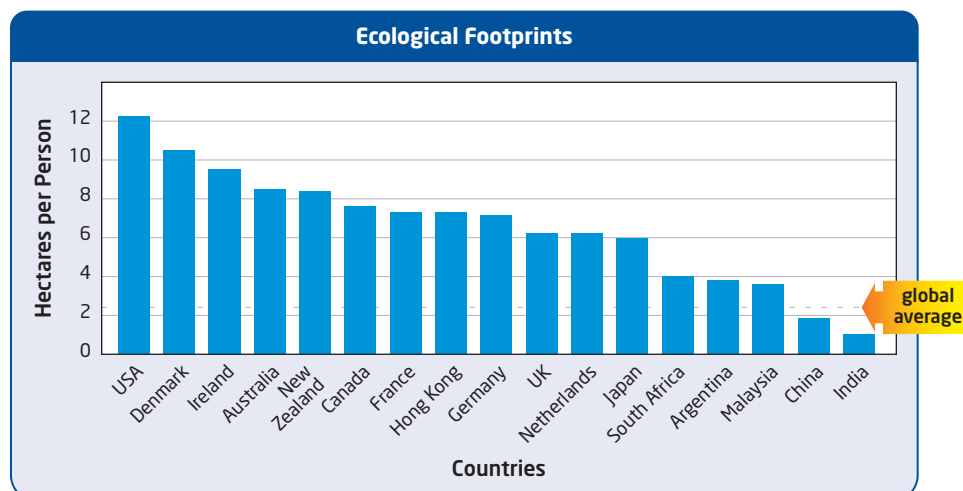


Figure 2.19 Ecological footprints are often measured by the amount of land that is required annually per citizen.

Section 2.3 Review

Section Summary

- The ecological niche of humans has been broadened by our intellectual abilities and the development of technology.
- Humans have altered the ecosystems that support us, so our carrying capacity is high.
- Modern human societies are still subject to the ecological principle of carrying capacity.
- Human growth has rapidly accelerated over the past 400 years, with a current doubling time of less than one human lifetime.
- An ecological footprint is used to describe the impact of a person's or population's consumption habits on the supporting ecosystems.

Review Questions

- K/U** 1. What has the human brain allowed us to do to our ancestral niche and to our original carrying capacity?
- C** 2. Sketch what you consider to be your own personal niche.
- K/U** 3. What are the two ways that carrying capacity can be increased?
- K/U** 4. List several specific ways that humans have been able to increase their carrying capacity.
- C** 5. Draw a footprint in your notebook. At each toe, write one thing you do that reduces your ecological footprint. At the heel of your footprint, write the one thing you do (or don't do) that causes your greatest ecological impact. Across the middle of your footprint, write the one thing you would find most difficult to change to shrink your ecological footprint.
- T/I** 6. The table on the right contains data about the ecological footprints of different countries.
- a. Construct a bar graph of the data in the table.
 - b. Which countries have the largest ecological footprint per person? Which countries have the smallest ecological footprint per person?
 - c. Why do you think there are such large differences in the footprints of these countries?
- A** 7. According to one source, the ecological footprint of Canada (in hectares per person) is 7.7. The global average footprint is about 2.2. Why do you think Canadians have such a large ecological footprint? Consider Canada's history and geography when answering this question.

Ecological Footprints

Country	Ecological Footprint (hectares per person)
Afghanistan	0.1
Brazil	2.1
Ethiopia	0.8
Japan	5.9
Russia	4.4
United Arab Emirates	11.9
United Kingdom	6.3
United States	12.3