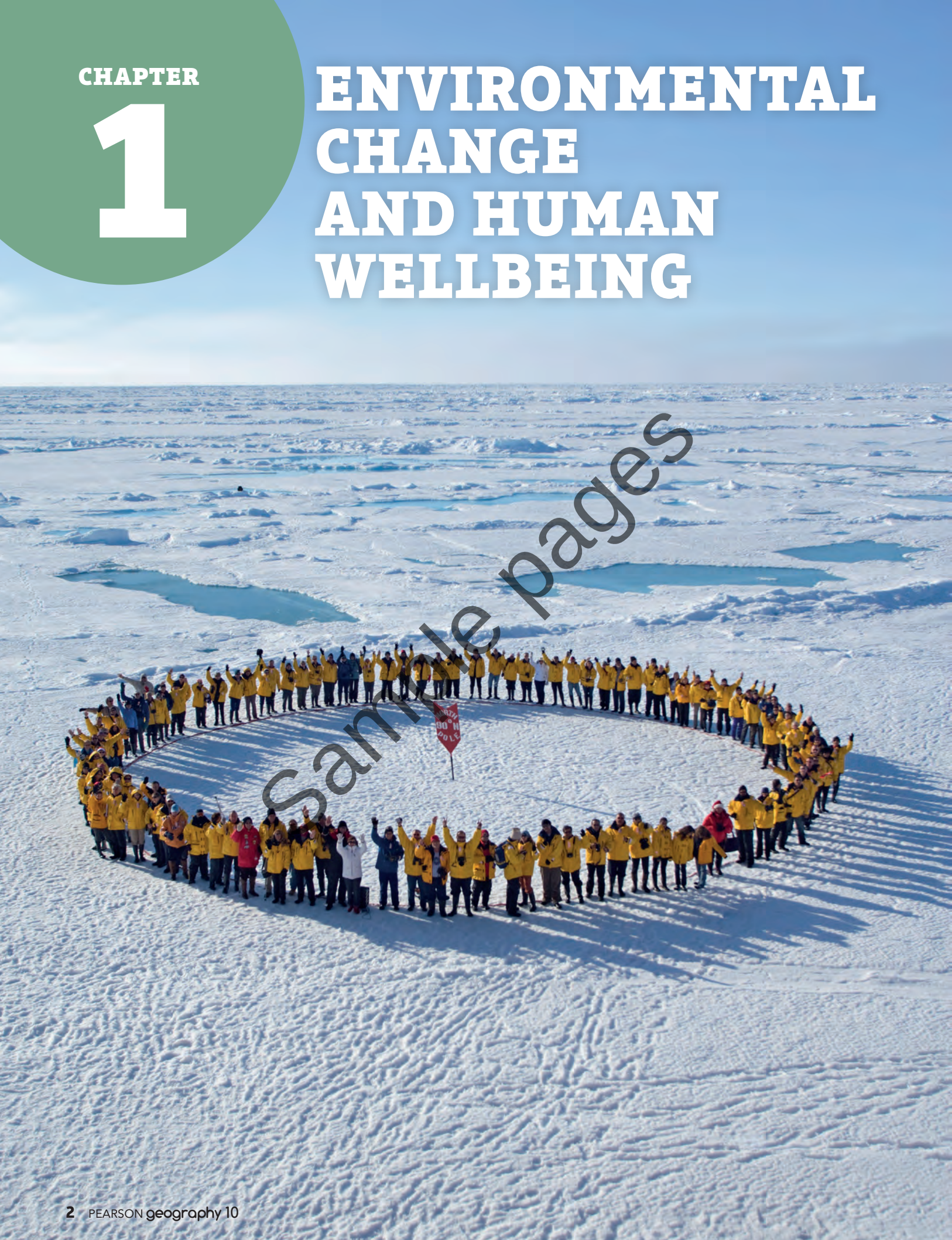
CHAPTER

1

ENVIRONMENTAL CHANGE AND HUMAN WELLBEING



At the beginning of the twentieth century there were 1.6 billion people on earth. Pollution and environmental degradation were problems, but were mainly local. The world still seemed vast, and large areas remained virtually untouched by the activities of people.

Just over 100 years later, the world's population was heading towards 7 billion and the environmental problems that have resulted from this rapid growth now affect the whole planet. How we manage these environmental challenges and how we address the social and economic inequalities that exist between and within places are critical to our future wellbeing.

This chapter introduces the concept of environmental functions, the major challenges to their sustainability and the environmental worldviews that influence how people perceive and respond to these challenges, as well as the differences in human wellbeing between places.

KEY IDEAS

- To understand human-environment systems thinking and how it assists us to understand the causes and consequences of environmental change
- To understand the environmental functions that support life
- To investigate the major challenges to environmental sustainability
- To compare the environmental worldviews that influence how people perceive and respond to these challenges
- To understand what is meant by the terms 'human wellbeing' and 'global citizenship'

GLOSSARY

absolute poverty	lack of access to minimum necessities or essentials for living
bioaccumulation	the accumulation of substances such as pesticides in an organism
biodiversity (biological diversity)	the variety of all life forms: plants, animals and microorganisms; the genes they contain; the ecosystems of which they form a part; and the processes that link them
carbon cycle	the naturally occurring processes in which carbon is exchanged between organisms and the environment
desertification	the spread of deserts
development	changes that create a better quality of life for people
ecological	the relationship between living things (including people) and their physical environment
empathy	the ability to understand and share the feelings of another
environment	the totality of our surroundings
extinct (species)	a species of animal or plant that no longer exists
fossil fuels	a natural fuel such as coal or gas, formed in the geological past from the remains of living organisms
global citizenship	a recognition that we are all citizens of the one planet and behave in ways that demonstrate a respect for the earth and all its people
global warming	the gradual rise in average temperatures brought about by an increase in the heat-absorbing gases present in the atmosphere
greenhouse effect	the atmospheric processes that maintain an average surface temperature of 15°C
habitat	the physical environment in which a community of plants and animals lives
human rights	the rights to which all humans are entitled
human wellbeing	the quality of life experienced by people individually and collectively
land degradation	the downgrading of the productive capacity of land due to the activities of people
non-governmental organisations (NGOs)	non-profit, often volunteer-based groups of people seeking to achieve a collective goal locally, nationally or internationally
pollution	any hazardous, or potentially hazardous, substance released into the environment
poverty	the inability to meet the basic needs for food, clothing and shelter; the absence of money, goods or the means of subsistence
relative poverty	where some people are poorer than others in the community but still have access to necessities of life

1.0 Human circle around the North Pole, July 2008

1.1 Geography's contribution

We are both the product of, and the creators of, places. We study geography so that we can appreciate why this world is like it is, what our role is in it and how we can sustain or change it. Geography gives us an understanding of the world that we live in.

What is geography?

Geography is the study of places and the relationships between people and their environments. Geographers explore both the physical elements of the earth's surface and the human societies spread across it. They also examine how human culture interacts with the biophysical environment, and how locations and places can have an impact on people. Geographers seek to understand where things are found, why they are there, and how they develop and change over time. Geography has traditionally been divided into two domains:

- ***physical geography:*** the study of earth's seasons, climate, atmosphere, soil, streams, landforms and oceans
- ***human geography:*** the study of the distribution of networks of people and cultures on the earth's surface.

1.1 Geography greatly enhances our aesthetic appreciation of the world in which we live.

These domains have their own subsets of related disciplines, each of which makes its own unique contribution. Geographers draw on the knowledge constructed by other related disciplines, apply geographical thinking and develop responses to problems.

Key value of geography

Studying geography and gaining a knowledge about places and spaces greatly enhances our aesthetic appreciation of the world in which we live. We can have a sense of wonder, curiosity and respect about places such as Denali National Park in Alaska, shown in Figure 1.1.

The geographic knowledge, understandings and skills we develop through the study of geography provide us with a 'lens' through which to view the world around us. This can enrich our lives. Armed with geographical knowledge, understandings and skills we are better able to take on the responsibilities of **global citizenship**. These understandings and skills will, for example, enable us to make personal and collective contributions to addressing some of the great challenges facing humanity, such as global warming, inequality, rapid urbanisation, population growth, habitat loss and resource depletion.

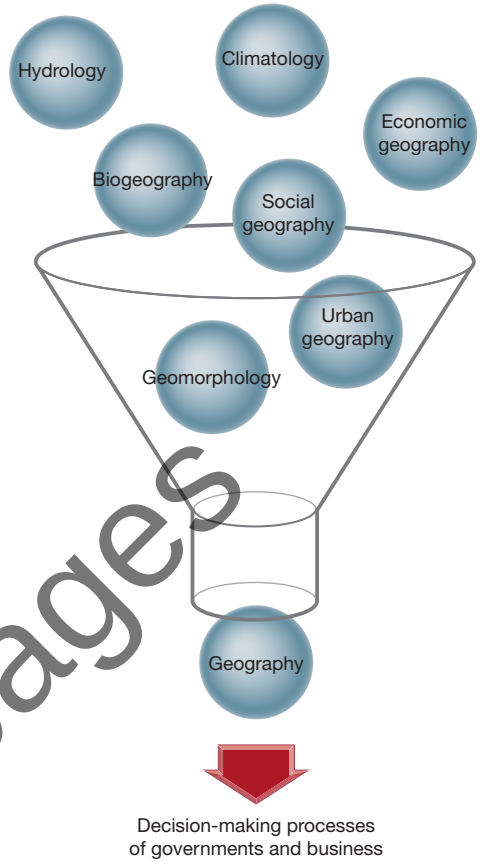
Utilitarian value of geography

Geographical knowledge is of great value to planners, forecasters and decision makers in business and government. Whether the issue being addressed is the location of new public infrastructure such as a bridge or motorway, or the rehabilitation of a wetland, decision makers must consider such geographic issues as location, the relationship between processes on different scales, and the changing character of particular environments and landscapes (see Figure 1.2). Geographic expertise can be of great importance in helping organisations and individuals operate more efficiently and make well-informed decisions.

Geographers contribute to policy and decision making by:

- publishing their research findings—these works influence society's general understanding about issues, and society's opinions are transmitted to decision makers through a variety of channels, such as opinion polls, the media, letters and deputations to decision makers, protests and the ballot box
- providing expert advice in published reports and in presentations to decision-making bodies
- participating in the formal decision-making process through their interactions with decision makers. They might also be formally appointed to decision-making bodies, where their knowledge and professional judgement can inform the decision-making process.

1.2 Geography's contribution to the decision-making processes of governments and business



ACTIVITIES

Knowledge and understanding

1 Explain why we are all geographers.
2 Distinguish between physical and human geography.
3 Outline the intrinsic value of geography.
4 Outline the utilitarian value of geography.

Applying and analysing

5 Study Figure 1.2. What does this diagram tell us about geography's contribution to the decision-making processes of business and government?

Investigating

6 Study Figure 1.2. Select one of the fields of study shown in the diagram. Collect a minimum of five recent articles about one of these fields. Prepare a short report on how an understanding of geography contributes to the decision-making processes of business and government in this field.

1.2 The environment: Life's support system

The environment is the totality of our surroundings and comprises the living and non-living features of the earth's surface. The term 'biophysical environment' refers to features that are altered or created by people, called the managed and constructed environments. People perceive, adapt to and use environments in different ways.

People and the environment

Geographers are interested in the relationship between people and the **environment**. People depend on the environment for their survival and wellbeing. The environment supports and enriches our lives by providing raw materials and food, absorbing and recycling wastes, and being a source of enjoyment, inspiration and spiritual wellbeing. It also influences our lifestyles, our recreational activities and the ways in which we use the land.

Environmental change

Environmental change is any alteration to an environment that disturbs natural **ecological** processes. Some environmental changes have beneficial outcomes for humans. The clearing of land for agriculture and the grazing of animals, especially when combined with irrigation, have increased food production; and mining and forestry have provided the resources necessary to construct water storage facilities, buildings, machines, vehicles and transport infrastructure. All these activities have promoted economic growth and employment. Some environmental changes can have negative effects, especially if they result in soil erosion, air and water pollution, or climate change.

Challenges to sustainability

Population growth

Many of the challenges facing humanity are directly related to the surge in the world's population. Increasing numbers of human beings, combined with improved material standards of living (for some), have greatly increased the demands people place on the planet, its resources, ecosystems and environmental processes.

Energy use

The burning of **fossil fuels**, which are used to meet people's energy needs, has had a major impact on the earth's atmosphere. The **development** of alternative sources of energy, such as solar energy, wind power, tidal flow and hydroelectricity, is one way of reducing people's reliance on fossil fuels.

Climate change

Over the last 200 years, the amount of carbon dioxide present in the atmosphere has increased by more than 25 per cent. The main cause of this increase is the burning of fossil fuels (oil, coal and natural gas) and the cutting down of trees, which convert carbon dioxide into oxygen. Increasing global temperatures, rising sea levels and the retreat of ice caps and glaciers have all been linked to this impact of people on the atmosphere.

Pollution

Pollution is the release into the environment of any matter that has a harmful effect. Pollutants, many of which are the product of our demand for consumer goods, can reduce the ability of the biophysical environment to provide ecosystem services (clothing, food and shelter).

Land degradation

The removal of natural vegetation (the result of deforestation, overgrazing and farming) is the main cause of **land degradation**. When trees are removed the land is exposed to the agents of erosion: wind and running water.

Urbanisation

The migration of people from rural areas to large cities has created many problems. The rapid growth of cities, especially in developing countries, has overwhelmed the ability of authorities to meet the basic needs of the urban population. Overcrowding, pollution and the growth of squatter settlements are all results of rapid urbanisation.

Exploited oceans

The world's oceans are an important natural resource. Of particular importance are the world's fisheries. These supply vast amounts of food. Unfortunately, the rate at which this resource is being exploited is unsustainable. Pollution is another major problem affecting oceans. If oceans are to be used sustainably, their use must be carefully managed and there needs to be international cooperation.

1.3 In the Tripa peat swamp forest of Indonesia, the Sumatran orang-utan population has declined by 80 per cent, as people have burnt forest to clear tracts of land for oil palm production.

Habitat loss

A **habitat** is the physical environment in which a community of plants and animals lives. As habitats are destroyed, the communities of plants and animals that depend on them are displaced. Some of these face extinction, such as the orang-utan in Indonesia (see Figure 1.3).

SPOTLIGHT

Biosphere 2

In 1991, eight men and women moved into a US$200 million purpose-built glass and steel replica of the earth's biomes in the Arizona desert. Known as Biosphere 2, the complex was designed to investigate whether the eight occupants could be self-sustaining in a sealed-off environment. It was hoped that a facility such as this could be used to colonise outer space.

The original idea was for the inhabitants to grow all their own food, and for the biomes, which included oceans with coral reefs, mangrove wetlands, tropical rainforest, savannah grasslands and a fog desert, to supply naturally recycled air and water. Despite the use of the latest technology, Biosphere 2 could not produce enough air, water or food to support the eight people. Significantly, the level of carbon dioxide could not be controlled. The experiment was abandoned after just three years. Today, the University of Arizona uses Biosphere 2 for scientific research.

1.4 Biosphere 2, a failed attempt to recreate the complex ecological processes of planet earth

ACTIVITIES

Knowledge and understanding

1. Define the term 'environment' and outline its importance.
2. Outline what 'environmental change' is and explain how it can be both beneficial and detrimental.
3. Outline the impacts of world population growth on the environment and how this affects the wellbeing of people.

Applying and analysing

4. Study the Spotlight box: Biosphere 2. Describe what this example tells us about the complexity of the earth's environmental processes.
5. Construct an annotated mind map highlighting the key challenges to sustainability.

1.3 Towards a sustainable future

Environments were once considered 'bottomless pits'—infinite stores of resources that could be exploited for the benefit of humans. Today, environments are seen as fragile, threatened systems in need of careful management. The concept of sustainability is at the centre of contemporary approaches to environmental management.

Sustainability

Sustainability in an ecological context refers to the ability of biological systems to remain diverse and productive. For humans, sustainability is about maintaining the capacity of the environment to support life well into the future and the quality of life.

Four functions of environments

The capacity of the earth to support life and human wellbeing depends on maintenance of the four functions of the environment, as outlined in Figure 1.5.

Source

The source function is the provision of the naturally occurring resources needed to sustain life and our material wellbeing. It includes the minerals and ores, timber and food—the plants we grow, the animals we graze and the seafood we harvest.

Sink

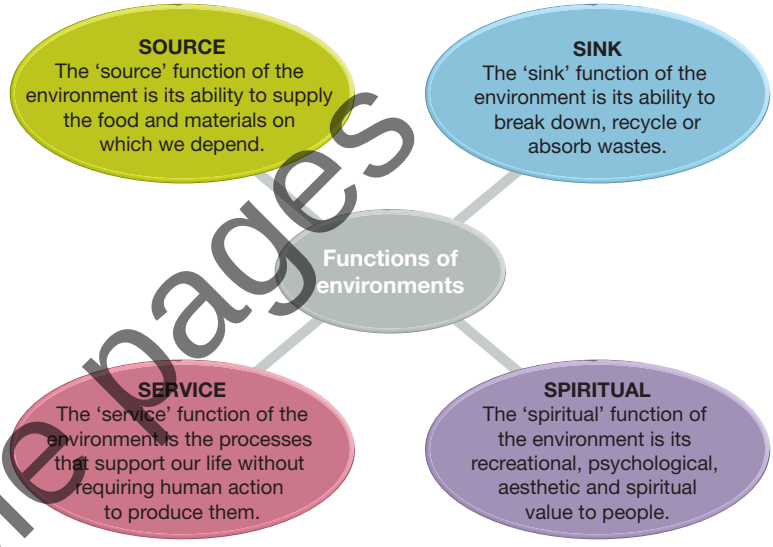
The sink function is the ability to break down, recycle or absorb and render harmless waste and pollution. The world's oceans, for example, are the largest active carbon sinks on earth. When waste output exceeds the limit of the sink function, long-term damage occurs.

Service

The earth's environmental service functions are all those things done for us by the biophysical environment; for example the absorption of carbon dioxide and production of oxygen by forests, and the filtering of water and recycling of nutrients via the process of decomposition by wetlands.

Spiritual

The spiritual functions of the environment include its cultural and recreational value to people and the ways in which it enriches the aesthetic experience of people.



1.5 The four functions of environments

Sustainable development

Sustainable development is development that meets the needs of the present population without affecting the ability of future generations to meet their needs.

The aim of sustainable development is to achieve improvements in people's quality of life or wellbeing while protecting the environment. Sustainable development and good environmental management go hand in hand. If we are to put sustainable development into practice we must:

- use the earth's renewable resources in ways that do not reduce their usefulness for future generations
- involve people in making the decisions that affect their lives and their environment
- develop technologies that are cleaner, use less energy and require fewer natural resources
- reduce the waste we produce, and make products that last longer and are easy to recycle and repair
- reduce the amount of energy we use
- encourage the development and use of renewable energy from the sun, wind and flowing water.

SPOTLIGHT

The earth's carbon stores, sources and sinks

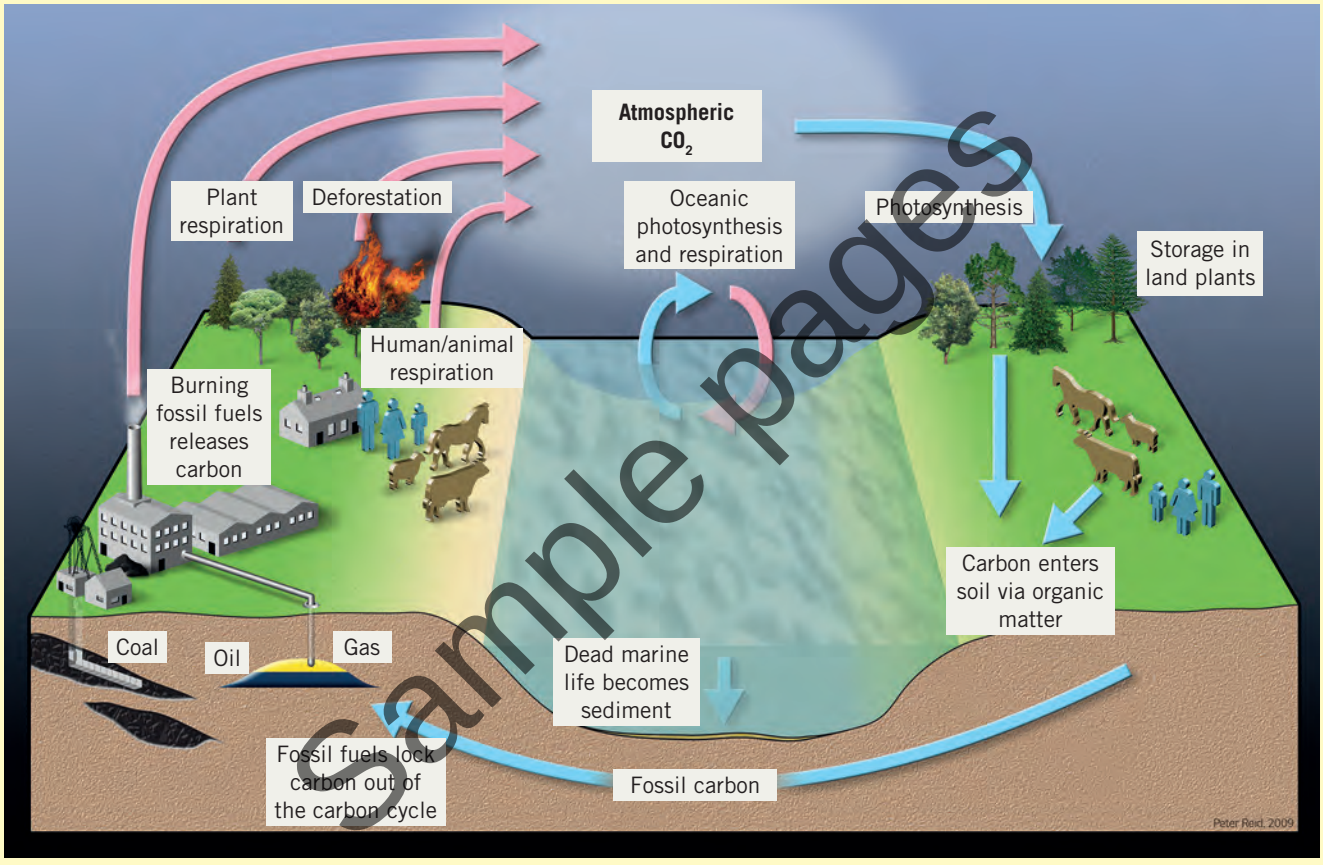
Carbon dioxide (CO_2) is continually recycled on earth. The environmental processes by which CO_2 is released to the atmosphere are called carbon sources, while processes that absorb it are called carbon sinks. The atmosphere, fossil fuels and the earth's forests, soils and oceans are important stores of carbon. Carbon is constantly moving between these different stores. A carbon sink absorbs more carbon than it gives off, while a carbon source emits more than it absorbs.

Volcanoes, forest fires, decomposition, respiration and, under certain conditions, the world's oceans are all natural 'sources' of atmospheric CO_2. When the oceans warm or are disturbed by storms they can release large amounts of dissolved CO_2.

Photosynthesis, forests, oceans and freshwater bodies and fossil fuels are all natural 'sinks' for atmospheric CO_2.

The amount of carbon in the atmosphere at any one time depends on the balance that exists between the various sources and sinks. This system of sinks and sources is referred to as the **carbon cycle**.

1.6 The earth's carbon stores, sources and sinks



ACTIVITIES

1.1

Knowledge and understanding

1 State how our thinking about environments has changed over time.
2 Outline the four functions of the environment.
3 Explain what is meant by the term 'sustainable development'.

Applying and analysing

4 Identify the source, sink, service or spirituality functions of the environment shown in Figure 1.6. Which of these functions is of greatest value to humans? Justify your choice. What would be the impact if this environment was degraded or destroyed?
5 As a class, brainstorm the concept of 'sustainability'. Develop a mind map highlighting the main points raised in the discussion. Use the mind map to write your own definition and explanation of 'sustainability'.
6 Email the Australian Prime Minister with suggestions about how the government could promote sustainable development.

1.4 World population growth

In 2014, 7.2 billion people inhabited planet earth. By 2050, there will be 9.6 billion of us. At the beginning of the last century there were just 1.6 billion people. This rapid rise in human numbers is unprecedented and threatens the wellbeing of the environmental systems on which all life depends.

World population trends

Table 1.7 shows the growth in the world's population since 1000 AD. The highest rates of world population growth occurred during the 1950s and 1960s. They peaked at 2.2 per cent in 1963 before declining to just 1.05 per cent in 2014, as illustrated in Figure 1.8. Population growth is expected to decrease. Table 1.9 shows how long it has taken to add each additional billion to the world's population.

1.7 World population growth rates, 1950–2100. Note that the 2100 population size is a medium prediction by the United Nations. The low prediction is 6 billion and the high prediction is 16 billion.

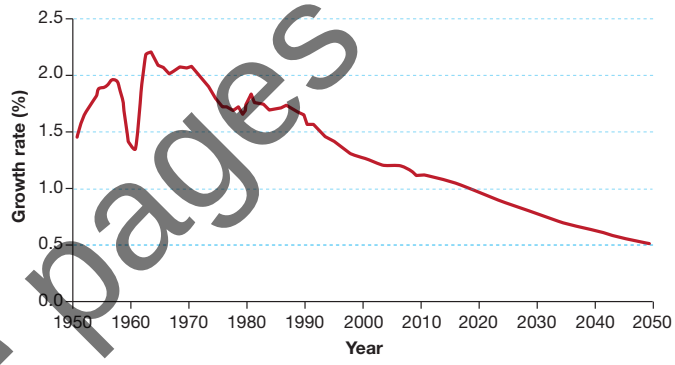
Year	Population (million)
1000	275
1100	306
1200	348
1300	384
1400	378
1500	429
1600	486
1700	635
1800	919
1900	1571
2000	6073
2100	10853*

* UN estimate

DID YOU KNOW?

The total number of humans who have ever lived is estimated to be 107 billion.

1.8 World population growth rates, 1950–2050



Source: US Census, 2011

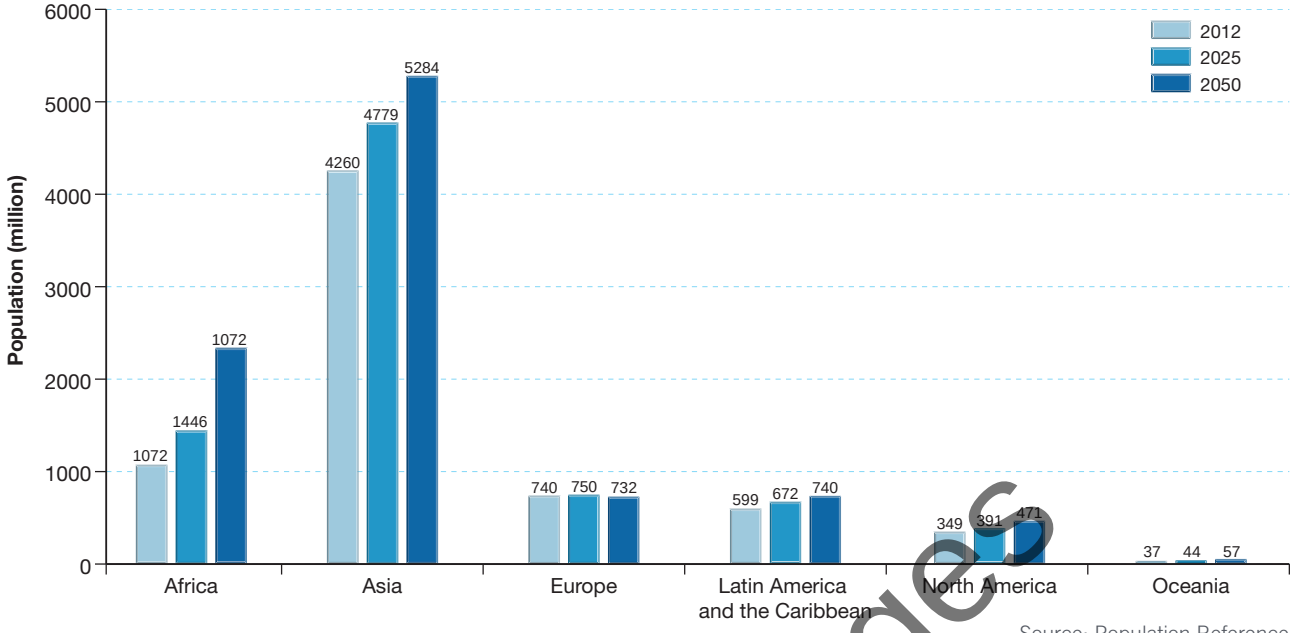
1.9 Adding billions

World population	When reached	How long did it take?
1 billion	About 1800	Since the beginning of humanity (2 million years)
2 billion	1930	130 years
3 billion	1960	30 years
4 billion	1974	14 years
5 billion	1987	13 years
6 billion	1999	12 years
7 billion	2011	12 years

Source: Population Reference Bureau, 2012 World Population Data Sheet

The population of the world's developed regions will remain largely unchanged at around 1.3 billion between now and 2050. In contrast, the population of the 49 least developed countries is projected to double from around 900 million people in 2013 to 1.8 billion in 2050. Population growth will be greatest in Africa. Figure 1.10 shows projected world population growth by region in 2013, 2050 and 2010.

1.10 Current and projected world population growth by region, 2012, 2025 and 2050



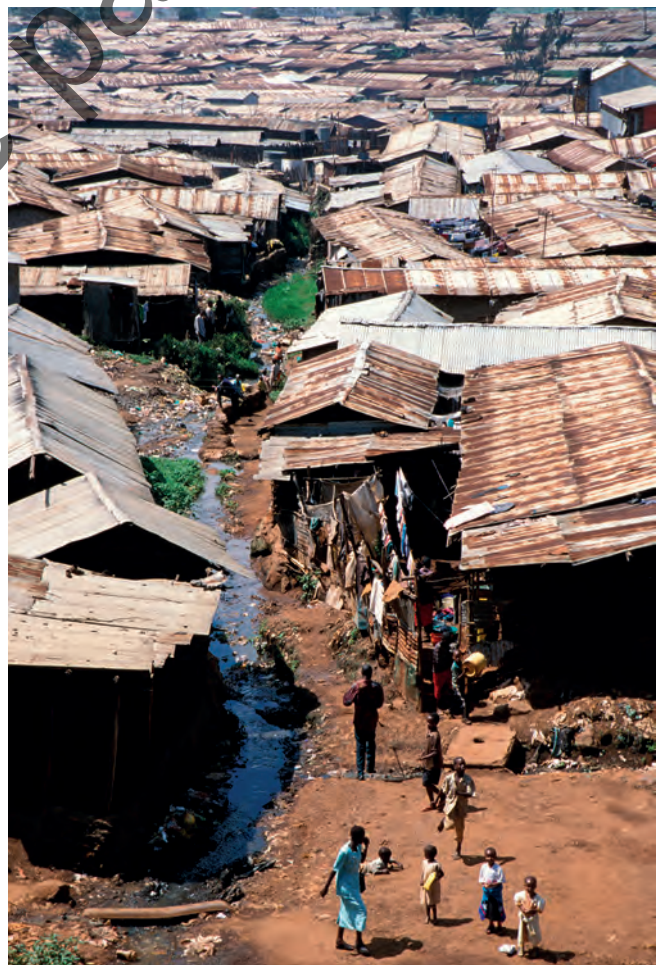
Source: Population Reference Bureau: 2012 World Population Data Sheet

Improving the wellbeing of people in developing countries is, not surprisingly, a major challenge facing humanity. Unless economic growth occurs at a rate faster than population growth, people will get a small share of the 'economic pie'.

Consequences of rapid population growth

Many people around the world are inadequately fed, housed, educated and employed. Billions of people live in conditions that Australians would find intolerable, as shown in Figure 1.11. Demographers predict that the earth's population will grow until a fall in fertility rates brings about a gradual decline in population in the latter part of this century.

The problem with population growth is the material demands of the population, especially those living in the developed world. Over 1 billion people enjoy lifestyles that impose a disproportionate demand on our planetary ecosystems. This consumerism is powered by a sudden expansion in our technological capabilities that has enabled us to use (and sometimes misuse) natural resources. Our massive demand for the energy sourced from fossil fuels, for example, is altering the composition of the earth's atmosphere. The resulting climate change endangers whole ecosystems and perhaps humanity itself. Humanity has, however, confronted such challenges before. In recent times it has successfully addressed the issues of acid rain and ozone depletion. Collectively, we can reduce our environmental footprint by limiting our consumption of fossil fuels and by developing alternative (renewable) sources of energy. Humanity has the capacity to confront such issues. It also has the ability to address issues of global inequality.



1.11 Nairobi's Kibera slum. Meeting the needs of people living in the world's cities is a major challenge.

The big shift

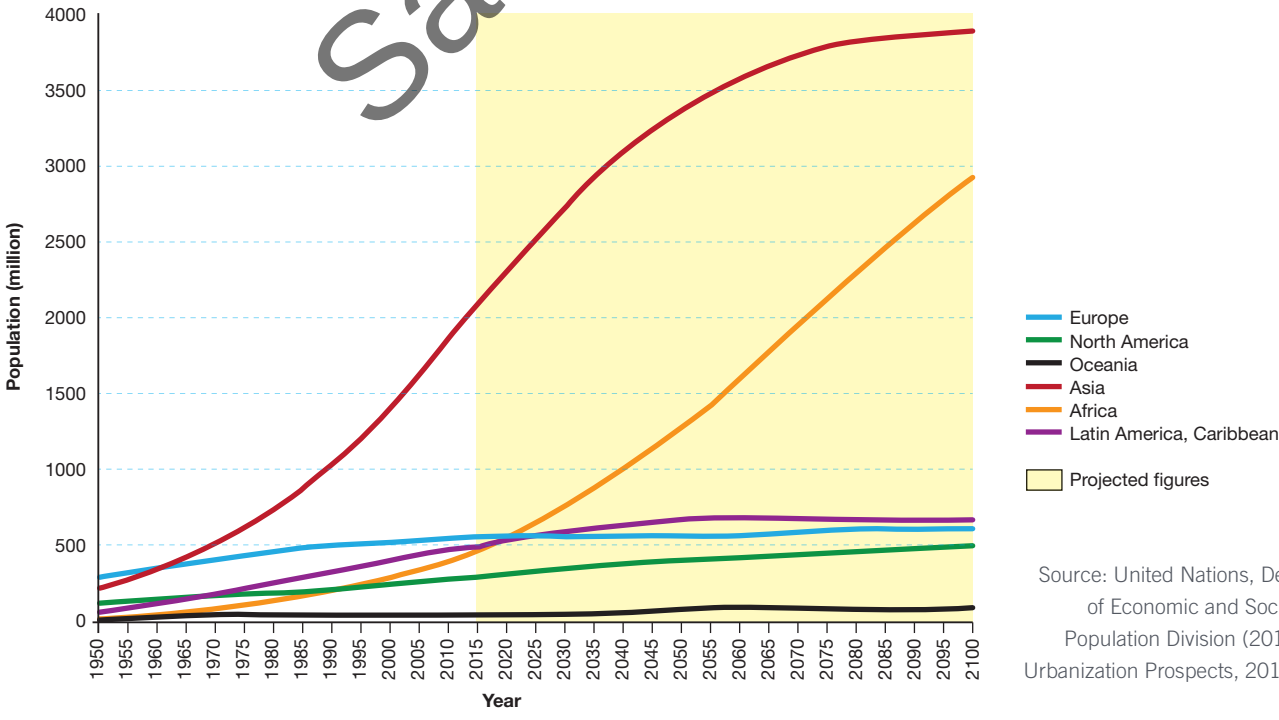
In 2007, the world reached an important milestone. For the first time in the planet's history, more than half the human population lived in urban areas. There are now 3.3 billion urban dwellers. Table 1.12 shows urban population distribution in 2011. By 2030, this number is expected to grow to almost 5 billion. Many of the new urban residents will be poor. Their future, in cities in developing countries, and the future of humanity itself depend on how increasing urbanisation is managed.

1.12 The proportion of people living in urban areas

	Urban population percentage, 2011
World	51
Developed	75
Less developed	46
Least developed	28
Africa	39
North America	80
South America	80
Asia	44
Europe	71
Oceania	66

Source: Population Reference Bureau, World Population Data Sheet, 2011

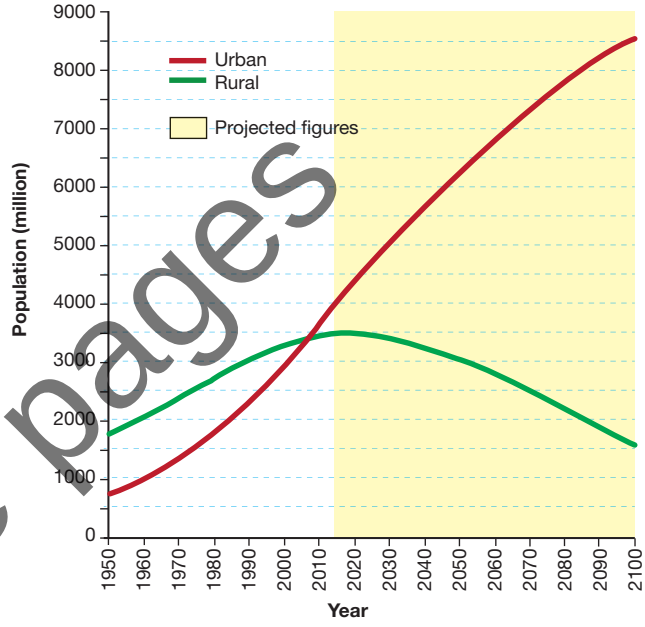
1.13 Urban population by major regions, 1950–2100



Source: United Nations, Department of Economic and Social Affairs, Population Division (2012): World Urbanization Prospects, 2011 revision

The world's urban population grew very rapidly over the course of the twentieth century: from 220 million to 2.8 billion. The next few decades will see an unprecedented scale of urban growth in the developing world. By 2030, the towns and cities of the developing world will make up 80 per cent of the world's urban population. Figure 1.13 shows past and projected urban populations by world regions. Figure 1.14 shows past and projected world trends in urban and rural populations.

1.14 Urban and rural populations, 1950–2100



Source: United Nations, Department of Economic and Social Affairs, Population Division (2012): World Urbanization Prospects, 2011 revision

There is, however, a positive side to this transformation. When people move to the cities, the fertility rate declines. Over time, this will help to stabilise the world's population.

The big issue is how the planet will cope with the ecological footprint of these additional consumers, especially if the material expectations of people in developing countries continue to increase.

Skillsbuilder

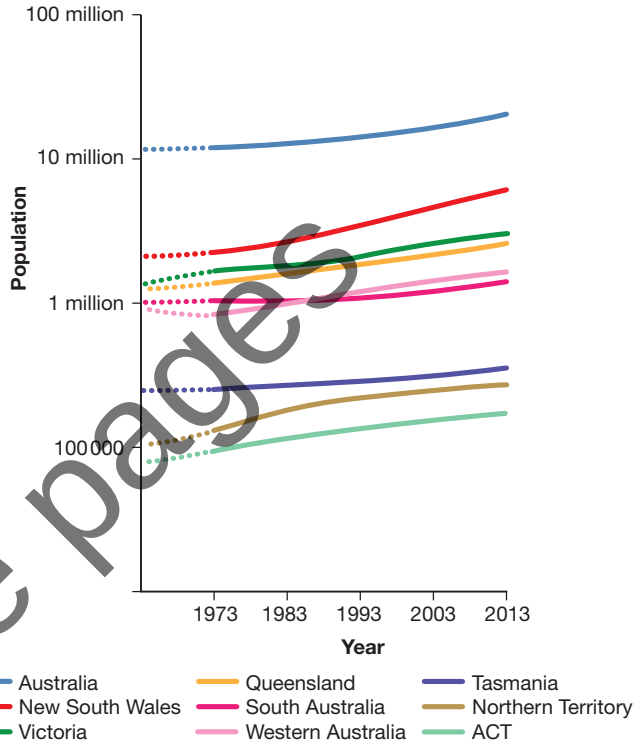
Semi-logarithmic graphs

We use semi-logarithmic graphs when we need to graph a range of values that are difficult to fit on a standard graph. Semi-logarithmic graphs can accommodate data with a huge range of values. They also enable us to make judgements about the rate of change—the steeper the graph, the greater the rate of change.

Semi-logarithmic graphs have a vertical scale that is graduated in a semi-logarithmic progression. This means that equal intervals or cycles on the vertical scale increase geometrically, for example 1, 10, 100, 1000, 10 000. The horizontal scale has a normal arithmetical progression.

Figure 1.15 shows a semi-logarithmic graph for Australian population growth by state from 1973 to 2013.

1.15 Australian population, 1973–2013



Source: ABS

ACTIVITIES

Knowledge and understanding

1. Explain why the increasing material demands of a growing world population are a problem.
2. Outline the trends in world population.
3. Explain why the 'big shift' from rural to urban living is seen as a positive development.

Geographical skills

4. Study Table 1.7. Construct a semi-logarithmic graph showing the growth of the world's population (actual and projected) between 1000 and 2100. (Hint: use a scale of 10 million, 100 million, 1 billion, 10 billion and 100 billion.) In which period did the world's population grow most rapidly?
5. Study Figure 1.8. Using data from the graph, describe the trend in world population growth rates.
6. Study Table 1.9. Outline the trend apparent in the time it takes for the world to add each additional billion people to its population.
7. Study Figure 1.10. Identify the regions of the world projected to have the most rapid increases in population growth between 2012 and 2050. Which region will have the slowest growth? What are the implications of these trends?
8. Study Figure 1.13. Identify the regions that will experience the most rapid rise in urban population in the period 2010–2100.
9. Study Figure 1.14. Using data from the graph, describe the projected trends in the world's rural and urban populations.

1.5 Pollution

Pollution is any hazardous or potentially hazardous substance released into the environment. It can affect people's wellbeing and the ability of the environment to provide environmental services.

Air pollution

Air pollution is the contamination of the atmosphere by substances that can, either directly or indirectly, impact on human health and welfare. Sulfur dioxide, particulate matter, nitrogen oxides, carbon monoxide and lead are common atmospheric pollutants. Air pollution can irritate existing respiratory conditions, bring on an asthma attack, irritate people's eyes, produce unpleasant odours, damage property and reduce visibility. In the large cities of the developing world, air pollution is a major environmental problem.

Water pollution

Water pollution occurs when pollutants are directly or indirectly released into oceans, rivers, lakes and aquifers without adequate treatment to remove harmful substances.

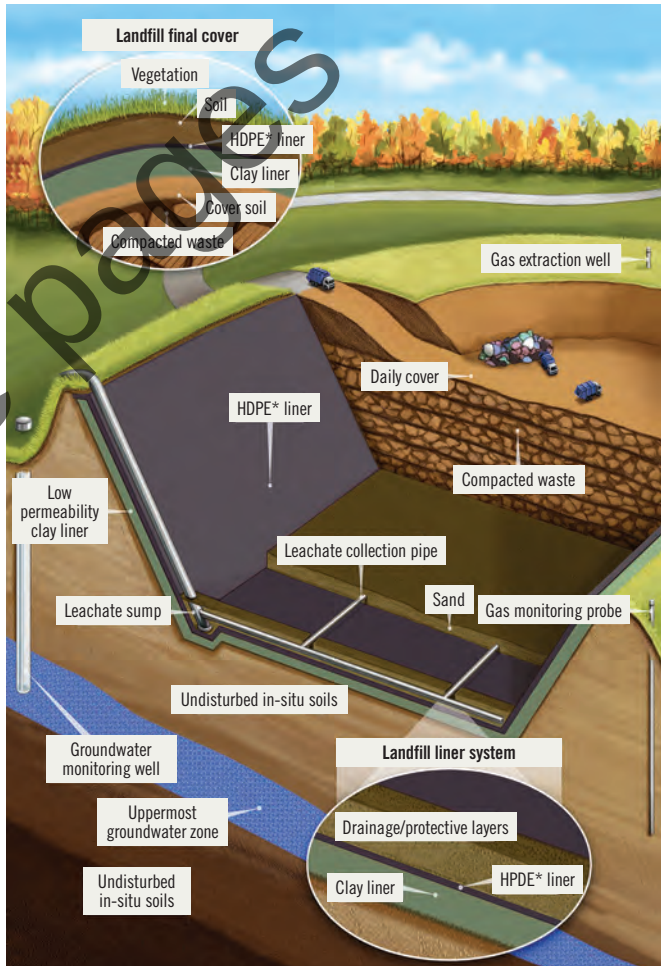
Dirty water is the world's biggest health risk, and continues to threaten both quality of life and public health. Many of our water resources lack basic protection, making them vulnerable to pollution from farms, industrial plants, and activities such as fracking. This can lead to drinking water contamination, habitat degradation and beach closures. Urban run-off is a particular concern. When water from rain runs off roofs and roads into waterways, it picks up toxic chemicals, dirt, litter and disease-carrying organisms.

Solid wastes

Solid wastes include most of the rubbish we would normally throw into rubbish bins, plus many of the wastes produced by industrial plants and the building industry. As populations grow and standards of living increase, the amount of solid waste produced increases.

There are a number of environmental hazards associated with casual waste disposal. These include the contamination of groundwater by toxic substances; soil contamination; methane emissions; and dust, vermin and odour. These hazards can also occur in poorly managed landfill sites.

1.16 A well-managed landfill site



*HDPE (high-density polyethelene) is a strong plastic.

The alternatives to casual waste disposal are recycling, re-use and waste reduction.

- ***Recycling:*** materials such as glass, plastic, aluminium, steel and paper can be reprocessed and used again.
- ***Re-use:*** re-using printer ink cartridges by having them refilled.
- ***Waste reduction:*** you can choose to buy goods without a lot of packaging and use re-usable bags instead of the disposable plastic bags provided by supermarkets.

In Australia, 54 per cent of waste ends up in landfill sites (this is down from 93 per cent in 1996–97). Wetlands and old quarries have, for many years, been sites for the disposal of this type of waste, but wetlands are now considered too important to use for waste disposal, and old quarries are in short supply. Figure 1.16 shows a well-managed landfill site.

Types of waste

E-waste

Obsolete electronic goods (known as e-waste) are one of the fastest-growing waste types, and their safe disposal is a major problem. In 2013, nearly 50 million tonnes of e-waste was generated worldwide—or about 7 kilograms for every person on the planet. Mobile phones, laptops, tablets, iPods and iPads, plasma and LCD televisions and electronic gaming machines are all constantly being updated and replaced. These products are made up of hundreds of different materials and contain toxic substances such as lead, mercury, cadmium, arsenic and flame retardants.

Much of the e-waste generated in developed countries ends up in processing plants in India, China and other parts of Asia. There are concerns about the working conditions in these plants as exposure to toxic substances can be hazardous to health.

Plastic waste

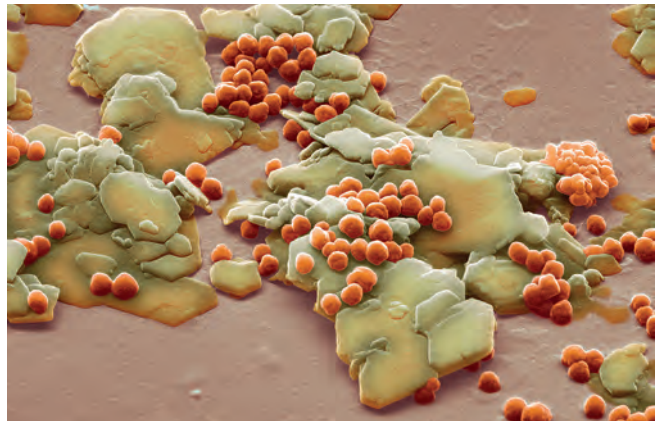
Plastic shopping bags are very damaging to the environment. Consider the following facts.

- Australians consume about 6.9 billion plastic bags every year. If these were tied together they would stretch around the world thirty-seven times.
- Every year, up to 80 million of these bags find their way onto our streets as rubbish.
- The World Wide Fund for Nature estimates that more than 100 000 whales, seals, turtles and birds die every year as a result of plastic bags.

Environmental groups advocate the imposition of a plastic bag levy. By imposing this added cost on retailers (and/or consumers), environmental groups hope to encourage the use of re-usable alternatives.

Microplastics and microbeads

Microplastic pollution found in marine environments originates from either larger pieces of plastic broken into smaller pieces over time, or from cosmetic products (soaps, exfoliants and toothpastes) that contain microbeads made from polyethylene. These pieces of plastic, shown in Figure 1.17, are too small to be filtered during wastewater treatment and are discharged into the water cycle, making their way into freshwater and marine environments, then the food chain. There are efforts worldwide to lobby cosmetic companies to stop using microbeads in their products.



1.17 Facial scrub particles shown under an electron micrograph. It is thought that small marine animals ingest the microplastics and pass the pollutant up the food chain.

Toxic wastes

Toxic wastes (sometimes referred to as hazardous wastes) are chemicals that can cause death or injury to living creatures. While toxic wastes are most often associated with industrial processes, they can also be found in the home and are widely used in agriculture, medical procedures and light industries such as dry-cleaning establishments. Toxic wastes can pose a long-term risk to people's health. They can enter the food chain, where they accumulate in the fatty tissues of animals (a process known as **bioaccumulation**). Some of these animals form part of the human food chain. Once they accumulate, these toxic substances can cause birth defects, cancer and developmental disorders. Abandoned industrial sites can be a major problem, especially when the site and/or adjacent waterways contain e-waste concentrations.

ACTIVITIES

1.2

Knowledge and understanding

1 Define the term 'pollution'.
2 Outline the impacts of air pollution.
3 Explain why water pollution is considered a health risk.
4 State why the disposal of solid wastes is increasingly problematic.
5 Outline the alternatives to the dumping of wastes.

Applying and analysing

6 Study Figure 1.16. Write a report highlighting how a landfill site can be managed in a way that protects the environment.
7 Develop an information campaign educating the public about one of the types of pollution: e-waste, plastic waste or toxic waste.

Review and reflect 1

Activity 1

Global citizenship

a Study the views shown in Figure R&R 1.1. Discuss the comments. Are they examples of good global citizenship? Prepare a series of statements presenting an alternative perspective.

b Find someone in the community whom you think is a good global citizen to interview. Your interview should be presented as an oral report. You should describe the person's qualities and outline the contribution the person makes to the wellbeing of society and/or the environment.

Before you interview the person, consider the following tasks, to ensure you are prepared.

- Decide how you will interview the person: via the phone, in person, via email, Skype or Google Hangouts, etc.
- Consider how you will record their answers: written responses, audio or video.
- Write down the questions you want to ask. Start with 'ice breaker questions', which encourage people to talk about themselves. Remember to ask 'open-ended questions', such as 'tell me about a time when …'

R&R 1.1 Some negative attitudes about global citizenship

Activity 2

Developing a plan of community action

Become actively involved in a geographical issue affecting your local community. Develop your own campaign by following the steps below.

a Become informed about the issue.
b Develop strategies to increase community awareness about the issue. For example, you could make posters that explain or illustrate the issue. Display these around the community. You could also seek publicity for your campaign by contacting the local media and writing letters to the editor for publication in your local newspaper.
c Try to influence decision makers. Write letters or emails to local Members of Parliament and members of the local council. Outline your views on the issue in a clear and concise manner, and ask for their support.
d Evaluate your campaign. What was successful and what changes would you make if you were to be involved in another campaign?

R&R 1.2 A Gawler Region Community Forum Inc protest against the release of farmland for urban development

Activity 3

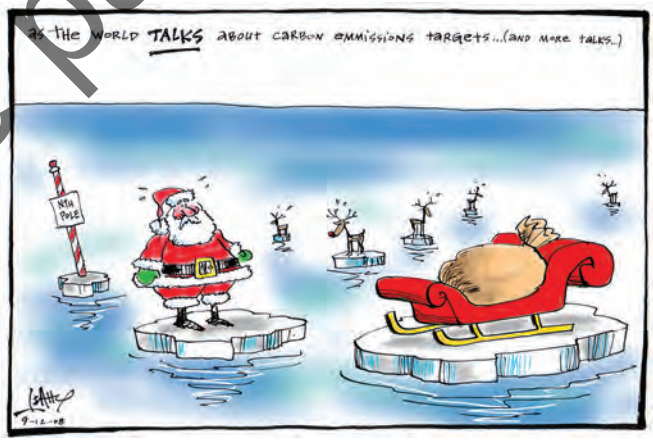
Global warming: Cartoon interpretation

a Study each of the following cartoons and identify the perspective or point of view of the cartoonist. Copy and complete the table below.

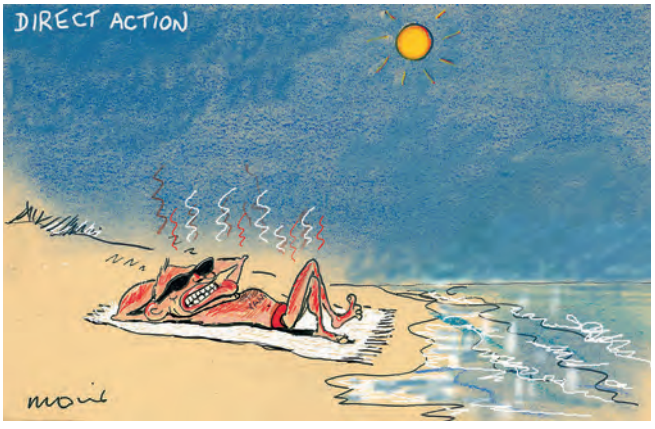
	Cartoon a	Cartoon b	Cartoon c
Location			
Images			
Themes			

b In your opinion, which cartoon has the most impact and which has the least impact. Why?
c Source two more cartoons with alternative views of climate change. Using the format in question a, interpret the themes of the cartoons.

R&R 1.3 Global warming, by Wilcox



R&R 1.4 Global warming, by Leahy



R&R 1.5 Moir's view on global warming scepticism

Activity 4

Reflecting on the ideas of others

We live in a system that has severed or rendered invisible many of our connections to nature—such as the food we eat, or the people and ecosystems from which our consumer products are derived.

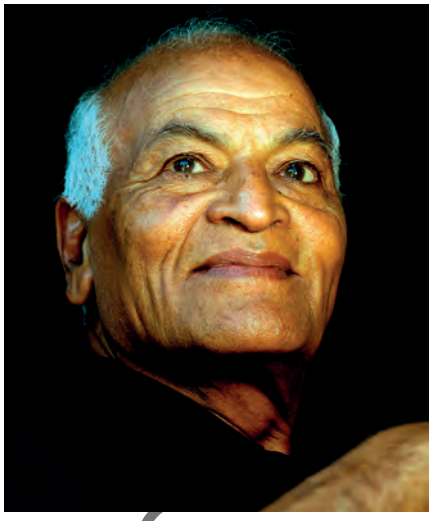
This has encouraged human beings to believe that they can manipulate and rearrange the material world any way they like, with few or no moral or ethical constraints, duties or obligations. Some also argue that the idea of material nature as a stockpile of inanimate resources lies at the centre of the modern consumerist worldview.

Further, we have obscured and hidden the natural origins of the … products we use every day. The packaged chicken in the grocery store has been cleaned, sanitised and presented in a way that disguises the fact that it was once a living, breathing animal [see Figure R&R 1.6]. The [mobile] phone is an assemblage of literally hundreds of material elements, mined, milled and gathered from around the world, manufactured, assembled, distributed and disposed of by faceless people to unknown places, with unknown environmental consequences. This entire organisation of the global economic system is constructed upon the underlying worldview and accompanying detachment from natural origins.

Source: A.A. Leiserowitz & L.O. Fernandez, *Toward a New Consciousness: Values to Sustain Human and Natural Resources*, Yale School of Forestry and Environmental Studies, 2007

R&R 1.6 Many people do not connect frozen chickens with living creatures

R&R 1.7 Environmentalist and humanitarian, Satish Kumar



A tree has intrinsic value. That is, a tree is good not because it gives me an aesthetic pleasure when I see the beautiful cherry blossoms. No, the cherry tree is good in and of itself, even if nobody goes and looks at it, if nobody ever says: 'Wow, look at those beautiful cherry blossoms!' Even if no one ever sees it, the tree will still blossom. This is divine grace appearing on the earth. And it has an intrinsic value. Trees, animals, plants, rocks, mountains, rivers, worms, butterflies, honeybees—every creature upon this earth has intrinsic value and the right to be as they are, who they are, what they are. We talk about human rights, and that's fine. But nature also has rights. The trees have a right to exist. We have no right to cut them down without proper purpose. And when you understand this, when you recognise the rights of the trees, then you are truly an ecologist.

Satish Kumar

R&R 1.8

Chef Seattle (1786–1866) leader of the Squamish and Duwamish Native American tribes in what is now the US state of Washington

The earth does not need us managing it in order to go on, whereas we depend on the earth for our survival. From this perspective, it makes little sense to talk about saving the earth. It has been around for billions of years and doesn't need saving. What we need to save is the existence of our own species and cultures, which may have been around for less than an eye blink of the 3.5–billion-year history of life on earth, as well as the existence of other species that may become extinct because of our activities.

Source: Chef Seattle, quoted in G. Tyler Miller & E.S. Spoolman, *Environmental Science*, 14th edition, Cengage Learning, 2013

a Select one of the following options about the production of chickens.
Option 1: Undertake group research on the various methods of producing eggs as well as chickens for slaughter. Each group is to present their findings to the class in a multimedia format.
Option 2: Conduct a class debate on the following topic: 'All chickens should be raised and live in free-range conditions'.

b Assess the relevance of Chef Seattle's environmental perspective in the modern world.

c Undertake research on the intrinsic value of elements of the natural world. Prepare a collage of images or create an artwork to demonstrate the importance of intrinsic value. Include a definition of intrinsic value in your visual presentation.

d Conduct a class debate on the following topic: 'Species such as mosquitoes do not warrant any protection'.

Activity 5

Where does my dinner come from?

a As your dinner is being prepared at home
- **i** record from the labelling where the food item is produced and packaged
- **ii** record the origins of fresh fruit or vegetables

b Undertake internet research on the location and methods of production, water requirements and environmental impacts of each of the various items of food identified.

c Present your findings on an annotated poster (include a map).

Activity 6

Mobile phone production

Undertake internet research to find the following information.

a Which rare earth minerals are used in the manufacture of many of the features of your latest phone?

b Where they are extracted?

c Which country owns most of these minerals?

d What are the working conditions like for the miners?

Present your findings in the format of a newspaper article.