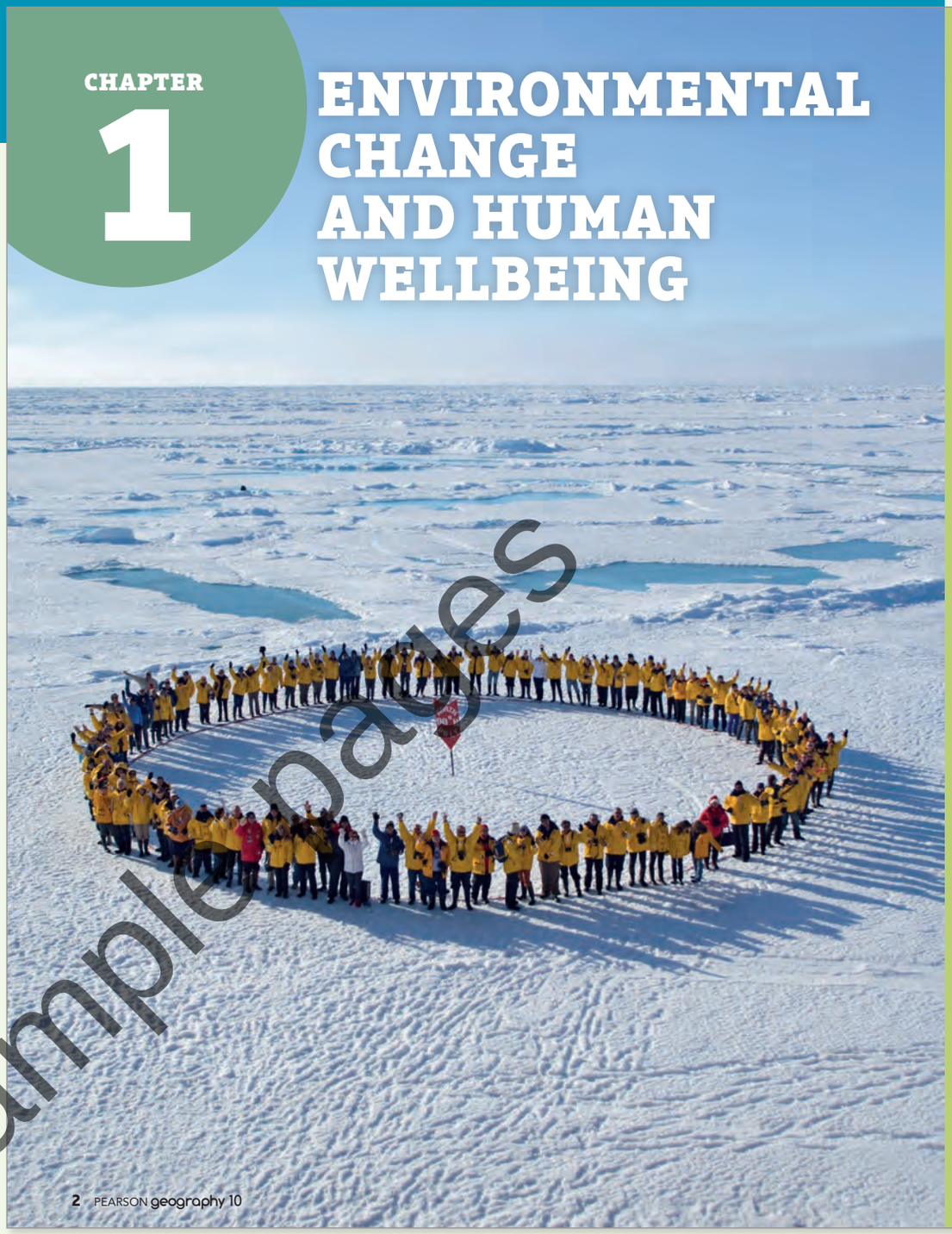
CHAPTER OVERVIEW

CHAPTER 1

ENVIRONMENTAL CHANGE AND HUMAN WELLBEING



What's coming up

This chapter provides an overview of how environments have changed over time and how they can change into the future, as a result of both natural processes and human activity. The functions of the environment are considered, as are the environmental worldviews of a number of stakeholders. This chapter also examines human wellbeing and the spatial patterns of wealth and poverty in the world. The perspectives of Aboriginal and Torres Strait Islander people on environmental management are discussed.

Using the image

The chapter opening image shows a group of people forming a human circle around the North Pole in July 2008.

Students examine the image and respond to the following questions.

1. What is the latitude of the North Pole?
   The latitude of the North Pole is 90° North.
2. Which countries of the world are located close to the North Pole?
   Countries close to the North Pole include Russia, the United States of America, Canada, Denmark, Norway, Sweden and Finland.
3. To which global environmental changes might these people be trying to alert the global community?
   Climate change and global warming
4. How could the melting of the Arctic ice cap affect neighbouring nations and the world?
   Sea levels could rise. New shipping routes could open up, with ice-free sea channels providing access for ocean-going vessels from the Atlantic Ocean through a north-west passage to the north of Canada into the Pacific. Indigenous people could witness major changes to their hunting lifestyle as habitats change and species face the risk of extinction. Greenland is witnessing warmer temperatures, the melting of its ice cap and glaciers and longer growing seasons, and crops previously considered impossible so far north are able to be grown. Russia has shown interest in drilling for oil and natural gas in the Arctic region.

Sample pages

Pre-quiz

Students respond to the following questions.

1. What is meant by the term 'environmental change'?
   Environmental change occurs when conditions in the biophysical and human world alter from those previously experienced. These changes may be positive, such as those encouraging economic development; or negative as is evident when land degradation occurs.
2. What is meant be the term 'human wellbeing'?
   Human wellbeing is the quality of life experienced by people individually and collectively.
3. What have been the impacts of increasing numbers of humans on the natural environment over time?
   The demand for all types of resources has increased. Forests have been cleared. Land has been cultivated to feed a growing urban-industrial population.
4. What are the functions of the environment?
   The environment has a range of functions. It is a source of natural resources (such as oxygen, water or oil).

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

Sample pages

It provides sinks in which waste and pollution can break down, be recycled and rendered harmless. It provides a spiritual function that enriches our lives, providing opportunities for recreation and aesthetic appreciation of the natural and human landscape.

5 What is meant by the term 'sustainable development'?
Sustainable development is a type of development that does not compromise the capacity of the environment to support life for future generations.

Getting started

In small groups students brainstorm major environmental changes and groups share their ideas with the rest of the class.

Draw up the groups' findings in the form of a three-column table, with the headings 'Environmental change', 'Scale' and 'Cause'. Students decide whether each change is occurring on a local, a regional or national, or a global scale, and whether it is due to natural or human causes, or both. Finally, students hypothesise about the potential impacts of these environmental changes on people and the environment over time.

EAL/D support

Oral rehearsal

Photographs are useful to spark discussions and encourage EAL/D students to practise their use of language.

Conduct this activity in pairs so that students can answer the questions aloud to their partner:

- Present tense: What do you see in the photograph? Who are the people in the photograph?
- Present continuous tense: What are the people doing/wearing?
- Past tense: Who took the photograph?
- Past continuous tense: What were the people doing?
- Passive voice: Where was the photograph taken? When was the photograph taken?

PEARSON geography 10 RESOURCES

Pearson Reader and eBook

Documents
Test: Environmental change and human wellbeing
Teaching program: Chapter 1

Interactive activities
Definitions
People and the environment
Carbon: Stores, source and sinks
Population growth
Pollution
Marine environments
Climate change
Environmental worldviews
Indigenous environmental management

Interactive case studies
Kinglake National Park
Managing Adelaide's coastline
Estuarine wetlands—Queensland
The sustainability on Ningaloo Reef

Templates
Graphic organisers
Blank outline maps

Pearson Reader extra content

Interactive activities
Features of populations
The greenhouse effect and the ozone hole
Effects of human activity on ecosystems
Biodiversity
Humans and environment
Conservation of natural resources

Geographical knowledge and understanding

Group work

Geography's contribution to understanding the world we live in

MI: verbal–linguistic, interpersonal, intrapersonal

Draw up an A3 sheet of paper entitled 'Geography's contribution to understanding our world' with three rectangles, headed:

a What geography is and what geographers do.
b Different branches of geography and what they study.
c How geography can contribute to our understanding of the world around us.

In groups of three or four, students write four or five statements about what geography is and what geographers do.

Then, using a dictionary of geography or internet sources, each member of the group undertakes research about one of the following branches of geography:

- hydrology
- climatology
- biogeography
- economic geography
- social geography
- geomorphology
- urban geography
- cartography (geographic information systems).

Students report back to the group by adding their responses to the A3 summary sheet.

Students then develop a summary of the subject's contribution to the world around us.

AC general capabilities: literacy; ICT; critical and creative thinking; personal and social capability

AC geographical concepts: place; space; environment; interconnections; sustainability; scale; change

Geographical inquiry and skills

Geoskills

Photo sketch

MI: visual–spatial, bodily–kinaesthetic, naturalistic

Students do an annotated sketch of the photograph shown in Figure 1.1 of a location in the Denali National Park in Alaska, USA. The environment shows a rugged and spectacular natural environment close to the high latitudes where the treeline gives way to groundcover vegetation. They give the sketch a title and identify components of the biophysical environment, such as ground cover plants; coniferous trees; hills, valleys and mountains; and clouds.

Students describe the environment they have sketched and decide whether this is a natural or human environment. They select two of the branches of geography shown in Figure 1.2 and explain how geographers working in these fields could apply their knowledge to make sense of their sketched environment.

Climatologists could collect climatic data from weather stations in the region to assess whether there have been any long-term changes in average temperatures and rainfall conditions. Biogeographers could analyse the nature of the vegetation in the location and explain why coniferous trees grow here but then give way to low groundcover plants. They would probably suggest that the changes in vegetation cover are related to the latitude of the national park (being so far

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.

Sample pages

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.

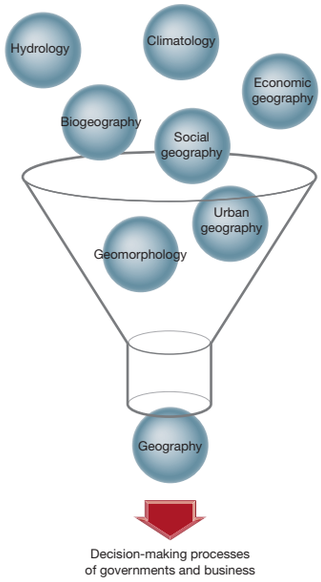
Utilitarian value of geography

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.

Sample pages

north of the Equator) and the cold and snowy conditions that would prevail in this location during the long winter months.

AC general capabilities: literacy; critical and creative thinking; personal and social capability

AC geographical concepts: place; space; environment; interconnections; scale; change

EAL/D support

Starter activity

EAL/D students are more likely to engage with geographical concepts when they are able to make links based on their personal knowledge and experiences.

Students produce a mind map with the term 'geography' in the centre. They brainstorm their own interpretation of the term 'geography', and link these ideas with arrows and brief notes as necessary.

Students can extend these ideas by categorising their words based on the following groupings:

- natural words (e.g. forest, trees, oceans, deserts)
- urban words (e.g. cities, buildings, development)
- weather words (e.g. rain, sunshine, seasons, wind)
- landform words (e.g. hills, mountains, trenches, plains, gorge)
- employment words (e.g. biologist, scientist, geologist)
- management words (e.g. legislation, policy)
- geoskills words (mapping, graphs, photographs, drawings).

Activity answers

Knowledge and understanding

1 Geography is the study of places and relationships between people and their environments. As all people explore and experience both physical elements of the planet and human society, it can be said that 'we are all geographers'.
2 Physical geography is the study of earth's seasons, climate, atmosphere, soil, streams, landforms and oceans, while human geography is the study of the distribution of networks of people and cultures on the earth's surface.
3 Studying geography and gaining knowledge about places and spaces greatly enhance our aesthetic appreciation of the world in which we live, which can enrich our lives. In this way, geography is intrinsically a part of our day-to-day life.
4 Geographical knowledge is of great value to planners, forecasters and decision makers in business and government. It enables decisions about environments, communities and businesses to be informed and more accurate.

Applying and analysing

5 Figure 1.2 shows that when governments and businesses use geography during their decision-making processes then they take into account a wide variety of social, economic and political themes—which ultimately results in better decisions being made.

Investigating

6 Student answers will vary.

Geographical knowledge and understanding

Evaluate understanding

Types of environmental change

MI: visual–spatial, verbal–linguistic, logical–mathematical, naturalistic

Students identify at least five types of environmental change from the text. They source visuals from the internet or other reference sources to provide an example of these changes at a specific location. They then develop a set of criteria to explain why these changes are either positive or negative for people and the environment.

AC general capabilities: literacy; critical and creative thinking

AC geographical concepts: place; space; environment; interconnections; scale; change

Geographical inquiry and skills

Geoskills

Showing global-scale environmental changes

MI: visual–spatial, bodily–kinaesthetic, naturalistic

Working in groups of three or four, students develop an annotated graphic display entitled 'Environmental change in the world'. To do this, students paste a black outline map of the world in the centre of a piece of poster paper. They source visuals that show environmental change in the world and draw lines to show the locations of these places on the world map. Students describe the type of change shown in their visuals and predict whether these will have positive or negative impacts upon people or the biophysical environment.

Student groups develop an oral presentation of their findings to be shared with the rest of the class.

Display the completed posters in either the geography classroom or in a prominent location in the school to alert others to what Year 10 students are studying in this subject.

AC general capabilities: literacy; critical and creative thinking; ethical understanding

AC geographical concepts: place; space; environment; interconnections; sustainability; scale; change

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.

Sample pages

EAL/D support

Starter activity

'Biomes' is a term used to refer to the key regions of the planet. Biomes are defined by their climate, flora and fauna.

EAL/D students collect visual examples of each of these regions (aquatic, desert, forest, grasslands and tundra), and present these images on a sheet of paper next to the relevant biome name and a short explanation.

Activity answers

Knowledge and understanding

1. The term 'environment' describes the totality of our surroundings and comprises the living and non-living features of the earth's surface. Our environment is important because it sustains life on earth.
2. Environmental change is any alteration to an environment that disturbs natural ecological processes. These processes can be both natural and human-made.

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.

Spotlight support

Background

Biosphere 2 was named after Biosphere 1—the earth on which we all live. Biosphere 2's structure was designed to explore the web of ecological interactions in five representative biomes: an ocean with a coral reef; a wetland environment with mangroves; a savanna grassland and a coastal fog desert. The structure also housed an agricultural system and human habit. The below-ground infrastructure housed heating and cooling systems, networked through water pipes. Solar heating was provided through the glass panels that covered much of the facility. The costs of this experiment exceeded $US200 million over the period 1985–2007.

Taking it further

Students research and investigate:

- the work undertaken by the teams of researchers on the first and second missions
- the problems that plagued the experimental design such as the difficulties in achieving self-sufficiency in food production; dietary deficiencies; difficulties in simulating the complexity of natural environments, including the creation of biological diversity
- the personal difficulties encountered by the participants in working cooperatively.

Sample pages

Environmental change can be beneficial, such as the clearing of land for agriculture. However, the detrimental impact of clearing is land degradation from soil erosion and water pollution.

3 Rapid population growth combined with rises in the standard of living places increased demands on the earth's resources, ecosystems and environment. These demands can cause pollution, land degradation, climate change and species loss, which will negatively affect human wellbeing.

Applying and analysing

4 The Biosphere 2 was an experiment that aimed to build a enclosed, self-sufficient world. Ultimately, the project was unable to produce enough air, water and food to support the eight people inside. This reflects the complexity of earth's processes: it is able to sustain a population of seven billion, yet humans are unable to artificially replicate these processes.

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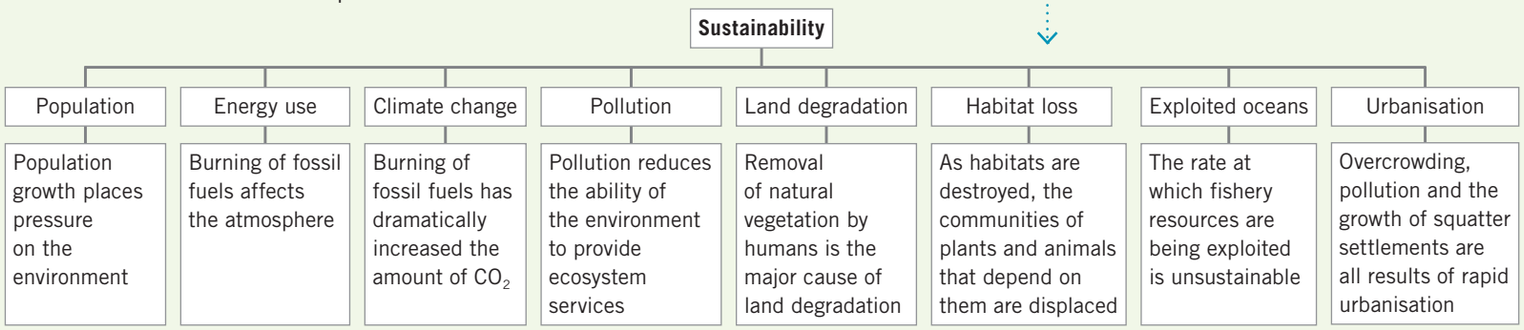

Geographical knowledge and understanding

Evaluate understanding

Applying concepts of sustainable development

Students refer to the dot points in the section 'Sustainable development' to source visual materials from the internet or other reference sources. They should provide examples from specific locations in the world that further elaborate upon the points raised.

The visuals sourced should show the sustainable use of resources, such as forests replanted after felling, solar panels on the roofs of homes, wind farms, tidal power, and community environmental action such as Clean Up Australia Day and recycling programs.

AC general capabilities: literacy; ICT; personal and social capability; ethical understanding; intercultural understanding

AC geographical concepts: place; space; environment; sustainability; interconnections; scale; change

Geographical inquiry and skills

Evaluate understanding

Investigating sources and sinks

MI: visual–spatial, bodily–kinaesthetic, naturalistic

Figure 1.6 shows the earth's carbon stores, sources and sinks. Working in groups of four or five, students select another biophysical system and develop an annotated diagram similar to that shown in Figure 1.6. Students choose from:

- the rock and soil cycle
- the hydrological cycle
- the processes of orogenesis, or mountain building
- tectonic plate movement
- the cycle of erosion in river valleys.

Students' completed annotated diagrams form the basis of an oral presentation to the class. Display the completed posters in the geography classroom or in a prominent location in the school to alert others to what Year 10 students are studying in this subject.

The final work should have similar characteristics to Figure 1.6 but will differ, depending upon the biophysical system the students choose to research.

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.

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.

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Sample pages

AC general capabilities: literacy; ICT; critical and creative thinking

AC geographical concepts: place; space; environment; interconnections; change

EAL/D support

Geographical concepts

To assist EAL/D students in their comprehension of the four functions of environments—'source', 'sink', 'service' and 'spiritual functions'—encourage them to define each term, provide an example of this term, and produce a visual they can associate with the term.

Activity answers

Knowledge and understanding

1 Historically, environments were considered to be 'bottomless pits' that could be exploited for resources on an indefinite basis. Today, environments are seen as fragile, threatened systems in need of careful management.

2 The four functions of the environment are:
- source—provision of resources
- sink—ability to break down, recycle and absorb waste and pollution

SPOTLIGHT

The earth's carbon stores, sources and sinks

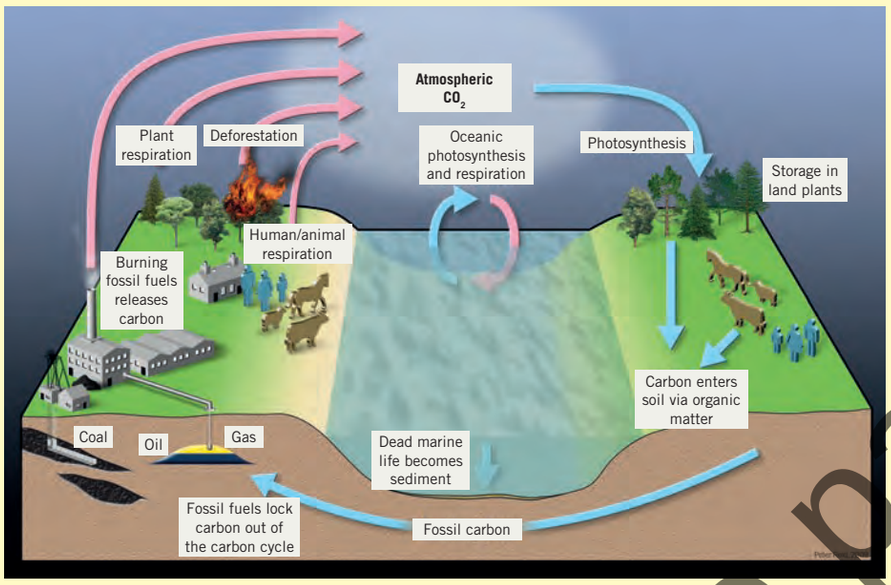
Carbon dioxide (CO_2) is continually recycled on earth. The environmental processes by which CO_2 is released to the atmosphere are called carbon sources, while processes that absorb it are called carbon sinks. The atmosphere, fossil fuels and the earth's forests, soils and oceans are important stores 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.

Spotlight support

Background

The carbon cycle is the natural system by which carbon is exchanged around the world. Along with the hydrological cycle and the nitrogen cycle, the carbon cycle involves a series of processes that allow life on earth to be sustained. The carbon cycle involves sources of carbon and reservoirs or sinks, as the accompanying diagram indicates. These are linked by pathways of exchange. The major sinks are found in the atmosphere, the biosphere (such as in living plants), the hydrosphere (such as the oceans) and the lithosphere (such as in sediments and soils). The earth's interior also holds carbon in the crust and mantle. These carbon stores interact with other components of the biophysical environment to create flows of energy which, under normal conditions, create a finely balanced carbon budget. Humans, however, have adversely affected this balance through such activity as deforestation and land clearance, the development of agricultural systems and urbanisation, and, in particular, the burning of fossil fuels, which have all elevated carbon dioxide levels in the atmosphere. Global warming could have serious impacts on both people and the biophysical environment.

Taking it further

Students access online resources such as video clips and other educational resources that further explain the operation of the carbon cycle.

There are many YouTube clips on the internet that that are educationally sound and explain the operation of the carbon cycle. These could be used as a lesson in testing the reliability of material on online sites.

Sample pages

- service—production of oxygen, absorption of carbon dioxide, water filtering
- spiritual—cultural and recreational value to people.

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

Applying and analysing

4 **Value to humans: student answers will vary.**
5 Student answers will vary.
6 Student answers will vary.

Source	Burning fossil fuels Deforestation Coal Oil Gas
Sink	Storage in land plants Carbon enters soil via organic matter Dead marine life becomes sediment Fossil fuels lock carbon out of the carbon cycle
Service	Plant respiration Photosynthesis Oceanic respiration
Spiritual	Recreational Psychological Aesthetic

Geographical knowledge and understanding

Evaluate understanding

Analysing the dynamic nature of global population

MI: visual–spatial, verbal–linguistic, logical–mathematical

Students access atlas maps and resources showing a range of global population data, such as:

- the global distribution of population
- graphs showing the overall patterns or trends in world population growth over time
- graphs showing the contribution made by particular regions or continents to the current pattern of global population growth.

Students develop well-structured paragraphs to describe each aspect of the data outlined above. They include quantitative (statistical) evidence to support their descriptions and write summative statements about the current patterns of world population growth.

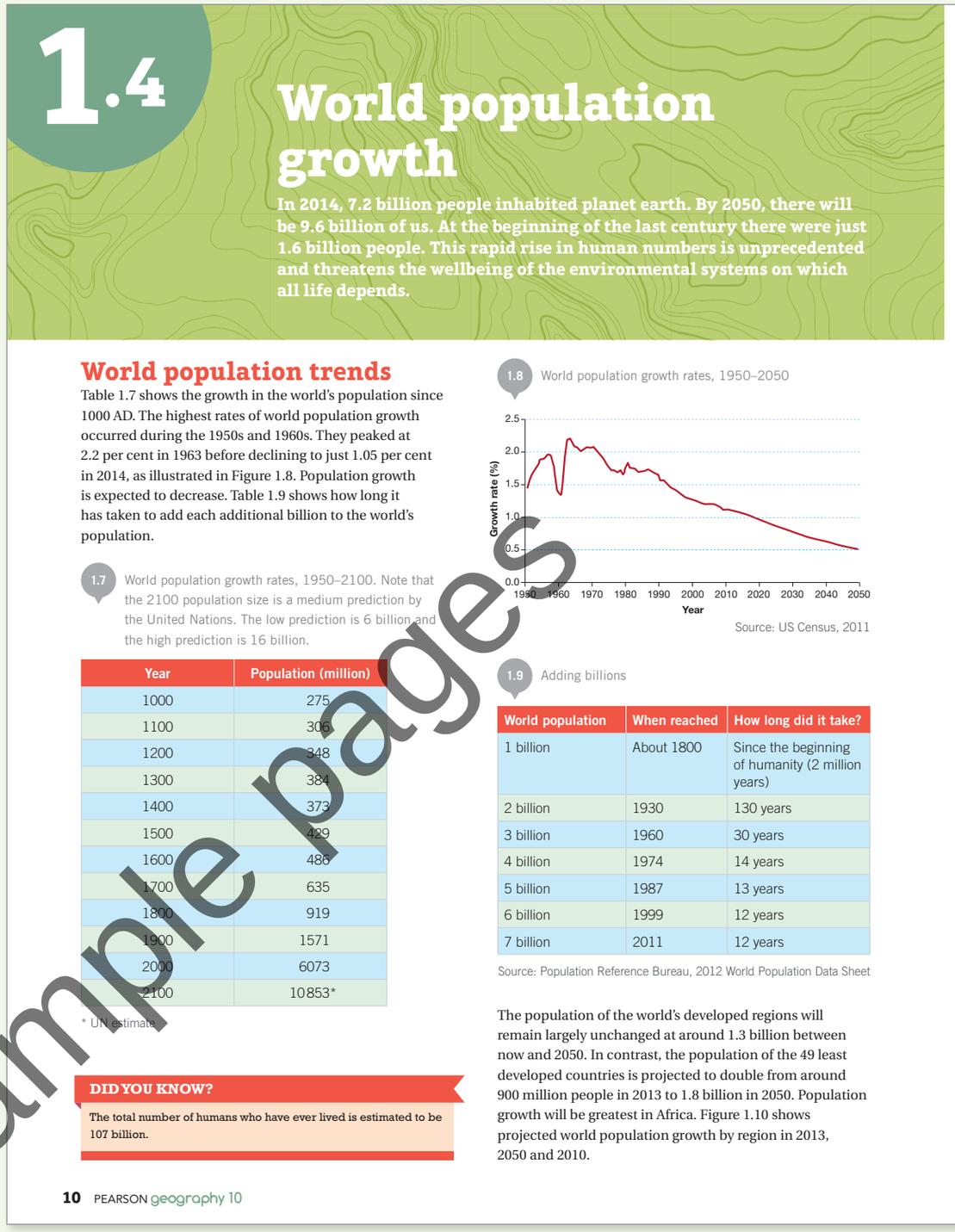
Students then use the text to outline four consequences of population growth in both the developed and the less developed regions of the world. Mention should be made of:

- the impacts on demand for the world's natural resources, such as water, oil, gas and forests
- the impacts on the earth's atmospheric system
- the impacts on levels of urbanisation, including the number of millionaire cities in the world (those with populations over one million) and where they are located.

This task has been highly structured for both teachers and students to follow step by step. These steps could form the basis of assessment rubrics to establish whether students have demonstrated the skills and knowledge required for the task.

AC general capabilities: literacy; numeracy; ICT; critical and creative thinking; ethical understanding; intercultural understanding

AC geographical concepts: place; space; environment; interconnections; sustainability; scale; change



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	373
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.

10 PEARSON geography 10

Sample pages

Geographical inquiry and skills

Geoskills

Analysis of age–sex structures

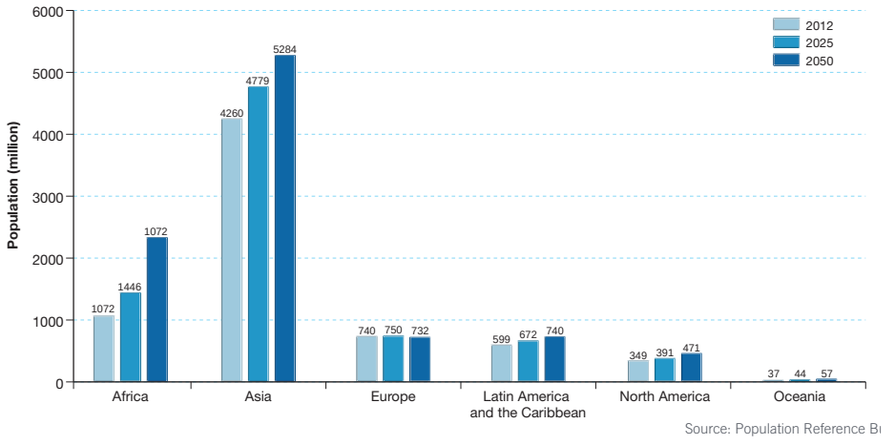
MI: visual–spatial, verbal–linguistic, logical–mathematical

Students access age–sex structure data from a population pyramid website. Working in pairs, students select one country from the developed and one country from the less developed world. They consider the data for the years 1960, 1975, 1990, 2005 and 2020.

They copy and paste the sets of histograms into a word-processing document and describe the demographic (population) characteristics and changes evident in the shape of the population pyramids over time. Reference should be made to trends in fertility (birth rates) and mortality (death rates).

Students then develop an oral report to present to the class to describe the fertility and mortality trends evident in their particular case studies. Comparisons should be made with other students' case studies. As a class, students hypothesise

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



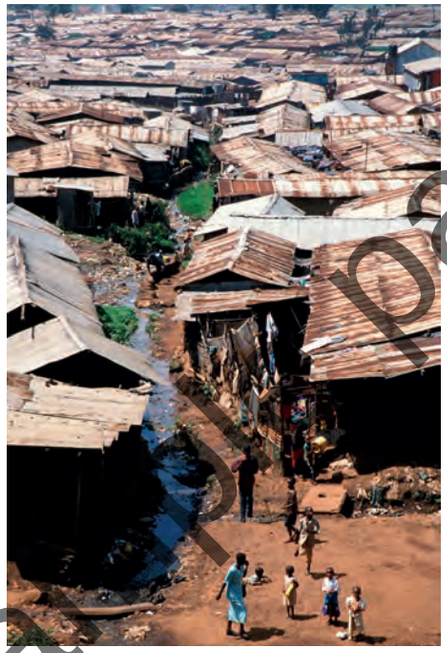
Source: Population Reference Bureau: 2012 World Population Data Sheet

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.

Sample pages

about why the shapes of the population pyramids are so different for developed and less developed countries. Reference should be made to the consequences of rapid population growth in the less developed regions of the world.

AC general capabilities: literacy; numeracy; ICT; critical and creative thinking; personal and social capability; ethical understanding; intercultural understanding

AC geographical concepts: place; space; environment; sustainability; interconnections; scale; change

Geographical inquiry and skills

Extension task

Film review: Slumdog Millionaire

MI: visual–spatial, logical–mathematical

Students view the film *Slumdog Millionaire* to examine the impacts of population growth and describe living conditions in the Indian cities shown. Students explain why such cities are among the most rapidly growing cities in the world today. Special mention should be made of the contribution of rural–urban migration. This task should be the basis of class discussion to engender greater intercultural understanding.

AC general capabilities: literacy; critical and creative thinking; personal and social capability

AC geographical concepts: place; space; environment; interconnections; scale; change

EAL/D support

Vocabulary assistance

If EAL/D students are unfamiliar with the term 'economic pie', provide the following explanation:

The term 'economic pie' is a reference to the total value of the economy being viewed as a pie. A person's or group of people's share or slice of the 'economic pie' is the amount of the economy that person or those people can access. Obviously those with higher incomes have a larger piece of economic pie, and those with lower incomes have a smaller piece of economic pie.

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.

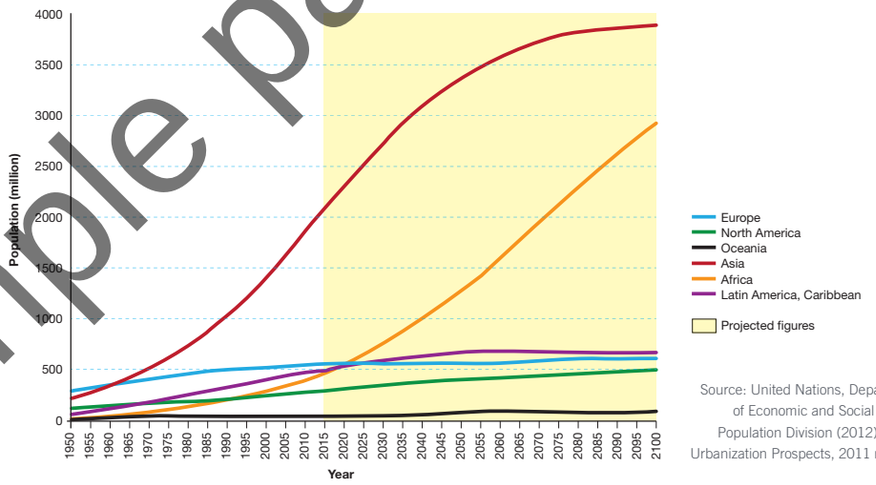
The world's urban population grew very rapidly over the course of the twentieth century: from 220 million to 2.8 billion. The next few decades will see an unprecedented scale of urban growth in the developing world. By 2030, the towns and cities of the developing world will make up 80 per cent of the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

1.12 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

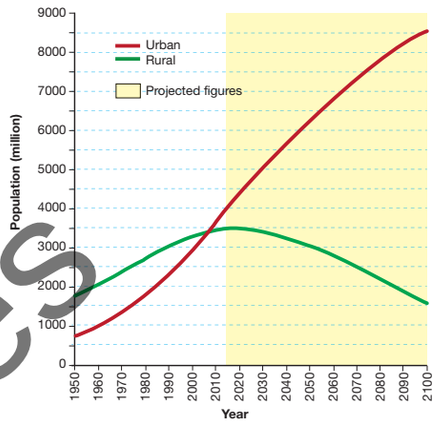
Source: Population Reference Bureau, World Population Data Sheet, 2011

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

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

Sample pages

Activity answers

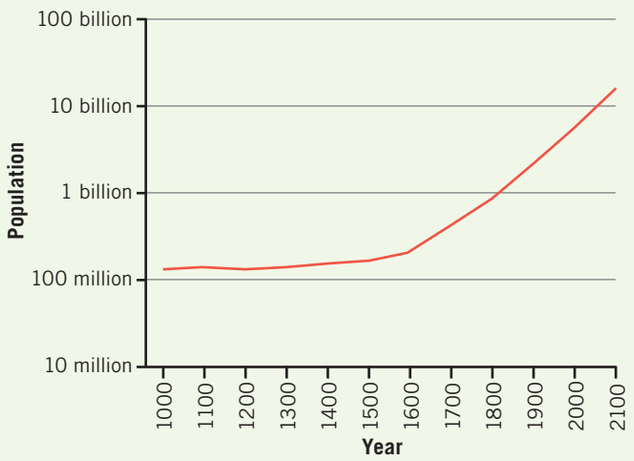
Knowledge and understanding

1 A growing world population places increasing pressure on the earth's resources. The demands on resources to feed, clothe, house and meet consumer demands of an increasingly wealthy world are unsustainable.

2 Geographers predict that the earth's population will continue to grow, but at a declining rate. Most growth will take place in developing nations. The population of urban areas will continue to grow, while rural populations are predicted to decline.

3 The 'big shift' from rural to urban has a positive side. This is due the decline in fertility rates of urbanised populations. Over time, this will help to stabilise the world's population.

World population growth rate



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

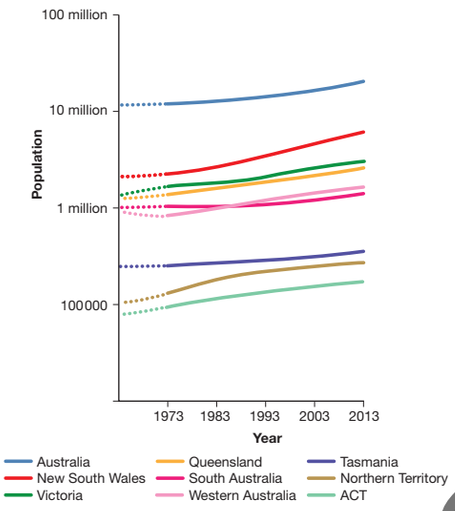
Semi-logarithmic graphs

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.

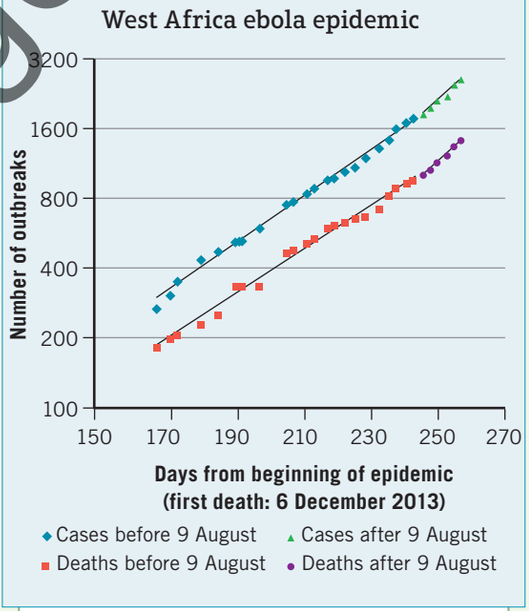
Skillsbuilder support

Semi-logarithmic graphs

Semi-logarithmic graphs are different from arithmetic graphs, in which the horizontal and vertical axes represent equal intervals. In semi-logarithmic graphs, only one axis represent equal intervals and that is generally the horizontal axis. Semi-logarithmic graphs are useful when:

- the rate of change is important
- there is a greater range in data than will fit on an arithmetic graph scale
- there is more data at one end of the range
- predicting trends.

Note that the steeper the line in a semi-logarithmic graph, the greater the amount of change. This can be observed in the semi-logarithmic graph for the ebola outbreak in West Africa.



Source: WHO and *New England Journal of Medicine*

Sample pages

Geographical skills

4. The world's population grew rapidly in the 1800s, when the population almost doubled, and then in the 1900s, when the population tripled.
5. World population growth rates after 1950 were rapid, then dropped in the late 1950s, before rising again to peak in the mid-1960s. Since the late 1960s, there has been a steady decline in population growth rates. Population growth is predicted to continue to decline.
6. There has been a dramatic reduction in the time it takes to add another billion to world population. It is estimated to have taken 2 million years to reach one billion but the sixth and seventh billions were added in only 12 years each.
7. Africa will have the world's largest population growth; Europe will have a negative population growth. The implications—student answers will vary.
8. Africa and Asia are the regions that will experience the most rapid rise in urban populations.
9. The world's urban growth is projected to continue to grow rapidly. In contrast, the world's rural population is expected to decline into the future.

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.

Sample pages

used include scandium, yttrium, lanthanum, cerium, praseodymium, neodymium, terbium, dysprosium and lutetium.

b China

c Ninety-seven per cent of rare earth minerals come from China.

d Conditions for miners working in mines inside China, and in mines owned by Chinese companies in developing countries, are among the most dangerous in the world. Deaths are common, due to unsafe working practices.