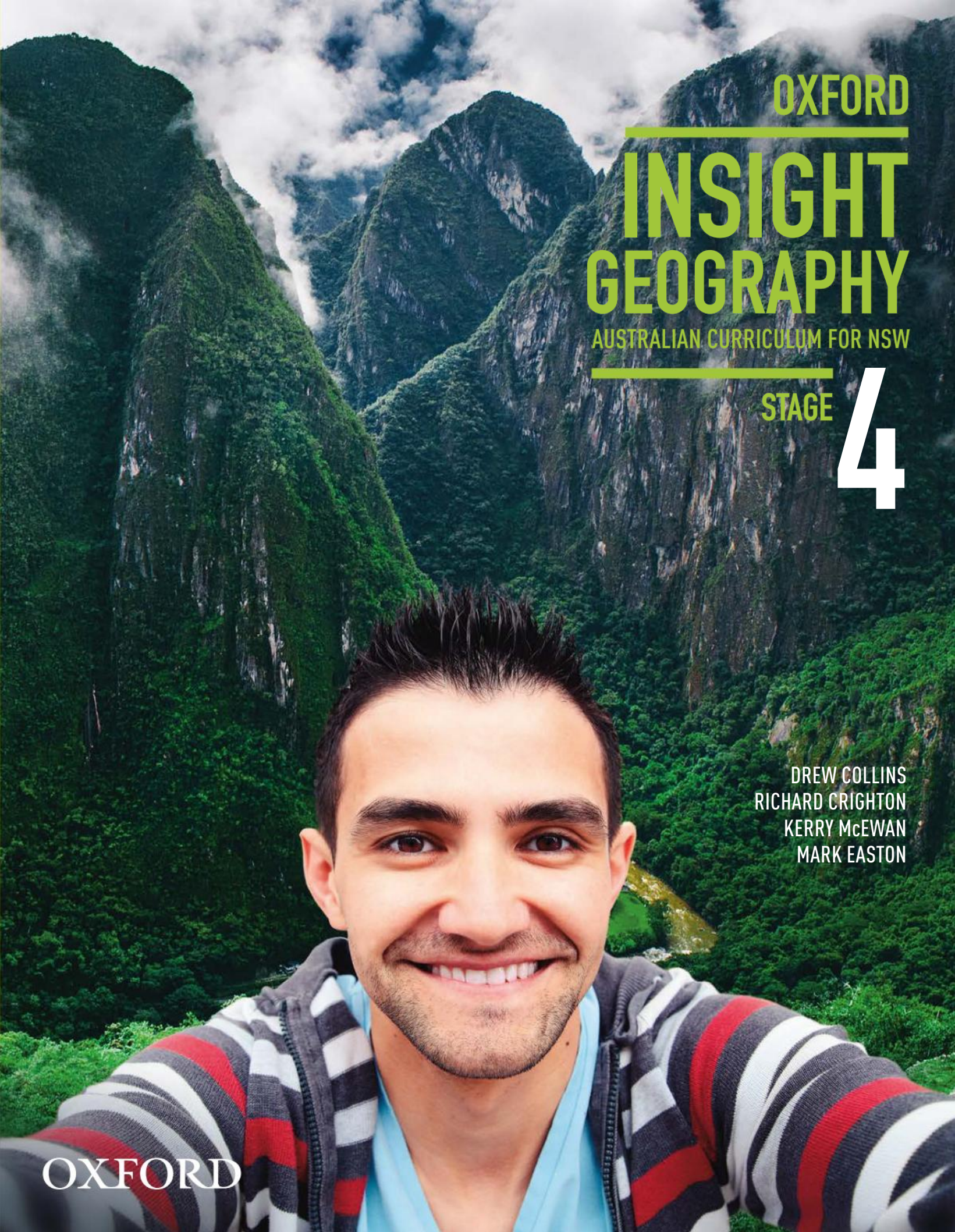


OXFORD INSIGHT GEOGRAPHY

AUSTRALIAN CURRICULUM FOR NSW

STAGE 4

DREW COLLINS
RICHARD CRIGHTON
KERRY McEWAN
MARK EASTON

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USING *OXFORD INSIGHT GEOGRAPHY*

Oxford Insight Geography has been developed and written by a team of experienced NSW Geography teachers to meet the requirements of the NSW syllabus for the Australian Curriculum: Geography. *Insight Geography* comprehensively covers all syllabus content to help students successfully meet all of the required outcomes. *Insight Geography* takes the guesswork out of the new syllabus: chapters are organised around the key inquiry questions from the syllabus while geographical concepts, geographical inquiry skills and geographical tools are integrated meaningfully into every chapter. The features, structure and design of the Student book, Student obook assess and Teacher obook assess will help you:

» optimise student understanding

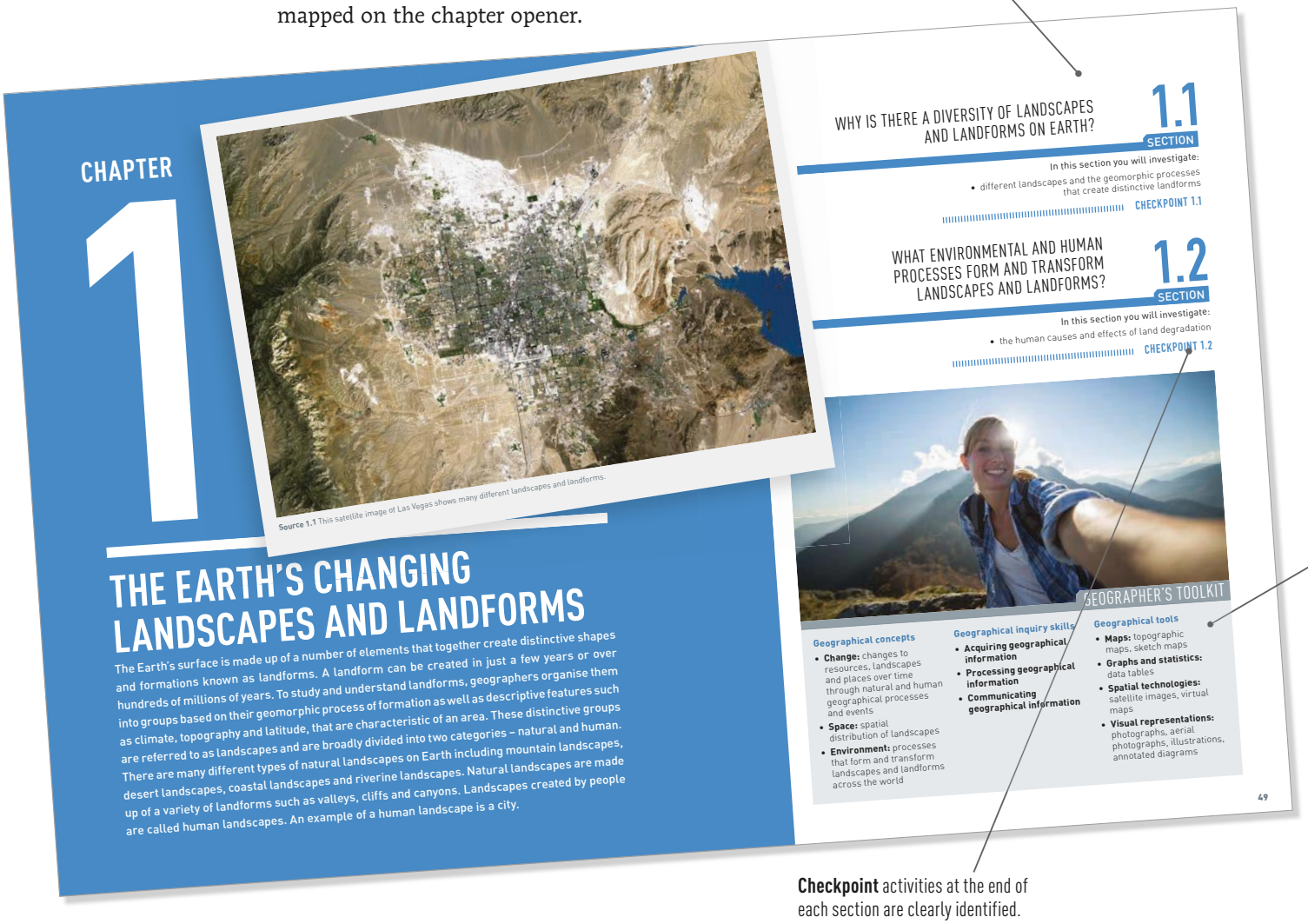
» personalise teaching and learning

» deliver better results.

OPTIMISE STUDENT UNDERSTANDING

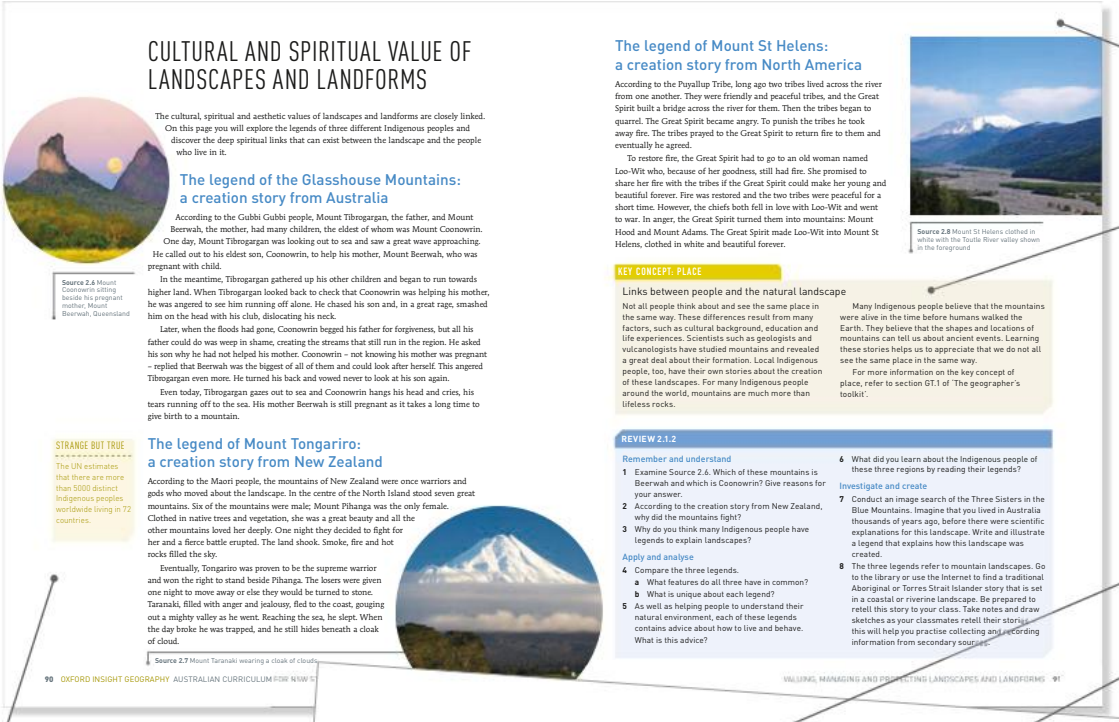
Each chapter of *Oxford Insight Geography* is sequenced according to the NSW Geography syllabus and structured around the key inquiry questions from the syllabus. Content dot points clearly map the learning sequence for students. Concepts, skills and tools are integrated in every chapter and mapped on the chapter opener.

The learning sequence for each chapter is structured around the key inquiry questions and content dot points taken directly from the syllabus.



Checkpoint activities at the end of each section are clearly identified.

Each topic covered in the Student Book is supported by a range of maps, graphs and statistics, visual representations, spatial technologies and fieldwork suggestions designed to engage and challenge a range of students. Key concepts are integrated into every chapter in the key concept boxes. Geographical inquiry skills are used to structure rich tasks and fieldwork suggestions.



CULTURAL AND SPIRITUAL VALUE OF LANDSCAPES AND LANDFORMS

The cultural, spiritual and aesthetic values of landscapes and landforms are closely linked. On this page you will explore the legends of three different Indigenous peoples and discover the deep spiritual links that can exist between the landscape and the people who live in it.

Source 2.6 Mount Coonowrin sitting beside his pregnant mother, Mount Beerwah, Queensland

The legend of the Glasshouse Mountains: a creation story from Australia

According to the Gubbi Gubbi people, Mount Tibrogargan, the father, and Mount Beerwah, the mother, had many children, the eldest of whom was Mount Coonowrin. One day, Mount Tibrogargan was looking out to sea and saw a great wave approaching. He called out to his eldest son, Coonowrin, to help his mother, Mount Beerwah, who was pregnant with child.

In the meantime, Tibrogargan gathered up his other children and began to run towards higher land. When Tibrogargan looked back to check that Coonowrin was helping his mother, he was angered to see him running off alone. He chased his son and, in a great rage, smashed him on the head with his club, dislocating his neck.

Later, when the floods had gone, Coonowrin begged his father for forgiveness, but all his father could do was weep in shame, creating the streams that still run in the region. He asked his son why he had not helped his mother. Coonowrin – not knowing his mother was pregnant – replied that Beerwah was the biggest of all of them and could look after herself. This angered Tibrogargan even more. He turned his back and vowed never to look at his son again.

Even today, Tibrogargan gazes out to sea and Coonowrin hangs his head and cries, his tears running off to the sea. His mother Beerwah is still pregnant as it takes a long time to give birth to a mountain.

STRANGE BUT TRUE

The UN estimates that there are more than 5000 distinct Indigenous peoples worldwide living in 72 countries.

The legend of Mount Tongariro: a creation story from New Zealand

According to the Maori people, the mountains of New Zealand were once warriors and gods who moved about the landscape. In the centre of the North Island stood seven great mountains. Six of the mountains were male; Mount Pihanga was the only female. Clothed in native trees and vegetation, she was a great beauty and all the other mountains loved her deeply. One night they decided to fight for her and a fierce battle erupted. The land shook. Smoke, fire and hot rocks filled the sky.

Eventually, Tongariro was proven to be the supreme warrior and won the right to stand beside Pihanga. The losers were given one night to move away or else they would be turned to stone. Taranaki, filled with anger and jealousy, fled to the coast, gouging out a mighty valley as he went. Reaching the sea, he slept. When the day broke he was trapped, and he still hides beneath a cloak of cloud.

Source 2.7 Mount Taranaki wearing a cloak of clouds

The legend of Mount St Helens: a creation story from North America

According to the Puyallup Tribe, long ago two tribes lived across the river from one another. They were friendly and peaceful tribes, and the Great Spirit built a bridge across the river for them. Then the tribes began to quarrel. The Great Spirit became angry. To punish the tribes he took away fire. The tribes prayed to the Great Spirit to return fire to them and eventually he agreed.

To restore fire, the Great Spirit had to go to an old woman named Loo-Wit who, because of her goodness, still had fire. She promised to share her fire with the tribes if the Great Spirit could make her young and beautiful forever. Fire was restored and the two tribes were peaceful for a short time. However, the chiefs both fell in love with Loo-Wit and went to war. In anger, the Great Spirit turned them into mountains: Mount Hood and Mount Adams. The Great Spirit made Loo-Wit into Mount St Helens, clothed in white and beautiful forever.

Source 2.8 Mount St Helens clothed in white with the Toutle River valley shown in the foreground

KEY CONCEPT: PLACE

Links between people and the natural landscape

Not all people think about and see the same place in the same way. These differences result from many factors, such as cultural background, education and life experiences. Scientists such as geologists and vulcanologists have studied mountains and revealed a great deal about their formation. Local Indigenous people, too, have their own stories about the creation of these landscapes. For many Indigenous people around the world, mountains are much more than lifeless rocks.

Many Indigenous people believe that the mountains were alive in the time before humans walked the Earth. They believe that the shapes and locations of mountains can tell us about ancient events. Learning these stories helps us to appreciate that we do not all see the same place in the same way.

For more information on the key concept of place, refer to section GT.1 of 'The geographer's toolkit'.

REVIEW 2.1.2

Remember and understand

1 Examine Source 2.6. Which of these mountains is Beerwah and which is Coonowrin? Give reasons for your answer.
2 According to the creation story from New Zealand, why did the mountains fight?
3 Why do you think many Indigenous people have legends to explain landscapes?

Apply and analyse

4 Compare the three legends.
a What features do all three have in common?
b What is unique about each legend?
5 As well as helping people to understand their natural environment, each of these legends contains advice about how to live and behave. What is this advice?
6 What did you learn about the Indigenous people of these three regions by reading their legends?

Investigate and create

7 Conduct an image search of the Three Sisters in the Blue Mountains. Imagine that you lived in Australia thousands of years ago, before there were scientific explanations for this landscape. Write and illustrate a legend that explains how this landscape was created.
8 The three legends refer to mountain landscapes. Go to the library or use the Internet to find a traditional Aboriginal or Torres Strait Islander story that is set in a coastal or riverine landscape. Be prepared to retell this story to your class. Take notes and draw sketches as your classmates retell their stories – this will help you practise collecting and recording information from secondary sources.

90 OXFORD INSIGHT GEOGRAPHY AUSTRALIAN CURRICULUM FOR NSW STAGE 4

VALUING, MANAGING AND PROTECTING LANDSCAPES AND LANDFORMS 91

CASE STUDY

MOVING TO NOOSANGATTA

The warmer climate and stunning natural features of the south-east Queensland coastline mean this region has many high-rating liveability factors. The region, in fact, has attracted many Australians, particularly older people from New South Wales and Victoria, to make the move north. Just 50 years ago, the Gold Coast and Sunshine Coast were small holiday towns. Today, the area has seen such extensive growth and development that the towns and cities along this section of coastline may join together to form a continuous urban area known as a megalopolis. Some geographers predict that Noosa in the north and Coolangatta in the south will one day also join to form one vast urban area that some people have already nicknamed 'Noosangatta'.

The high population growth in south-east Queensland over the last few decades has led to an increasing demand for housing. As the suburban areas have spread, there has been a loss of 7500 hectares (75 square kilometres) of bushland and farms each year. The stunning natural features and easygoing lifestyle that attracted people to move to the area in the first place are coming under threat. A victim of its own success, the area is in danger of becoming less liveable.

Source 4.16 An oblique aerial photograph of coastal development between Noosa and Brisbane

REVIEW 4.1.4

Remember and understand

1 Why are many older Australians moving north to settle in south-east Queensland?
2 Explain what is meant by the expression 'a victim of its own success'.

Apply and analyse

3 Describe the importance of natural features such as rivers, mountains and coasts in affecting the location and shape of cities. Use evidence from the map (Source 4.17) for your description.
4 Is it likely that the city of Toowoomba will join the Noosangatta megalopolis? Give reasons for your answer.

Investigate and create

5 Explore the region shown in Source 4.17 on Google Earth. Use the 'Historical Imagery' tool to find examples of places that have undergone great changes in the last 10 years.

SKILL DRILL

Reading a complex map

A map is a plan of an area of the Earth's surface drawn directly from above. Complex maps, such as the one shown in Source 4.17, can appear a little confusing at first because they show a wide range of features. As with all maps, however, it is important that you read the legend, title, source and scale carefully, so that you can learn more about the region being shown.

Follow these steps to help you read and understand a complex map:

Step 1 Read the title carefully. Make sure that you understand what the map shows and the region that is shown in the map. If you are unsure of the location of the region, locate it in your atlas to see where it sits in relation to other regions or countries.

Step 2 Check the source of the map so that you can assess the reliability of the information. Maps drawn by government departments and professional publishers are generally more reliable than those drawn by individuals and businesses.

Step 3 Look carefully at the symbols and colours used in the legend and find an example of each of these on the map. Look for relationships between these symbols such as roads and urban areas.

SOUTH-EAST QUEENSLAND: ECOLOGICAL AND URBAN AREAS

Source 4.17

Source: South-East Queensland Regional Plan 2009–2031, Queensland Department of Infrastructure and Planning

Apply the skill

1 What is the source of the map shown in Source 4.17?
2 Is this a reliable source of information?
3 Use the line scale to estimate the straight line distance from:
- Brisbane to Robina
- Brisbane to Noosa
- Brisbane to Toowoomba.

For a guide on estimating distance, refer to section GT.3 of 'The geographer's toolkit' (Skill drill: Using line scale to measure distances).

4 Describe the distribution of existing and future urban areas. Use the names of towns and cities as well as compass directions and geographic features such as the coast and rivers in your description.
5 Describe the distribution of protected areas and the land and wetlands areas of high ecological significance.
6 Which areas of high ecological significance are likely to be impacted most by the continued growth of urban areas in this region?

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THE PLACES WE LIVE 139

Chapter content is organised into discrete two- or four-page units to support teaching and learning.

Key concept boxes encourage students to think geographically.

Case studies expose students to a range of sources.

Skill drills support an explicit focus on geographical skills.

Strange but true boxes present a range of weird and wonderful geographical facts designed to entertain and provoke discussion.

Geographical concepts, **Geographical inquiry skills** and **Geographical tools** are integrated meaningfully into every chapter and highlighted here on every chapter opener.

Every two- or four-page unit concludes with a **Review** question box with differentiated **Remember and understand**, **Apply and analyse** and **Investigate and create** tasks to provide a range of activities for different abilities and learning styles.

PERSONALISE TEACHING AND LEARNING

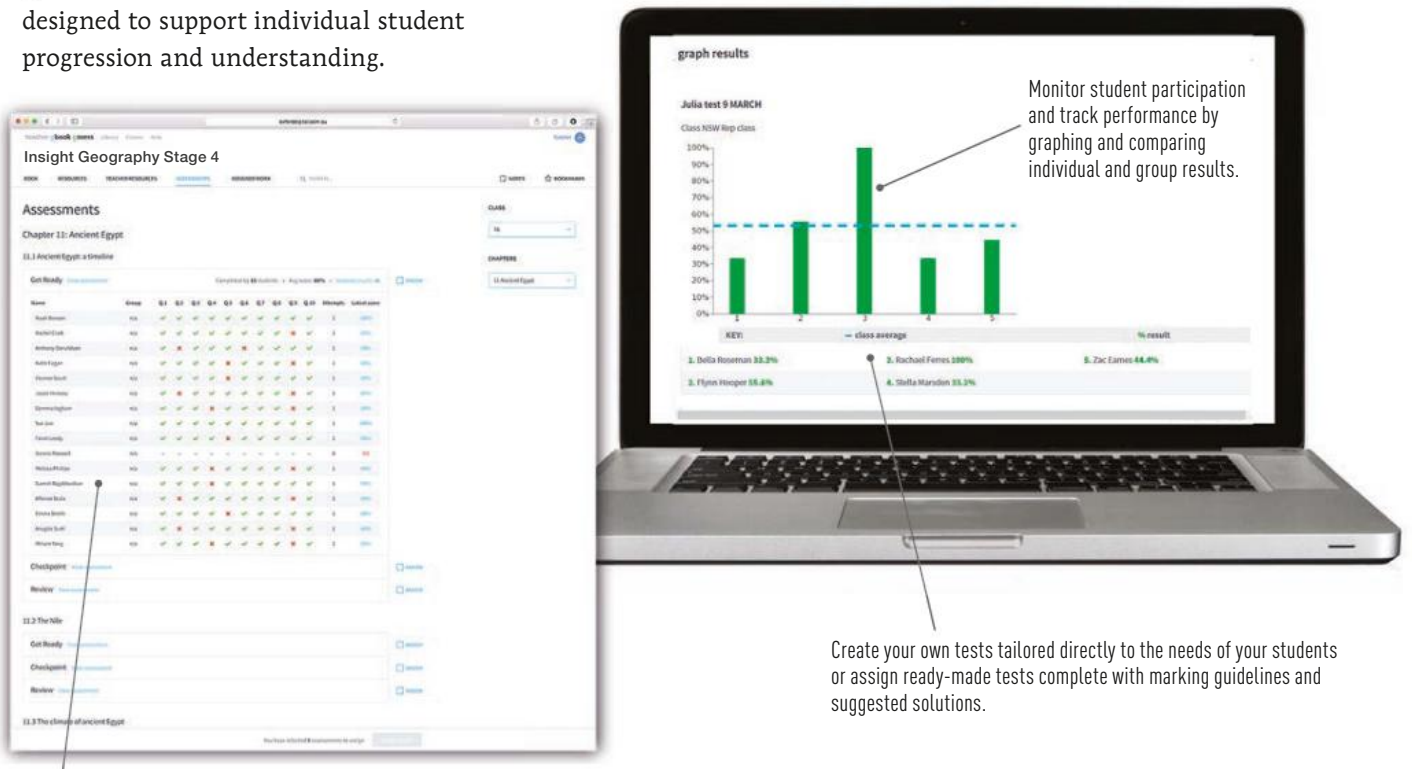
The new syllabus demands contemporary online learning for all students in NSW. *Oxford Insight Geography* delivers new opportunities for teachers and students to personalise teaching and learning through obook assess:

» obook provides an electronic version of the Student Book with note-taking, highlighting and bookmarking. The obook includes videos, interactive learning modules, weblinks and worksheets, and can be accessed both online and offline. Access your entire cloud-based obook library anywhere on any device with one simple login.



Teachers can set students homework, tests and tasks mapped directly to the NSW Geography syllabus outcomes.

» assess provides 24/7 online assessment designed to support individual student progression and understanding.



DELIVER BETTER RESULTS

Oxford Insight Geography helps to deliver better results for you and your students by ensuring that student progress on all syllabus outcomes and content can be carefully monitored throughout every chapter. Features contained at the end of every section of every chapter allow you to easily identify gaps in student understanding and target further development in these areas.

Checkpoint questions appear at the end of every section. They are linked to content dot points in the NSW Geography syllabus and are designed to help you identify areas of weakness in student understanding. They can be used flexibly – completed orally in class (to support formative assessment) or set as written tests (to support summative assessment).

Rich tasks appear at the end of every section. They are open-ended, inquiry-based tasks designed to engage students to develop their geographical inquiry skills.



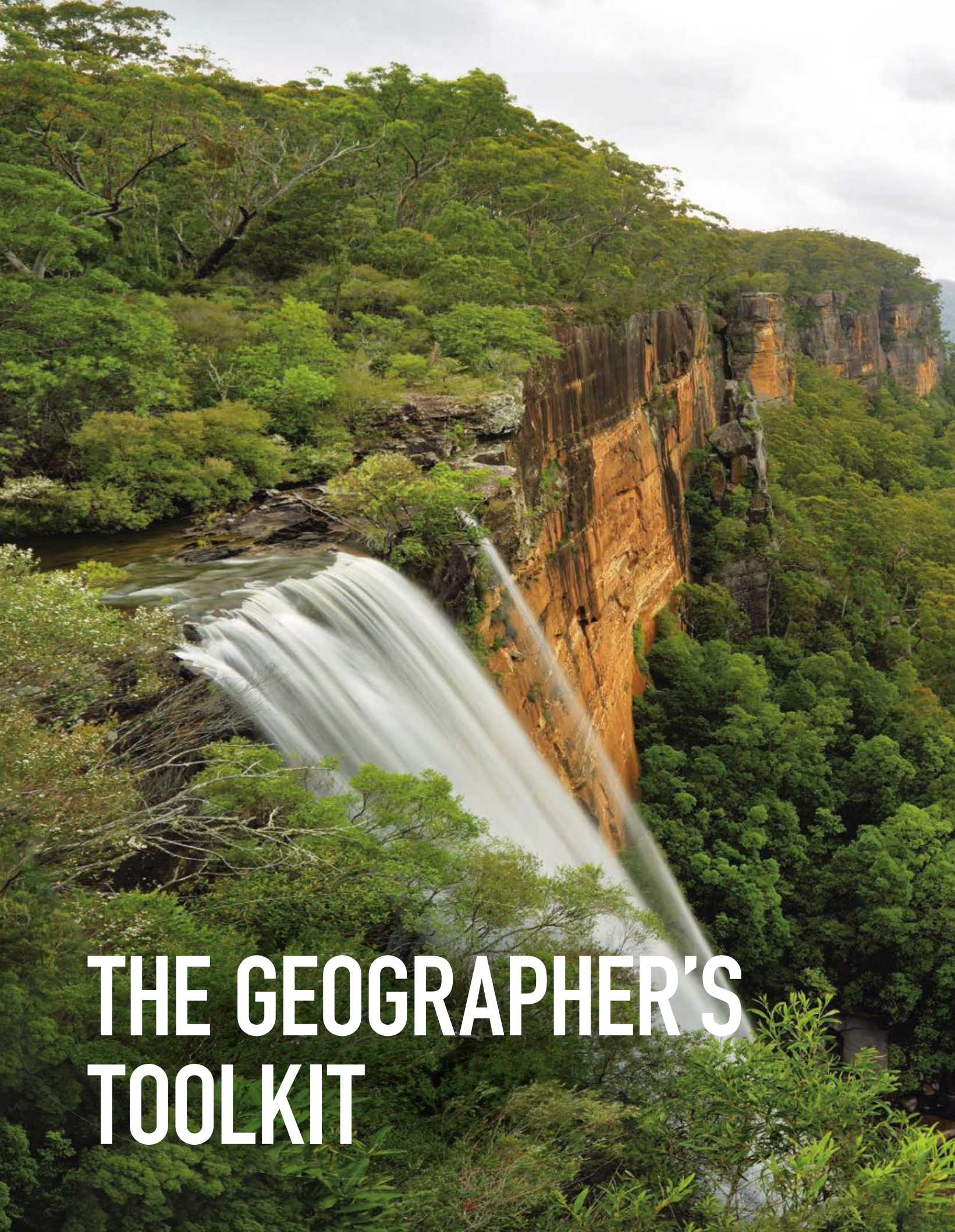
Each **Checkpoint** is supported by three separate student worksheets available electronically (via the Teacher obook assess). These worksheets are graded to **support**, **consolidate** or **extend** students, or differentiate abilities and personalise learning in your class. Like Checkpoint questions, student worksheets are linked to content dot points from the syllabus with the goal of providing tailored support to ensure better results.

NSW SYLLABUS FOR THE AUSTRALIAN CURRICULUM: GEOGRAPHY STAGE 4 – SCOPE AND SEQUENCE

STAGE 4: 100 HOURS TEACHING TIME		
GEOGRAPHICAL CONCEPTS	The following geographical concepts are to be integrated throughout Stage 4: • **Place:** the significance of places and what they are like • **Space:** the significance of location and spatial distribution, and ways people organise and manage spaces that we live in • **Environment:** the significance of the environment in human life, and the important interrelationships between humans and the environment	• **Interconnection:** no object of geographical study can be viewed in isolation • **Scale:** the way that geographical phenomena and problems can be examined at different spatial levels • **Sustainability:** the capacity of the environment to continue to support our lives and the lives of other living creatures into the future • **Change:** explaining geographical phenomena by investigating how they have developed over time
GEOGRAPHICAL INQUIRY SKILLS	**Acquiring geographical information** • develop geographically significant questions and plan an inquiry, using appropriate geographical methodologies and concepts • collect, select and record relevant geographical data and information, using ethical protocols, from appropriate primary data and secondary information sources **Processing geographical information** • evaluate information sources for their reliability and usefulness • represent data in a range of appropriate forms, with and without the use of digital and spatial technologies • represent the spatial distribution of different types of geographical phenomena by constructing maps at different scales that conform to cartographic conventions, using spatial technologies as appropriate	• analyse geographical data and other information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to identify and propose explanations for spatial distributions, patterns and trends and infer relationships • apply geographical concepts to draw conclusions based on the analysis of the data and information collected **Communicating geographical information** • present findings, arguments and ideas in a range of communication forms selected to suit a particular audience and purpose; using geographical terminology and digital technologies as appropriate • reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal
GEOGRAPHICAL TOOLS	The following geographical tools are to be integrated throughout Stage 4: • maps • fieldwork • graphs and statistics	• spatial technologies • visual representations
OUTCOMES	**A student:** › locates and describes the diverse features and characteristics of a range of places and environments **GE4-1** › describes processes and influences that form and transform places and environments **GE4-2** › explains how interactions and connections between people, places and environments result in change **GE4-3** › examines perspectives of people and organisations on a range of geographical issues **GE4-4** › discusses management of places and environments for their sustainability **GE4-5** › explains differences in human wellbeing **GE4-6** › acquires and processes geographical information by selecting and using geographical tools for inquiry **GE4-7** › communicates geographical information using a variety of strategies **GE4-8**	

	Landscapes and landforms	Place and liveability	Water in the world	Interconnections
KEY INQUIRY QUESTIONS	• Why is there a diversity of landscapes and landforms on Earth? • What environmental and human processes form and transform landscapes and landforms? • Why do people value landscapes and landforms? • To what extent are landscapes and landforms sustainably managed and protected?	• Why do people's perceptions of the liveability of places vary? • What effect does environmental quality and access to services have on people's wellbeing? • How can strong community identity and social connectedness enhance the liveability of places? • What approaches can be used to improve the liveability of places?	• Why does the spatial distribution of water resources vary globally and within countries? • How do natural and human processes influence the distribution and availability of water as a resource? • What effect does the uneven distribution of water resources have on people, places and environments? • What approaches can be used to sustainably manage water resources and reduce water scarcity?	• How are people and places connected to other places? • What role does technology play in connecting people to people, goods, services and information in other places? • What are the consequences of a globally connected world for people and places? • Why are interconnections important for the future of places and environments?
CONTENT	**Landscapes and landforms** • investigate different landscapes and the geomorphic processes that create distinctive landforms (ACHGK048, ACHGK050) **Value of landscapes and landforms** • investigate the aesthetic, cultural, spiritual and economic value of landscapes and landforms for people, including Aboriginal and Torres Strait Islander Peoples (ACHGK049) **Changing landscapes** • investigate the human causes and effects of landscape degradation (ACHGK051) **Landscape management and protection** • investigate ways people, including Aboriginal and Torres Strait Islander Peoples, manage and protect landscapes (ACHGK052) **Geomorphic hazard** • investigate ONE contemporary geomorphic hazard including causes, impacts and responses (ACHGK053)	**Influences and perceptions** • investigate factors influencing perceptions of the liveability of places (ACHGK043, ACHGK046, ACHGK065) **Access to services and facilities** • investigate the influence of accessibility to services and facilities on the liveability of places (ACHGK044) **Environmental quality** • investigate the impact of environmental quality on the liveability of places (ACHGK045) **Community** • investigate the influence of social connectedness and community identity on the liveability of places (ACHGK046) **Enhancing liveability** • investigate strategies used to enhance the liveability of places using examples from different countries (ACHGK047)	**Water resources** • investigate the characteristics and spatial distribution of global water resources (ACHGK037) **The water cycle** • investigate how the operation of the water cycle connects people and places (ACHGK038) **Australia's water resources** • investigate the quantity and variability of water resources in Australia and other places **Water scarcity and water management** • investigate the nature of water scarcity and ways of overcoming it (ACHGK040) **The value of water** • investigate the economic, cultural, spiritual and aesthetic values of water for people, including Aboriginal and Torres Strait Islander Peoples and/or peoples of the Asia region (ACHGK041) **Natural hazard** • investigate ONE contemporary atmospheric hazard or hydrologic hazard including causes, impacts and responses (ACHGK042)	**Personal connections** • investigate the influences on and effects of people's travel and recreational, cultural or leisure connections with different places for the future (ACHGK065, ACHGK069) **Technology** • investigate the way transportation and information and communication technologies are used to connect people to services, information and people in other places (ACHGK066) **Trade** • investigate the ways places and people are interconnected through trade in goods and services across a range of scales (ACHGK067) **Production and consumption** • investigate the effects of the production and consumption of goods on people, places and environments throughout the world (ACHGK068)

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THE GEOGRAPHER'S TOOLKIT



GEOGRAPHICAL CONCEPTS GT.1

GEOGRAPHICAL INQUIRY SKILLS GT.2

GEOGRAPHICAL TOOLS GT.3

Source GT.1 A view of Fitzroy Falls in Morton National Park in New South Wales, the traditional Country of the Yuin people

GT.1 GEOGRAPHICAL CONCEPTS

Geography is the study of the world around us. Geographers use seven concepts to help investigate and understand the world. At times you will use several of these at once, while at other times you may focus on just one. As you learn to use each of the key ideas you will begin to think like a geographer. The seven key concepts in geography are:

- place
- space
- environment
- interconnection
- scale
- sustainability
- change.

PLACE

Places are parts of the Earth's surface that are identified and given meaning by people. Your home and your school are important places for you because they are the places where you live and spend most of your time.

Places play an important role in the lives of every person on Earth. Places can be natural (that is, shaped by the environment and largely unchanged by humans) or human (that is, built or changed by humans).

Places determine our relationships with one another. Our closest relationships are likely to be with people in the same place. The environmental and social qualities of a place all influence the way we live. Climate, landscapes, types of plants and **resources**, transport networks, entertainment venues and workplaces all have a major impact on the way we live in our places.

For Indigenous Australians, place has a deep spiritual meaning. Their sense of identity comes from their relationship with place. Aboriginal people have lived in the Kakadu region of the Northern Territory (Source GT.2) for over 50 000 years. The **region** contains approximately 5000 rock art sites, some of which are over 20 000 years old. They represent the longest historical records of any group in the world. Aboriginal people refer to their place as **Country**.

Geographers use the concept of **place** when conducting any **geographical inquiry**. For example, a geographer visiting New York City in the United States (Source GT.3) would use the concept of place to help understand why people originally settled there, how the city was built and how it has changed over time.

Just as place influences people, people also influence place. The ways in which we live, and the actions we take, change the places in which we live. Geographers investigate the outcomes of these changes. For example, by investigating the way in which human actions have altered the Brazilian Rainforest, geographers can learn how to better manage and care for our natural resources.



Source GT.2 Jim Jim Falls in Kakadu National Park in the Northern Territory, known to the Aboriginal people of the region as Barrkmalam, is a spiritually significant place.



Source GT.3 Manhattan Island, New York City, is a culturally significant place to many people.

SPACE

To most people **space** means the empty universe, but to a geographer it has a different meaning. Geographers investigate the way that things are arranged on the Earth's surface. They look for patterns and try to explain them. The concept of space helps them to do this. It has three main elements:

- location – where things are located on the Earth's surface
- spatial distribution – the shapes and patterns in which things are arranged on the Earth's surface
- organisation – how and why things are arranged and managed on the Earth's surface by people.

The concept of space can also be used to investigate some other important aspects of the world around us. Geographers investigate the way that people use and change the space in which they live. They recognise that different groups of people use space in different ways and that this changes over time. They also investigate the ways that improvements in transport and communication have made links between places quicker and easier, and the ways that this is changing the world.

The city of Shimabara in the south of Japan (Source GT.4) illustrates the concept of space well. The city has been built on a flat coastal area at the foot of an active volcano, Mount Unzen. Houses, schools and office buildings in Shimabara are linked by roads leading to nearby farms closer to Mount Unzen. The volcano clearly presents a danger to people living in the town. As Source GT.4 shows, the flow of superheated ash and rock from the volcano has buried part of the city as it made its way to the sea. At first glance it may not be clear why anyone would risk living this close to a volcano, but closer analysis of the area reveals that the fertile volcanic soil is ideal for growing crops.

The concepts of place and space can be difficult to separate, but it will help if you remember that places can be divided into spaces. For example, a small place, such as your school, has different spaces. Each of these spaces has its own purpose. There are spaces for learning (such as classrooms and computer rooms), playing (such as playgrounds and sporting fields), eating (such as the cafeteria or canteen) and running the school (such as staff rooms and administration buildings).

Larger places (such as your suburb, town or city) are also organised into different spaces. There are spaces for housing (such as homes for families), businesses (such as shops and offices), industry (such as factories and warehouses), entertainment (such as concert halls and theatres) and sport and recreation (such as stadiums, parks and gardens).

Understanding the location, patterns and planning of spaces helps geographers to make sense of our world.



Source GT.4 An aerial photograph showing the path of the hot ash and rock that flowed to the sea from Mount Unzen, an active volcano on the island of Kyushu in Japan. Part of the city of Shimabara (shown in the foreground) has been buried by the eruption.

ENVIRONMENT

The world in which we live is made up of many different **environments**. Some environments are natural (or physical) such as deserts, grasslands, mountains, coral reefs, forests, oceans and ice caps. For an environment to be considered natural, its soils, rocks, climate, plants and animals must remain largely untouched by humans. Today, there are very few truly natural environments left on Earth.

Other environments have been so altered by humans that very few natural features remain. These environments are known as human environments and include large cities, towns, suburbs and vast areas of farmland. Human environments not only affect the natural **features** (such as soil, plants and animals), they also affect the climate. A large city, such as New York, has its own microclimate. It will often be a few degrees hotter than the surrounding areas because concrete in the buildings traps the Sun's heat. Skyscrapers also catch and funnel the wind, increasing its speed.

Most environments on Earth are now a combination of natural and human features. Antarctica, the harshest environment on the planet, is considered a natural environment despite humans having altered some areas of it. These changes have included the building of a number of permanent research bases and the carrying out of various scientific studies both on land and sea. The McMurdo research base, for example, operated by the United States (Source GT.5), has three airfields, a harbour and more than 100 buildings. In addition to these built structures, other human influences have affected this environment. The warming of the planet has contributed to the increased melting of ice shelves, and pollution of our oceans has had an impact on sea and land animals in Antarctica.

The study of different environments helps geographers to better understand and appreciate natural processes, such as how weather works, how mountains are formed, and how rainforests and coral reefs grow. The concept helps geographers to analyse the changes humans make to natural environments and better appreciate their impact so that they can be managed more wisely.



Source GT.5 A scientist looking out over McMurdo Station at Observation Hill in Antarctica. The line between the natural and built environment is clearly illustrated in this photograph.



Source GT.6 Bangladesh is one of the countries most vulnerable to climate change because of a number of interconnected processes that are causing sea levels to rise. It is estimated that 15 million of the poorest people living in Bangladesh, like those living in this slum, will be affected by a 1-metre rise in sea levels.

INTERCONNECTION

No place or thing on Earth exists in isolation. All environments on Earth and every living and non-living thing found within them are connected. These connections can be on a local level or a global level.

Geographers use the concept of **interconnection** to better understand the complex links between natural and human processes that shape our Earth. Places and people can be linked in many different ways that can be categorised as:

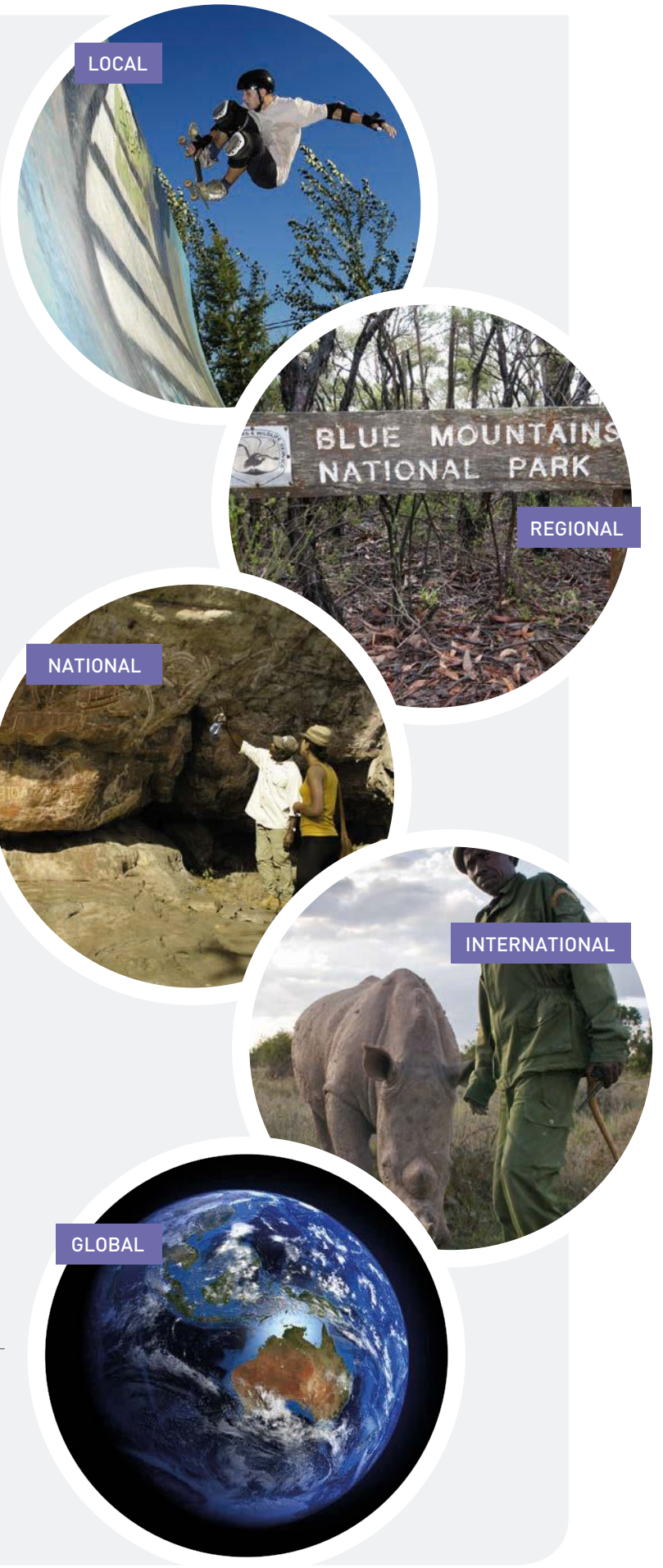
- natural processes, such as the water cycle and food chain
- human activities, such as the movement of people, the production and trade of goods, and the flow of investment and money linked within and between different countries.

It helps to think of the Earth as a single living organism, much like your body. Your brain, heart, lungs, stomach, arms and legs all work together as a single system to keep you alive and healthy. In much the same way, the Earth's living systems (such as climate, plants, animals, oceans, soils, atmosphere and energy) all function together and are interconnected. Even a slight rise in the Earth's temperature, for example, will have an effect on the oceans (such as damaging coral reefs and affecting the populations of marine life), the land (such as failure of crops and drought) and the polar ice caps (such as increasing sea levels and forcing millions of people to relocate). Source GT.6 shows a slum in Bangladesh, the most densely populated country in the world. Bangladesh is slightly larger than England in size, but is home to 150 million people; this is three times the population of England. Its coastal zone has a very low elevation above sea level, making it one of the countries most vulnerable to **climate change** through rising sea levels.

SCALE

The concept of **scale** is used to guide geographical inquiries. Geographers study things that take place on many different spatial levels – meaning from small areas (such as a local park) to very large areas (such as the use of oil and coal all over the world). They use the concept of scale to look for explanations and outcomes at these different levels. A geographical inquiry of the ways in which people use parks, for example, may be carried out at a range of scales (from smallest to largest):

- local – an inquiry into the daily visitors to a neighbourhood skate park, the types of facilities there and whether these facilities meet the needs of visitors
- regional – an inquiry into the types of visitors staying at campsites and tourist parks in the Blue Mountains region of New South Wales
- national – an inquiry into the yearly tourist numbers visiting national parks in Australia (such as Kakadu National Park and Christmas Island National Park), including the impact these visitors have on our national parks, the way in which these parks are managed, and on what levels Indigenous people are involved
- international – an inquiry into animal poaching in national parks and wild game reserves in different countries across Africa (such as South Africa, Kenya, Tanzania and Madagascar)
- global – an inquiry into the use of all marine parks around the world and their effectiveness in protecting different species of marine animals.



Source GT.7 Geographical inquiries can be carried out on a number of different spatial levels: local (e.g. at a nearby skate park), regional (e.g. at a campsite in the Blue Mountains region of New South Wales), national (e.g. at national parks across Australia), international (e.g. in different countries across Africa) and global (e.g. at marine parks all over the planet).

SUSTAINABILITY

The concept of **sustainability** relates to the ongoing capacity of Earth to maintain all life. This means developing ways to ensure that all resources on Earth are used and managed responsibly so they can be maintained for future generations.

Sustainable patterns of living meet the needs of the current generation without compromising the ability of future generations to meet their own needs. Many of the world's resources (such as oil, coal and natural gas) are non-renewable. This means that if we continue to use them, they will one day run out. Other resources (such as wind, forests, solar energy and water) are renewable. This means that they are available in a continuous supply or are able to regenerate naturally in most conditions. Sustainability encourages us to think more closely about these different types of resources – the ways in which they are formed and the speed at which they are being used. It also encourages us to look more closely at renewable options and take greater care of the Earth. Actions to improve sustainability can operate at a number of levels:

- local – Recycling of paper and plastics by individuals, schools and households reduces the number of trees that need to be cut down and the amount of oil that needs to be extracted to produce plastic bottles and bags.
- national – The Australian Government has begun to encourage sustainable use of energy through wind farms, hydroelectric power plants and solar panels.
- international – Efforts to protect endangered whale species around the world have attracted media attention and focused public opinion on maintaining breeding grounds free of large whaling vessels (Source GT.8).

Sustainability is an important concept for geographers. They use it to investigate how natural and human systems work, and understand how resources can be managed in such a way that they will be sustained into the future.



Source GT.8 A minke whale and her one-year-old calf are being dragged on board the Japanese factory ship *Nisshin Maru*. Anti-whaling activists argue that the number of whales hunted by the Japanese each year is unsustainable.

CHANGE

The Earth is constantly changing. Some changes occur very rapidly and are easy to see, while others take place over millions of years and are almost undetectable to us. The concept of **change** is important in geography because it helps us to understand what is happening around us and see the world as a dynamic place. Over millions of years, the Earth has been shaped and changed by natural forces, such as climate, earthquakes, volcanoes, running water and storms to name just a few. In more recent times, humans have shaped and changed the Earth to suit their own needs, but events such as volcanic eruptions and tsunamis are a reminder that powerful natural forces continue to alter the face of the Earth, regardless of what humans do.

Changes take place on many different levels, from personal and local right through to national and global. Small local changes that happen quickly, such as a tree falling over on your street or a creek flooding, are often easy to observe and explain. Larger regional or national changes, such as an earthquake or tsunami, can happen quickly and their effects can be widespread and have devastating impacts on places and people (see Source GT.9). Changes that take place on a global scale can take much longer to occur. Global warming, for example, is a long-term change that happens slowly. Global warming has widespread effects that are not easily explained.

Observing and understanding changes that are natural or are made by humans and have occurred over time is an important part of any geographical inquiry. Geographers need to look at different types of changes, why they have occurred, over what time period they have occurred and what further changes may take place as a result. Sometimes changes can be positive, such as the conservation of plants and animals in national parks, while other changes can have negative consequences, such as the deforestation of native rainforests in Indonesia. Geographers play an important role in ensuring that change is managed in a sustainable way.









Source GT.9 The changes that took place in a Japanese coastal suburb of Rikuzentakata as a result of a tsunami in March 2011 were devastating and very rapid. The top image shows the area before the tsunami and the bottom image shows the same area after it had struck.

REVIEW GT.1.1

Remember and understand

1 Examine the photo of Fitzroy Falls (Source GT.1). Is this a natural or human environment? Give reasons for your answer.

2 New York City (shown in Source GT.3) is one of the world's largest cities. List five ways in which this human environment would affect how people live and work.

3 Look carefully at Source GT.4. Why have people settled in this location? Describe the pattern formed by the houses in the township.

Apply and analyse

4 Here are some examples of changes that may be occurring on Earth at any given time:

- A new supermarket is being built near your house.
- Trees are being planted in your street.
- The polar ice caps are melting.
- A tornado is destroying a town in the United States.
- The Great Barrier Reef is being damaged by the crown-of-thorns starfish.

a Conduct some research online to rank these changes from the slowest to the most rapid.

b Which of these changes are caused by human activities and which are caused by natural processes?

c Identify the scale at which each of the above changes takes place; that is, local, regional, national, international or global.

5 Using Source GT.6, explain the chain of events that would lead to flooding in this slum area of Bangladesh. Describe how and why slum dwellers would be more affected by this event than the wealthy.

6 List three ways in which your school or household is addressing the concept of sustainability. Which of these do you believe is most successful? Why?

7 Examine Source GT.8. Work with a partner to conduct research on the importance of the Southern Ocean Whale Sanctuary in conserving endangered whale species.

8 Study Source GT.9. Identify the major changes to the Japanese coastal suburb as a result of the tsunami. How might an understanding of the concept of change be useful in guiding the rebuilding or relocation of the suburb?

9 Your class is undertaking research on the Great Barrier Reef. Develop one question for each of the seven geographical concepts discussed in the text.

Investigate and create

10 Create a diagram, such as a flow chart, to show the interconnection between the natural and human environment at Antarctica's McMurdo Station (Source GT.5). Include information on aspects such as climate, landforms, wildlife and human settlement (especially waste management and change to the natural environment).

11 Choose one of the key concepts that has been discussed. Design a poster for your geography classroom to help you and your classmates remember this concept and use it in geography.

GT.2 GEOGRAPHICAL INQUIRY SKILLS

Geography has been described as the 'why of where'. Geographers examine the world and try to explain what they see. Like a detective at the scene of a crime, they follow a line of inquiry – they ask geographical questions, collect evidence, evaluate and interpret the evidence to find an answer, communicate their findings, reflect on what they have found out and, finally, decide on a course of action.



Source GT.10 Geographers are curious. They look at the Earth's features and always want to know more about them.

To follow a line of inquiry, geographers need a range of skills. By studying geography you will gradually master each of these skills. Some of them you will find easy to master; others may take a little longer. As you develop each new skill you will have gained another important tool for explaining the natural processes and human activities that shape our amazing planet.

Each of the skills you will learn over the course of this year is explained in this section. It might help you to think of each of these skills as individual tools in your toolkit. For some geographical inquiries you may only need to use one tool; for others, you may need to use many.

ACQUIRING GEOGRAPHICAL INFORMATION

Identify an issue or problem

Developing an awareness and understanding of our world begins by observing the processes that are taking place in it. Geographers look at people, land, air, water, plants and animals and the connections between them to understand what is happening. They also seek to investigate where, why and how natural and human environments are formed and changed. These observations often include identifying any problems or issues that need to be investigated and resolved.

If you look out the window of your classroom you will become aware of your surroundings. Is it a sunny day? Is it windy? Can you see any buildings or trees? Are there any clouds? Even though you may look out this window on most days and take what you see for granted, these simple issues or problems can easily become the basis of a number of different geographical inquiries. If the Sun is shining, you might like to begin an inquiry into the hours of sunlight and the pattern of temperatures in your area. If it is windy, you might like to begin an inquiry into what direction the wind is coming from, how strong it is and why. If you can see lots of trees or buildings, you might like to begin an inquiry into what type of environment you are in and the different forces that have shaped it. Once you have identified an issue or problem to explore, the next stage is to develop some geographical questions to focus your inquiry.

Develop geographical questions to investigate the issue or problem

Geographers ask lots of questions. Geographical questions can be as simple as 'What is it?' and 'Where is it?' or more complex, such as 'What is the connection between these two things?' and 'How and why have things changed over time?'

As a geographer, no longer will you look at something in your world, such as Uluru, and only think of it as an interesting place to visit. Instead, you will begin to ask questions about how it was formed and came to look the way it does. You will also start to ask questions about the area in which it is located, its vegetation, how it is used and managed, and its significance for Indigenous Australians.

SKILL DRILL

Developing geographical questions

Study Source GT.11. This visitor to Uluru is asking some important geographical questions. You can learn to do this too by starting your questions with the words 'what', 'where', 'how', 'why', 'what impact' or 'what should' when thinking about a particular feature or place.

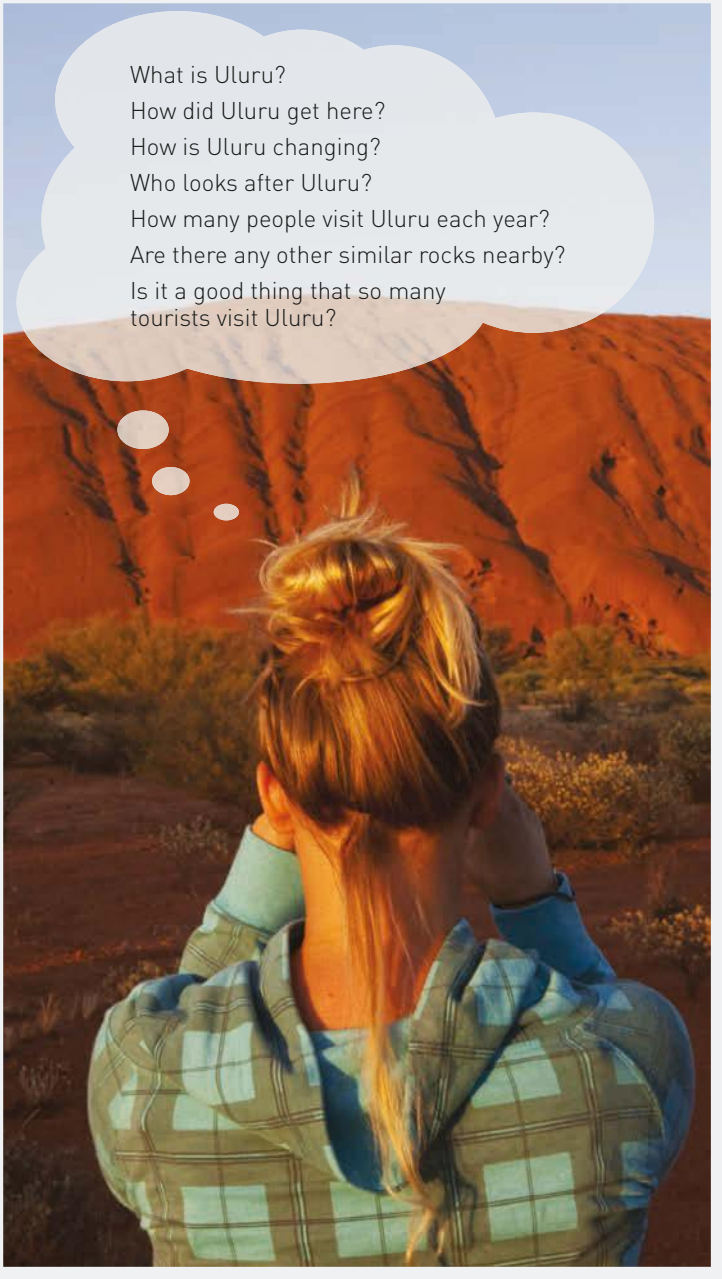
Your questions should deal with ideas such as:

- Where is it?
- How many are there?
- How big is it?
- What pattern or shape is it?
- Why is it like this? Is it like this because something else is at this location?
- How does it interact with other things in this place?
- Who interacts with it?
- Is it changing? If so, why is it changing and what will it look like in the future?
- How should people best manage this change?

The very best questions open up an exciting area for you to explore. For example, the visitor might ask a simple question, such as 'How big is Uluru?' This is a question with a relatively simple answer. A better geographical question for the visitor to ask would be 'Why is Uluru so big?' This question opens up a whole new area for exploration.

Apply the skill

1. Why would it be better to ask, 'Why is Uluru so big?' than, 'How big is Uluru?'
2. Where could you look to find answers to the question, 'Why is Uluru so big?'
3. Examine the photograph of Fitzroy Falls at the beginning of this chapter (Source GT.1). Work with a partner to develop geographical questions about this landscape.



Source GT.11 Developing geographical questions is an important part of a geographical inquiry.

Focus your inquiry

Once you have asked a range of more general questions about a geographical feature or issue, it is time to select one question that will become the focus of your inquiry. For example, you may choose to investigate the **key inquiry question**, 'Is it a good thing that so many tourists visit Uluru?'

The next step is to decide what data is needed to answer the question and how to collect the data.

Source GT.12 A guide for planning the direction of a geographical inquiry into Uluru

Key inquiry question	Data needed	Possible sources of data
Is it a good thing that so many tourists visit Uluru?	• Information on the importance and significance of Uluru to the Anangu, who are the Indigenous people in the area • Information on the management and maintenance of the park	• Conduct fieldwork into visitor numbers. • Create surveys and questionnaires for visitors to complete. • Contact Parks Australia and Uluru–Kata Tjuta National Park for information on how the park is managed. • Download resources from the Parks Australia website; for example, podcasts, maps, visitor guides, geological reports, audio tours and images.

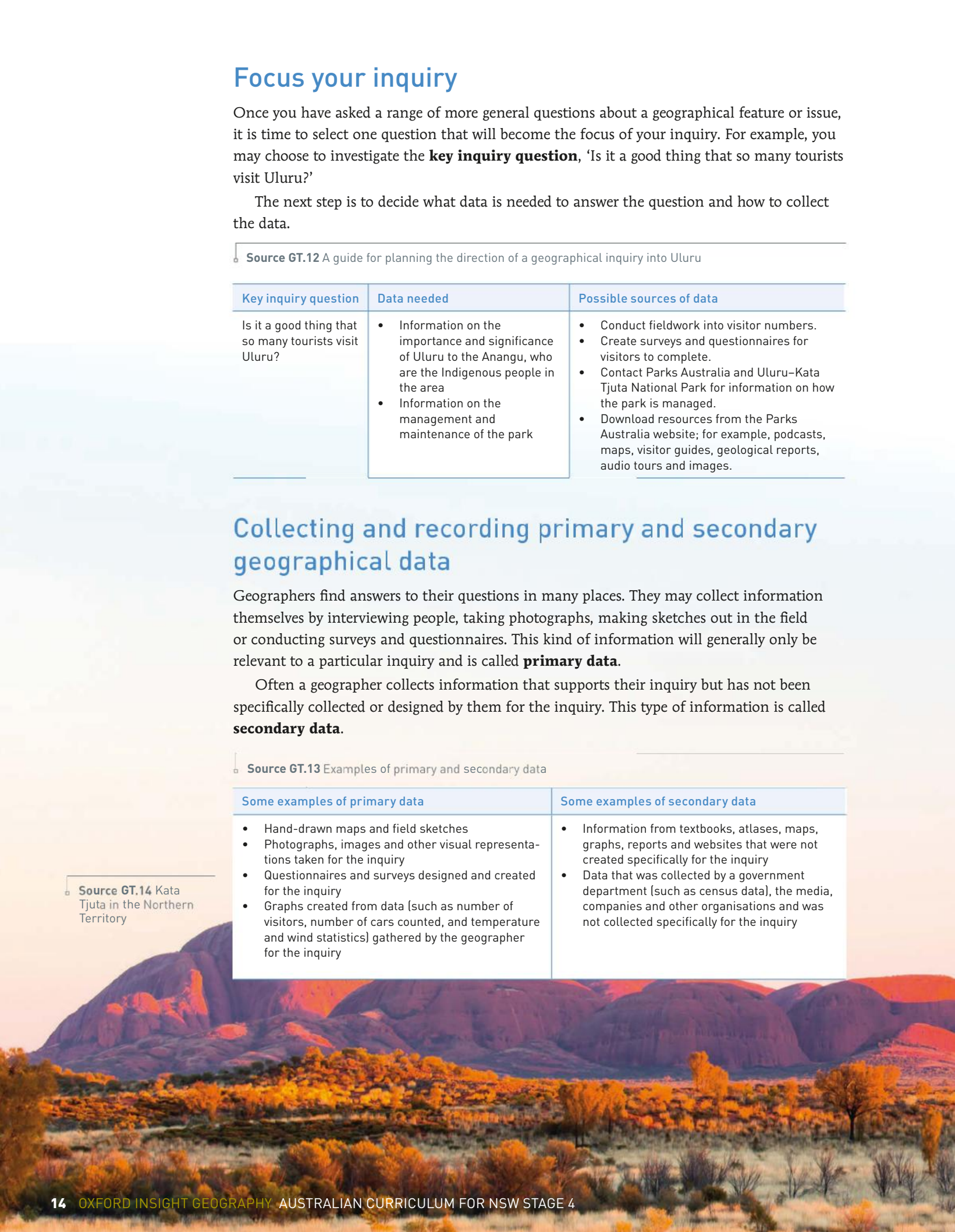
Collecting and recording primary and secondary geographical data

Geographers find answers to their questions in many places. They may collect information themselves by interviewing people, taking photographs, making sketches out in the field or conducting surveys and questionnaires. This kind of information will generally only be relevant to a particular inquiry and is called **primary data**.

Often a geographer collects information that supports their inquiry but has not been specifically collected or designed by them for the inquiry. This type of information is called **secondary data**.

Source GT.13 Examples of primary and secondary data

Some examples of primary data	Some examples of secondary data
• Hand-drawn maps and field sketches • Photographs, images and other visual representations taken for the inquiry • Questionnaires and surveys designed and created for the inquiry • Graphs created from data (such as number of visitors, number of cars counted, and temperature and wind statistics) gathered by the geographer for the inquiry	• Information from textbooks, atlases, maps, graphs, reports and websites that were not created specifically for the inquiry • Data that was collected by a government department (such as census data), the media, companies and other organisations and was not collected specifically for the inquiry



Source GT.14 Kata Tjuta in the Northern Territory

Primary and secondary data provide either **quantitative data** or **qualitative data**. Quantitative data includes anything that can be recorded as numbers (for example, Uluru is 3.6 kilometres long and 1.9 kilometres wide and has a circumference of 9.4 kilometres). Qualitative data, on the other hand, includes anything that can be recorded in words (for example, Uluru, one of Australia's best-known natural landmarks, is very large).

Source GT.15 Examples of quantitative and qualitative data

Some examples of quantitative data	Some examples of qualitative data
• Climate and temperature statistics • Tourist numbers • Population figures (including birth and death rates) • Types and amounts of food grown • Plant and animal species and wildlife in certain areas • Forest clearance rates • Numbers of people killed in natural disasters • Numbers of volcanic eruptions and earthquakes	• Opinions • Points of view • Personal stories • Likes and dislikes • Feelings

Good geographical inquiries will always be based on a combination of primary and secondary data that is both quantitative and qualitative. Even though qualitative data is an important part of any geographical inquiry, quantitative data is considered to be more valuable because it is less open to personal interpretations and can be more accurately represented in graphs and charts.

REVIEW GT.2.1

Remember and understand

1 Good geographers are like detectives. Why is this?

2 On your way to school you notice that bulldozers are clearing an area of bushland.

- **a** How could this observation form the basis of a geographical inquiry?
- **b** Write five different types of questions to assist you in your geographical inquiry into the clearing of this bushland.
- **c** Give two examples of primary data and two examples of secondary data that you could collect to answer your inquiry question.
- **d** What is the main difference between these two types of data?

Apply and analyse

3 There is a proposal to build a new shopping centre.

- **a** Describe how a geographer would be able to find out what local people thought about the proposal.
- **b** What two additional issues may be linked to this geographical inquiry into the construction of a new shopping centre? One issue should relate to the natural environment and the other to the built environment.

Investigate and create

4 Develop five questions that may assist a geographer with conducting an inquiry into the proposed development of a new shopping centre within their local area. Create a planning table similar to Source GT.12.



PROCESSING GEOGRAPHICAL INFORMATION

Evaluate data and information for reliability and bias



Source GT.16
A geographer creating a map (or graph) from the data they have collected

Before you move to the next stage of your inquiry, it is important to check that you have recorded all your data without errors, and that it is balanced and fair. Your data should not reflect your personal opinions, emotions or attitudes; it should present the facts in a clear and concise way.

Represent data and information in appropriate forms

Geographers often present the information they gather during their inquiries in a number of different forms. They may make maps, create graphs and tables or even draw diagrams to help them look for patterns in the data they have gathered. These tools also help people who were not involved in the inquiry (such as the general public, the government or people in the media) understand the work that has been done. Refer to GT.3 for more information on maps, graphs and statistics, **spatial technologies** and **visual representations**.

Interpret data and information gathered, analyse findings and results, draw conclusions

Once you have collected, recorded, evaluated and represented your data, it is time to interpret the data and information and to identify any **trends**, patterns or relationships. You will have used questionnaires and surveys to gather visitor statistics, drawn sketches and diagrams, created graphs and tables and taken photographs (all of which are primary data). You will also have collected information from various other sources, such as textbooks, websites, **geographic information systems (GIS)** and atlases (all of which are secondary data). Now it is time to look at this information, identify any possible links and relationships, and draw conclusions.

There are a number of methods that geographers use to help them during this stage of their inquiries. These include the PQE method and the SHEEPT method.

Using the PQE method

PQE is a tool used by geographers to analyse the data they have gathered (such as maps, tables, graphs and diagrams) and reach conclusions. PQE stands for pattern, quantify and exceptions.

Pattern (P)

In this step, you need to give a general overview of any patterns you may identify.

When looking at any form of data, look for things that stand out or form patterns. A pattern may be a group of similar features on a diagram, a concentration of a particular colour or feature on a map, or a particular shape that is created by data on a column graph. For example, when looking at a physical map of Australia (see Source GT.17) you might say, 'Most mountains run along the coast in the east'.

Quantify (Q)

In this step, you need to add specific and accurate information to define and explain the patterns.

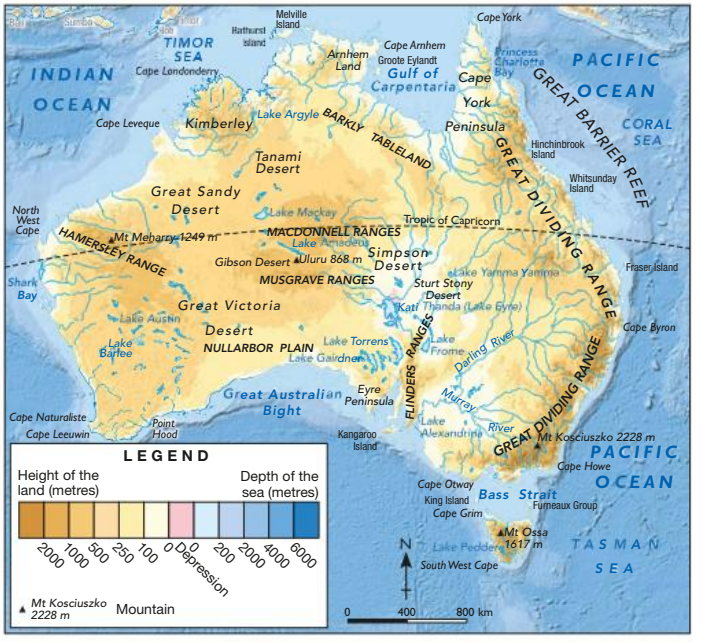
Quantifying involves using statistics, amounts, sizes and locations to give specific details. For example, rather than just saying, 'Most mountains run along the coast in the east', you would need to quantify this statement. You might instead say, 'A mountain range known as the Great Dividing Range extends more than 3500 kilometres along the eastern cost of Australia from Queensland to Victoria. It is the third longest mountain range in the world'.

Exceptions (E)

In this step, you need to identify anything that does not fit your patterns.

Often you may find that there are things in your data that do not fit into a pattern you have identified. These are called **exceptions**. They also need to be identified and quantified. For example, you might say, 'There are a number of other mountain ranges that are not on the east coast. These include the Flinders Ranges in South Australia and the MacDonnell Ranges in the Northern Territory'.

PHYSICAL MAP OF AUSTRALIA SHOWING OCEANS AND MAJOR MOUNTAIN RANGES, RIVERS, LAKES AND DESERTS



Source GT.17

Source: Oxford University Press

Using the SHEEPT method

SHEEPT is a tool used by geographers to help them consider the many factors that may contribute to the patterns identified in their data. When you are examining issues related to your inquiry, it is useful to think about them in terms of these six factors and rank them in order of importance. This will help you reach your conclusions. The letters SHEEPT stand for the following factors:

- social (**S**) – culture and people
- historical (**H**) – past events
- environmental (**E**) – the natural environment (including climate, landforms and vegetation)
- economic (**E**) – the earning or spending of money (including income earned from industry and tourism and the cost of building a dam or highway)
- political (**P**) – governments (including laws, regulations and policies)
- technological (**T**) – the availability and use of different types of technology (including the development of greener technologies, alternative energy sources and GIS).

REVIEW GT.2.2

Remember and understand

1 What does PQE stand for?
2 What does SHEEPT stand for?
3 How can the PQE and SHEEPT methods assist us to identify trends, patterns and relationships in geographical data and draw conclusions?

Apply and analyse

4 Look at Source GT.17. Use the PQE method to think about Australia's lakes.
   a Can you identify a pattern?
   b Can you quantify this pattern?
   c Are there any exceptions to this pattern?

Investigate and create

5 Conduct your own Internet research on the way in which Uluru is managed and use the SHEEPT method to think more closely about the factors that impact on Uluru.
   a List at least one point for each of the SHEEPT factors.
   b What conclusion(s) can you make about the way in which Uluru is managed?

COMMUNICATING GEOGRAPHICAL INFORMATION

Communicate the results using a variety of strategies

Geographers use a wide range of methods to inform other people about what they have found over the course of a geographical inquiry. After carefully considering their audience and the purpose of the inquiry, they may choose to communicate their conclusions in a number of different ways. Some of the methods that geographers use to communicate their findings include:

- written methods, such as essays or reports
- oral forms, such as oral reports, presentations, discussions and debates
- graphic forms, such as maps, graphs, and diagrams
- visual forms, such as **annotated visual displays (AVDs)**, photographs, sketches, **satellite images** and posters
- digital forms, such as Wikis, GIS, databases, 3-D models and simulations, and multimedia presentations.

SKILL DRILL

Creating an annotated visual display (AVD)

One of the most popular ways of presenting and communicating the findings of a geographical inquiry is to construct an annotated visual display (AVD). An AVD combines written text with visual representations (such as photographs, maps, graphs, tables, sketches and diagrams).

To create a successful AVD there are a few steps to follow.

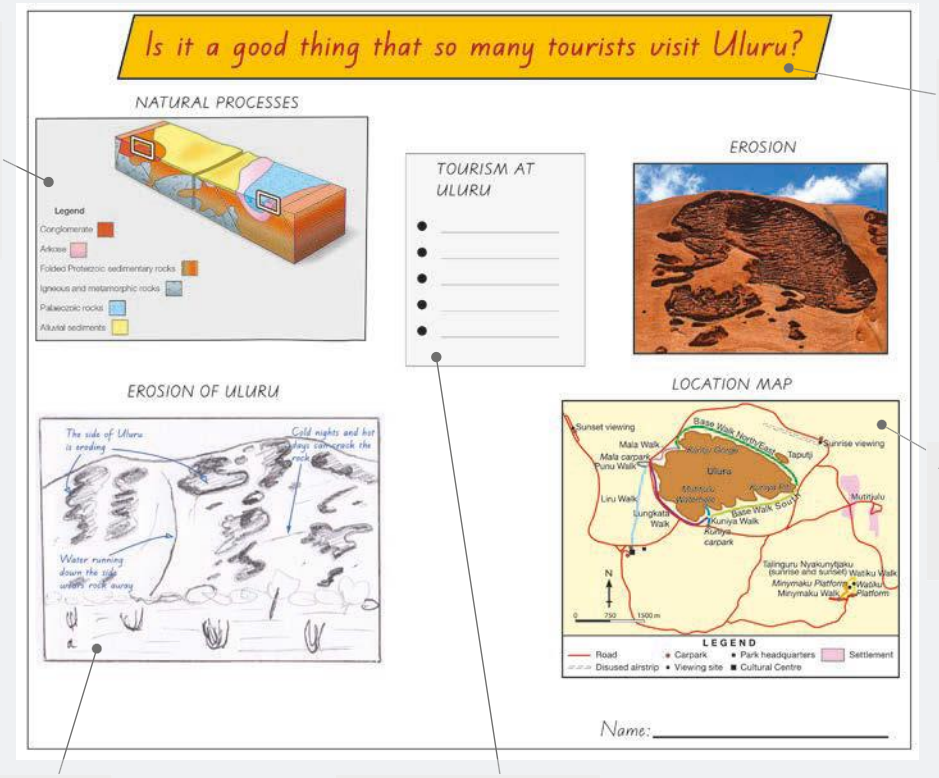
Step 1: Gather your data

Make sure that you have collected all the pieces of information and data that you have found or created throughout your inquiry. Print your photographs, tidy up your sketches and process any data that you have collected. Tables of raw data are usually much more effective when they are made into graphs (for example, bar graphs or pie graphs). All your maps, including sketch maps, must have BOLTSS (refer to GT.3, Geographical tools). Each resource (such as a graph, map, sketch, photograph, cross-section or written explanation) must also have a title and, in the case of photographs, a caption.

Step 2: Organise your results

On a large sheet of poster paper, lay out all your information and data. All written descriptions and answers should be typed, or neatly printed, on separate sheets of white paper, not written directly onto the poster paper. This will allow you to arrange them on the poster paper in the most logical and relevant way before you glue them down. The key inquiry question that began your geographical inquiry may guide your final layout. In the following example, the focus question, 'Is it a good thing that so many tourists visit Uluru?', suggests that there will be three main parts to the AVD:

- information about Uluru and its physical features
- tourist statistics and other data that show the effects that visitors are having on Uluru and its surroundings
- an analysis of the data, and a conclusion that answers the key inquiry question.



All diagrams, sketches, photographs and graphs must have a heading and a caption.

Make the heading stand out.

Always include a location map; remember BOLTSS.

A simple sketch can break up lots of writing.

Lists may be better than long paragraphs.

Source GT.18 An annotated visual display (AVD)

Natural processes illustration © Director of National Parks (Parks Australia)
www.parksaustralia.gov.au

Step 3: Present your results

When you are happy with your layout, design a main heading and other smaller headings. Don't forget to write your name in small, neat letters next to the heading or at the bottom of the AVD. Use glue to stick your resources onto your AVD. You may like to draw borders around some information.

Step 4: Acknowledge your sources

If you have used books or other resources (such as websites), these need to be acknowledged in a bibliography or a list of references. This can be stuck on the back of your AVD.

Apply the skill

1 Imagine that your class is exploring the Great Barrier Reef as a geographical inquiry with a particular focus on the impact of tourism on this natural environment.

a Discuss with a partner some geographical questions about this place.

b Select one of these questions that could be used to complete an AVD.

c Gather some data in response to this question. There is no need to explore this topic in great depth, but just to practise your communication skills. Your data could be sourced from the Internet, books, magazines or from your own personal experience. You should try to find about three or four images and some writing, such as a newspaper article.

d Work with your partner to design your AVD on a piece of A3-sized paper.

e Complete your AVD by following steps 3 and 4 of the Skill drill.

f Display your AVD on the classroom wall and compare it with those of your classmates.

Reflect on findings of the investigation

One of the final stages of a geographical inquiry is to reflect on the findings of your investigation. Reflecting involves not only looking at what you have learnt, but also how it has been learnt (that is, the process and effectiveness of the inquiry). It involves asking critical questions about the way in which your geographical inquiry was conducted and your role in it. One of the best ways to reflect on your progress is to complete a self-evaluation checklist rating your performance at each stage and adding comments (see Source GT.19).

Source GT.19 A self-evaluation checklist

The title of my geographical inquiry is:		
My geographical inquiry set out to investigate:		
GENERAL POINTS	**My rating**	**Comments**
I was able to complete all stages of my geographical inquiry.	1 2 3 4 5	
I was able to answer all my key inquiry questions.	1 2 3 4 5	
I was able to plan my inquiry effectively.	1 2 3 4 5	
My maps, graphs, tables and diagrams were clear and accurate.	1 2 3 4 5	
I was able to analyse my data and reach a conclusion.	1 2 3 4 5	
I was able to communicate my findings in an interesting and appropriate way.	1 2 3 4 5	
AREAS OF STRENGTH	**Comments**	
My areas of strength are:		
I'm getting much better at:		
AREAS NEEDING IMPROVEMENT	**Comments**	
The part I found most difficult was:		
I need the most help with:		
IMPORTANT ISSUES HIGHLIGHTED BY MY INQUIRY	**Comments**	
The most important thing I learnt from my inquiry was:		
This issue is important to me because:		
This issue is important to my community/country/world because:		

Propose actions, predict outcomes ... and take action!

After reflecting on what you have learnt, you may discover that action is needed in order to respond to the issue you have been investigating. There are a number of different ways that geographers can take action to make a change. These include:

- creating a fact sheet or multimedia presentation about the issue to inform your class, school or community
- using social media to raise awareness and gather support

- emailing your local government representative or Member of Parliament about the issue
- inviting an expert speaker to present at your school assembly
- planning a campaign to raise money for the issue.

Our geographical inquiry into Uluru, based on the key inquiry question, 'Is it a good thing that so many tourists visit Uluru?', may lead us to actively campaign for tourism at Uluru to be managed in a more sustainable way so that this important landmark can be enjoyed by future generations. In particular, one of the negative effects discovered in the inquiry was litter, and a good example of a campaign to combat this is shown in Source GT.20.



Source GT.20
A geographical inquiry found that cigarette butts were a leading cause of litter at Uluru. One of the responses was the introduction of personal ashtrays. These ashtrays are available from the Cultural Centre and carry the logo, 'Don't let the ranger see your butt'. Park authorities reduced the number of butts littering the area and believe this has also reduced the risk of bushfires.

REVIEW GT.2.3

Remember and understand

1 What do the letters AVD stand for?
2 Make a list of the things you need to gather before creating an AVD.
3 Why is it important to spend time on the layout of the written and visual information that will be shown on your AVD?
4 Name two ways in which you could 'reflect' on what you have learnt throughout a geographical inquiry.
5 Give two reasons why it is important to evaluate your own work.

Apply and analyse

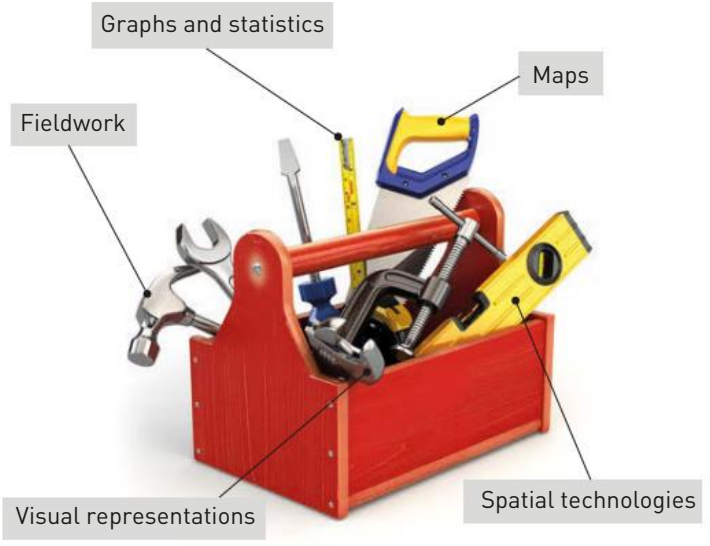
6 Do you think an AVD is an effective way to communicate the findings of a geographical inquiry? Why or why not?
7 As part of a geographical inquiry looking at the key question, 'Is it a good thing that so many tourists visit Uluru?', your teacher has asked you to take part in a class debate. List three points for the affirmative and three points for the negative. Which side would you rather be on? Why?
8 Which form (such as written, oral, graphic, visual or digital) do you think would be most appropriate for presenting the findings of a geographical inquiry into tourism at Uluru? Why?
9 Which do you think are the two most important questions to ask yourself in the self-evaluation checklist? Why?

Investigate and create

10 The school principal has asked your geography class to complete a geographical inquiry into the issue of recycling at your school. The principal hopes that by raising awareness of recycling, the school community may be willing to change its behaviour and make the school more sustainable. Conduct a class discussion on the most effective way to conduct the inquiry. At the end of your discussion, make a decision about the best way in which your findings could be presented to the whole school in order to convince everyone to participate.
11 The completed self-evaluation checklist can look very different depending on what you are investigating. Are there any areas that you think could be improved in GT.19? What questions could be changed or added so that you could improve on the reflection process?

GT.3 GEOGRAPHICAL TOOLS

Geographers use geographical tools in each step of their geographical inquiries. These tools can include many different types of maps, graphs and statistics, tables and charts, photographs and other visual representations and spatial technologies. Another essential tool for geographers is the ability to conduct fieldwork – any geographical study that takes place outside the classroom. In this section you will begin to explore some of the key geographical tools that you will use frequently in your study of geography.



Source GT.21 The essential tools needed by every geographer

MAPS

One of the most useful tools that geographers use to process information is a **map**. A map is a simplified plan of an area. Maps are drawn in the **plan view** (directly from above) because this ensures the scale will be the same across the entire area. If maps were drawn from an angle, some parts of the mapped area would look distorted and so it would not be an accurate representation of the area. When properly used, maps can reveal a great deal about our planet and the ways in which we use it.

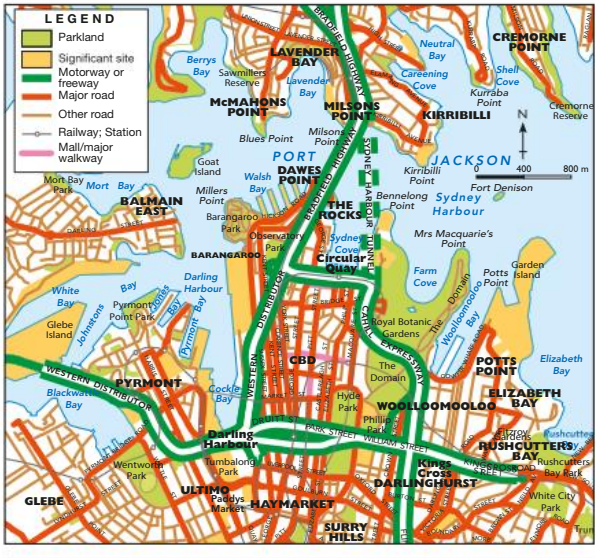
Simple maps

Geographers use different types of maps to show a whole range of different natural and built features – and the connections between them (See Sources GT.24 to GT.29). You will be learning how to create a number of different types of maps and interpreting the information that they provide.



Source GT.22 An aerial photograph of Sydney Harbour and the city

SYDNEY: HARBOUR AND CBD



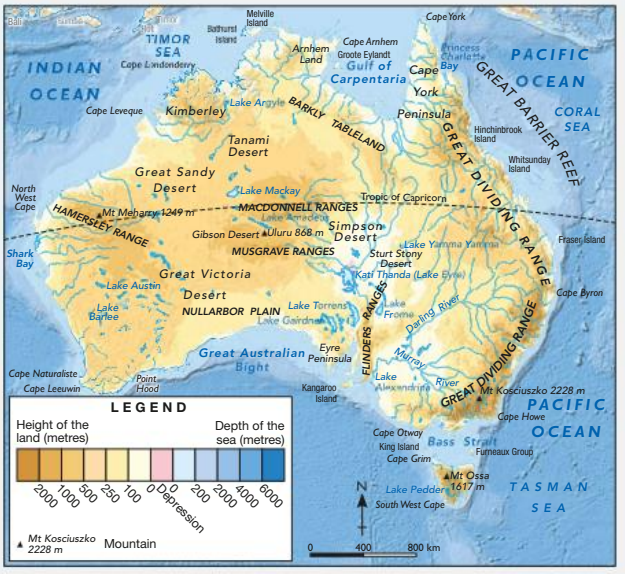
Source GT.23 A map of Sydney Harbour and the city (as shown in GT.22)

Source: Oxford University Press

Physical maps

Physical maps show the locations and names of natural features of the Earth. These may include deserts, mountains, rivers, plains, oceans, reefs, volcanoes and lakes.

AUSTRALIA: PHYSICAL



Source GT.24

Source: Oxford University Press

Political maps

Political maps show the locations and names of built features of the Earth. These may include country borders, state and territory borders, cities and towns.

AUSTRALIA: POLITICAL



Source GT.26

Source: Oxford University Press

Dot distribution maps

Dot distribution maps use dots (or shapes) to represent (and sometimes compare) a range of different features. The dots show the location of the chosen feature. The size and colour of the dots on the map can show different characteristics of that feature. Dot distribution maps help to show patterns and links between features – geographers refer to this as spatial distribution.

AUSTRALIA: POPULATION DISTRIBUTION



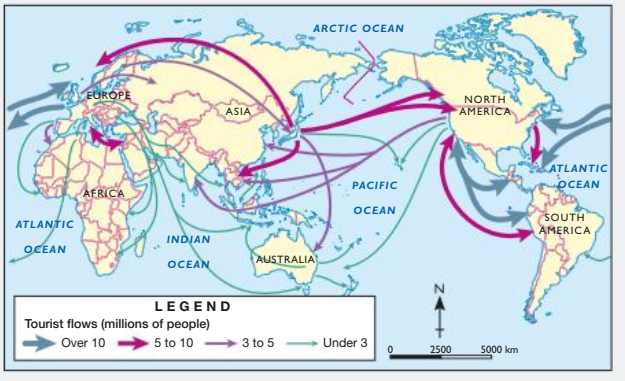
Source GT.25

Source: Oxford University Press

Flow maps

Flow maps show movement from one place to another. Arrows of different thicknesses or colours are used to show where different things (such as people or goods) are moving to and from, and compare the numbers involved in the movement.

WORLD: TOURIST FLOWS



Source GT.27

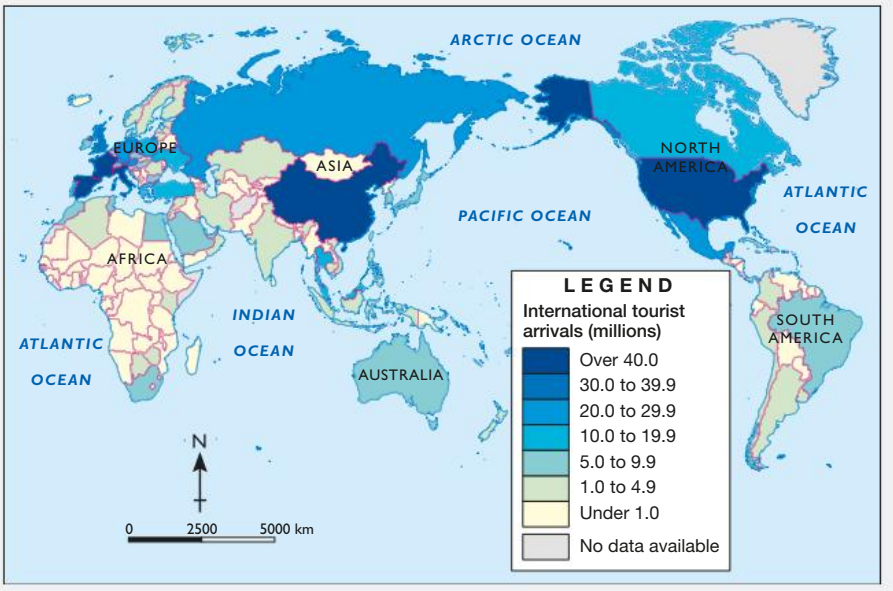
Source: Oxford University Press

Choropleth maps

Choropleth maps use different shades of the same colour to give a quick impression of the pattern formed by the data being shown. Darker shades show the highest values or the greatest amounts, while lighter shades show the lowest values or the least amounts.

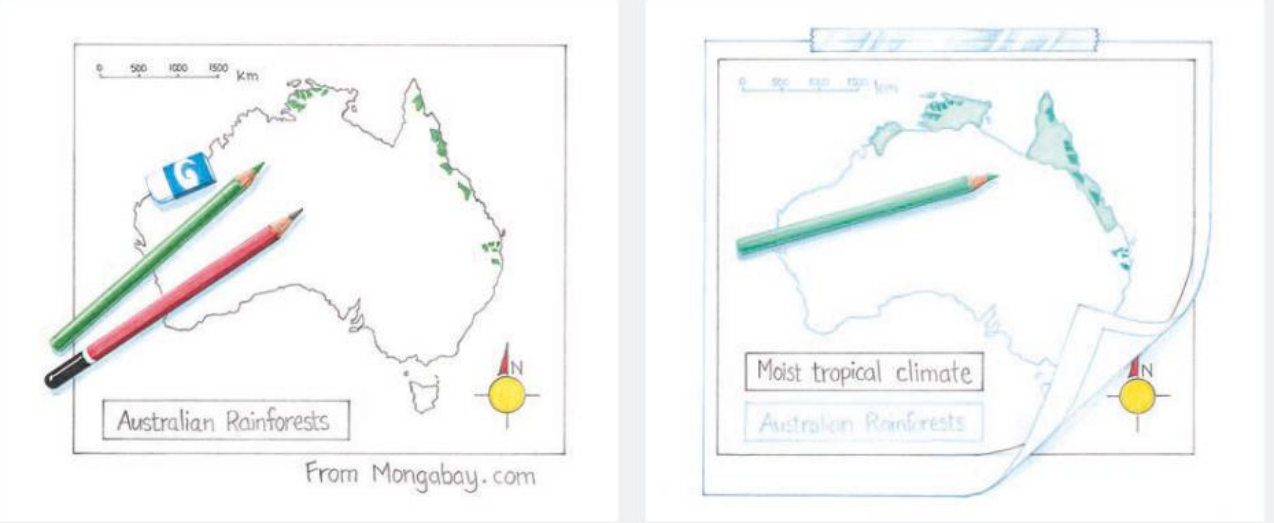
Source GT.28
Source: Oxford University Press

WORLD: INTERNATIONAL TOURIST ARRIVALS



Overlay maps

Overlay maps show how features on the Earth's surface may be related to each other. To create an overlay map you first need to produce a base map showing one feature (such as the location of Australian rainforests) and then place a piece of tracing paper or plastic sheet over this base map showing the other feature you are investigating (such as areas with a moist tropical climate).



Source GT.29 An overlay map showing the location of Australian rainforests on a base map (left) and areas with a moist tropical climate on an overlay (right)

More complex maps

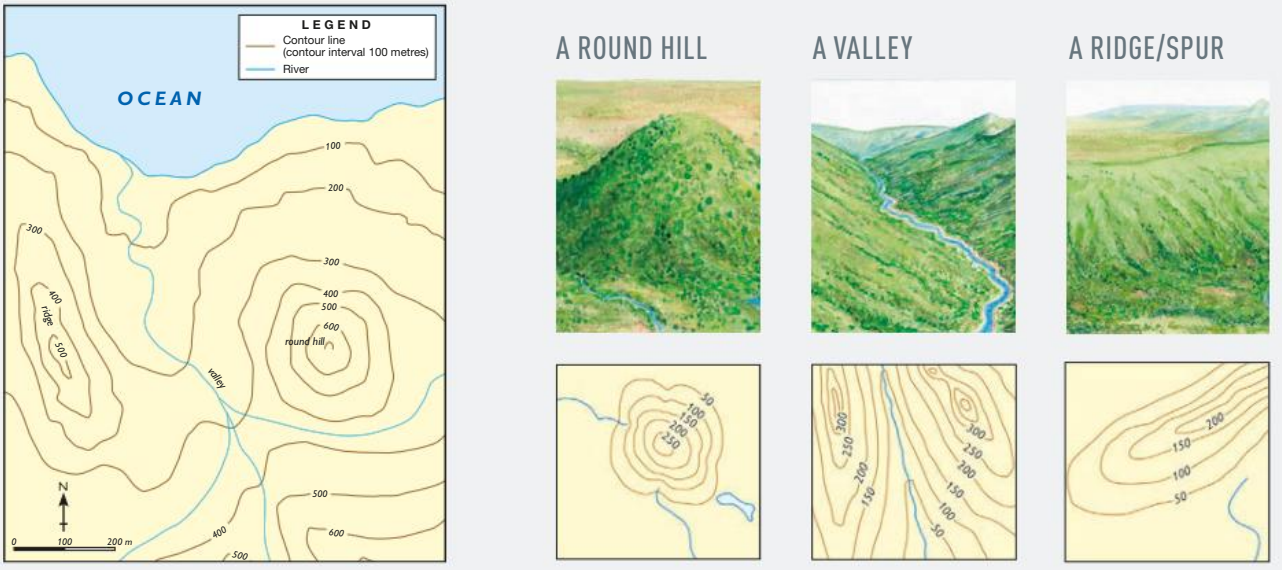
Over the course of the year you will also be working with a number of other, more complex maps. You won't necessarily be creating these maps yourself, but you will be learning how to make sense of the information they provide. These maps include topographic, weather and thematic maps.

Topographic maps

Topographic maps show the shape of the land (such as the shapes formed by valleys, hills and ridges) by using **contour lines**. Numbers on some of the contour lines show the height of the land above sea level. The closer together the contour lines are, the steeper the land.

Symbols and colours are also used on topographic maps to show other natural features (such as forests, rivers and lakes) and built features (such as towns, roads and mines). The contour patterns of three common features are shown beside the topographic map in Source GT.30.

TOPOGRAPHIC MAP SHOWING A ROUND HILL, A VALLEY AND A RIDGE



Source GT.30

Source: Oxford University Press

Weather maps

Weather maps show conditions in the atmosphere, such as air pressure, wind speed and wind direction at a particular point in time. They also show the size and location of warm and cold fronts. Weather maps are also known as synoptic charts. They are most commonly seen on the nightly news.



Source GT.31 Weather maps feature in the nightly news on television.

Thematic maps

Thematic maps show a particular theme or topic; for example, the distribution of resources (such as coal and gas), the different types of forests around the world, access to safe drinking water, or the types of crops and animals farmed in Australia.

AUSTRALIA: MAJOR CROPS AND LIVESTOCK



Source GT.32 Source: Oxford University Press

Essential features of maps

BOLTSS

Regardless of the type of maps you are creating or interpreting, all will share some common features. There are six features that ensure every map is drawn in a clear, concise and accurate way: border, orientation, legend, title, **scale** and source. To help you remember these features, you can use a mnemonic (memory aid) that consists of the first letter of each of the features. Together, these six letters make up the word **BOLTSS**. Source GT.33 shows a map of Australia that includes all the essential BOLTSS features.

B **Border** – an outline or box drawn around the map

O **Orientation** – an indication of direction, usually shown with a north arrow or compass rose

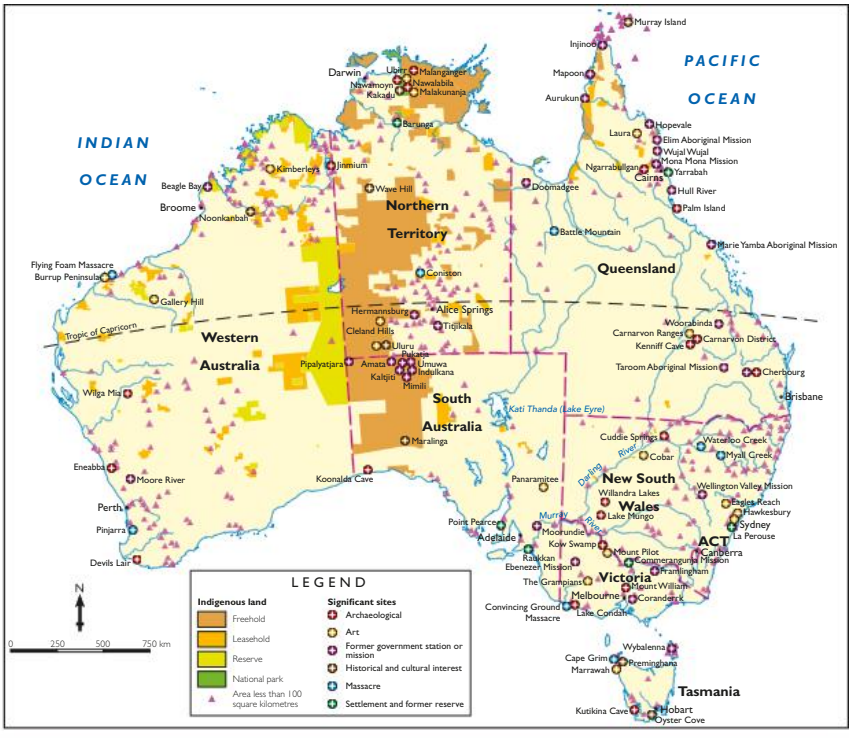
L **Legend** – an explanation of the symbols, colours and patterns used on the map (also known as a key)

T **Title** – a heading that describes the map and what it is showing

S **Scale** – a way of indicating what distances on the map represent in the real world. Scale can be shown in three different ways: as a written scale, a line scale or a ratio. Source GT.36 shows the three ways scale can be represented on a map.

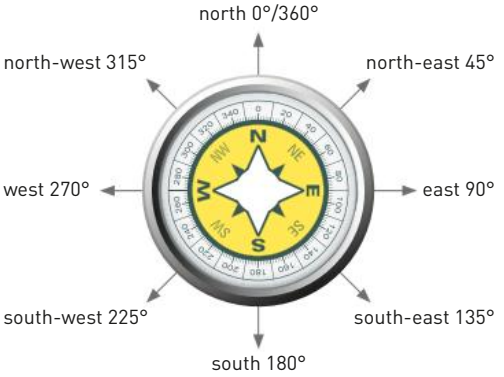
S **Source** – where the information used to create the map came from. If these details are not known, simply write 'Source: unknown'. If you have created the map from your own data, simply write 'Source: own map' or 'Source: [add your name]'.

AUSTRALIA: INDIGENOUS LAND AND SITES, 2006



Source GT.33 A map of Australia showing all the features of BOLTSS

Source: Oxford University Press



Source GT.34 A compass face showing cardinal points and compass bearings

Direction

Direction must always be shown on maps because it enables the user to work out the location of features shown. Direction is shown on maps by the use of compass points. A **compass** is an instrument with a magnetised needle that will always point to the Earth's magnetic field near the north pole (known as **magnetic north**). The face of a compass shows a circle made up of 360 degrees (see Source GT.34).

The four main directions on a compass are north, south, east and west. These are known as **cardinal points**. Most maps are oriented to north. Once north has been established, you can find the other points of the compass.

Using compass points is an accurate way of giving directions because the compass always points to magnetic north no matter which direction you are facing.

Compass bearings provide an even more precise way to give directions. A bearing is an angle that is measured clockwise from magnetic north. The bearing of magnetic north can be either 0 degrees or 360 degrees, the bearing of south is 180 degrees, the bearing of east is 90 degrees and the bearing of west is 270 degrees. These bearings are also shown in GT.34.

Scale

We use scale to shrink or increase real-world features so they will fit into a space. Model cars are scaled down in size and proportion from real cars.

The model shown in Source GT.35 looks like the real car, only smaller. It is a 1:35 scale model. This means that 1 centimetre on the scale model is equal to 35 centimetres on the real car. If 1 centimetre represents 35 centimetres, then 10 centimetres (the total length of the model) represents a total length of 350 centimetres (or 3.5 metres) on the real car.

Scale on maps

Maps are scaled representations of real areas. These representations have been designed to fit on a piece of paper or on a computer screen. Maps look the same as the real areas they are representing, just reduced to a size you can work with. Scale on maps allows you to work out the **distances** in the real world.

Look at the map of Tasmania (Source GT.36). In the bottom left-hand corner it shows the three types of scale that can be used on maps and how they work:

- written scale – A written scale tells you how much a distance on the map represents on the ground. The written scale on Source GT.36 is 'one centimetre on the map measures 30 kilometres on the ground'. Using this information we can easily work out that 5 centimetres on the map would be equal to 150 kilometres on the ground, and so on.
- line scale – A line scale is a numbered line that acts like a ruler. You can use it to measure distances on the map. The Source GT.36 line scale shows 1 centimetre is equal to 30 kilometres.
- ratio scale – A ratio scale shows scale in numbers. The ratio scale for Source GT.36 is 1:3 000 000, so one unit (that is, 1 centimetre) on the map represents 3 000 000 centimetres on the ground. Of course, 3 000 000 centimetres is equal to 30 kilometres.



Source GT.35 This model car is 35 times smaller than the real car. This is expressed as 1:35.

SKILL DRILL

Using line scale to measure distances

Scale is a handy tool to help you study the world around you from inside your classroom. Look at Source GT.36. You will notice that all the features on the map have been shrunk by the same amount so that they fit on the page.

You can use the line scale to measure the distance between two points 'as the crow flies' (that is, in a straight line) by following these steps:

Step 1 Place the straight edge of a sheet of paper over the points you wish to measure.

Step 2 Mark the starting and finishing points on the paper.

Step 3 Hold the edge of the paper against the line scale to work out the real distance between the two points.

Alternatively, you could use a ruler to measure distance. Just remember to use the line scale; not the ruler measurement (e.g. 3 centimetres on the ruler equals 90 kilometres on the ground).

Apply the skill

1 Use Sources GT.36 and GT.37 to answer the following questions:

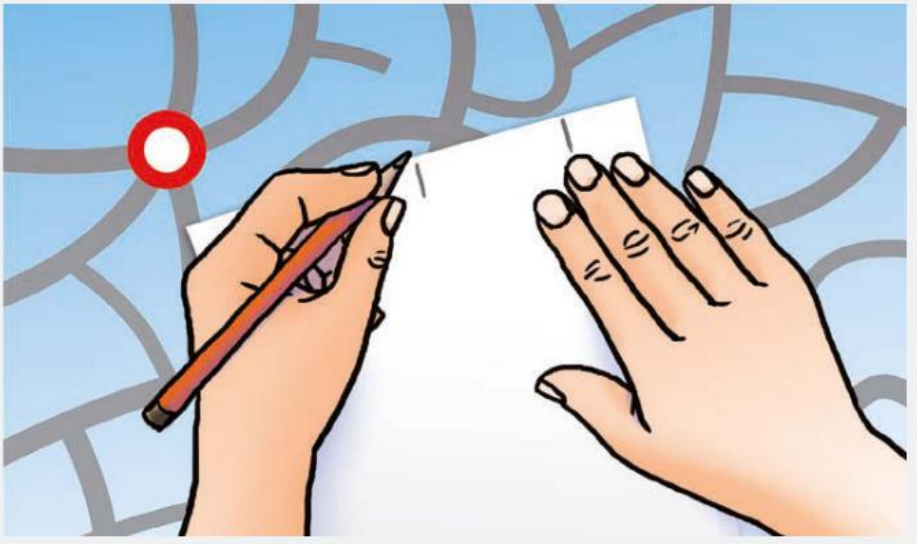
- **a** How far is it from the peak of Cradle Mountain to the centre of Hobart as the crow flies?
- **b** How far is it from Devonport in the state's north to Queenstown in the west as the crow flies?
- **c** How long is Lake Gordon from north to south?
- **d** How wide is the state of Tasmania at its widest point?

TASMANIA



Source GT.36

Source: Oxford University Press



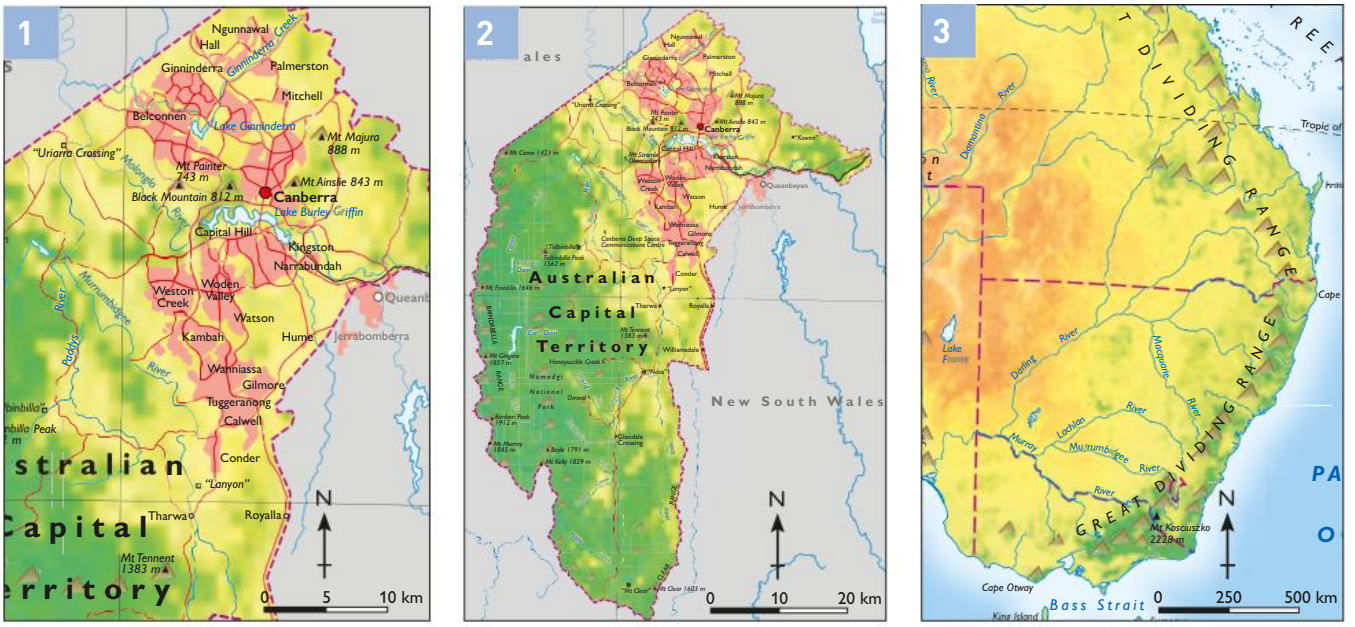
Source GT.37 Measuring straight distances on a map using a sheet of paper

Comparing map scales

Maps are often shown at different scales depending on the amount of detail they need to show. Source GT.38 shows three maps at different scales:

- Map 1 is a *large-scale* map. It shows a large amount of detail but only a small area. You can see the city area (in pink) and Lake Burley Griffin.
- Map 2 is a *medium-scale* map. It shows a medium amount of detail and a medium area. You can see the whole of the Australian Capital Territory (ACT).
- Map 3 is a *small-scale* map. It shows a small amount of detail but a large area. You can only just see the border of the ACT.

ACT AND EASTERN AUSTRALIA



Large-scale maps show detailed information about a small area.

Small-scale maps show general information about a large area.

Source GT.38

Source: Oxford University Press

REMEMBER:

- Large-scale maps show a *large* amount of detail, but a *small* area.
- Small-scale maps show a *small* amount of detail, but a *large* area.


Sumatra (Sumatera)
Borneo (Kalimantan)
Celebes (Sulawesi)
Java (Jawa)
Jakarta
Bandung
Semarang
Surabaya
Yogyakarta
Malang
Denpasar
Bali
Java Sea
Makassar
Manado
Gorontalo
Ambon
Halmahera
Flores
Sumba
Sumbawa
Timor
Kupang
Ende
Baubau
Buton
Banjarmasin
Palembang
Pontianak
Samarinda
Celebes Sea
Laut Maluku
Selat Makassar
Selat Sunda
Java
Madura
Lombok
Obi
Seram
Waigeo
Morotai
Tarakan
Bengkulu
Jambi
Pekanbaru
Batam
Belitung
Bunyut
Tanjung Pandan
Tolitoli
Kep. Sula
Kep. Talaud
Kep. Lingga
Kep. Anambas
Kendawangan
Teluk Betung
Enggano
Cilacap
Cirebon
Tegal
Pekalongan
Kudus
Purwokerto
Kediri
Probolinggo
Jember
Banyuwangi
Mataram
Bima
Waingapu
Ruteng
Labuan Bajo
Larantuka
Maumere
Selayar
Bitung
Kotamobagu
Luwuk
Poso
Palu
Mamuju
Majene
Pare-Pare
Bulukumba
Kendari
Raha
Wangi-Wangi
Tual
Saumlaki
Dobo
Merauke
Fakfak
Sorong
Manokwari
Biak
Nabire
Jayapura
Wamena
Tanahmerah
Timika
Agats
Ternate
Tidore
Weda
Sanana
Bula
Namlea
Piru
Masohi
Ambon
Saparua
Banda
Tanimbar
Aru
Kaimana
Teminabuan
Kep. Sula
Kep. Talaud
Kep. Anambas
Kep. Lingga
Kep. Tanimbar
Kep. Aru
Kep. Kai
Kep. Banda
Kep. Babar
Kep. Sermata
Kep. Barat Daya
Kep. Leti
Kep. Babar
Kep. Tanimbar
Kep. Aru
Kep. Kai
Kep. Banda

Locating places on maps

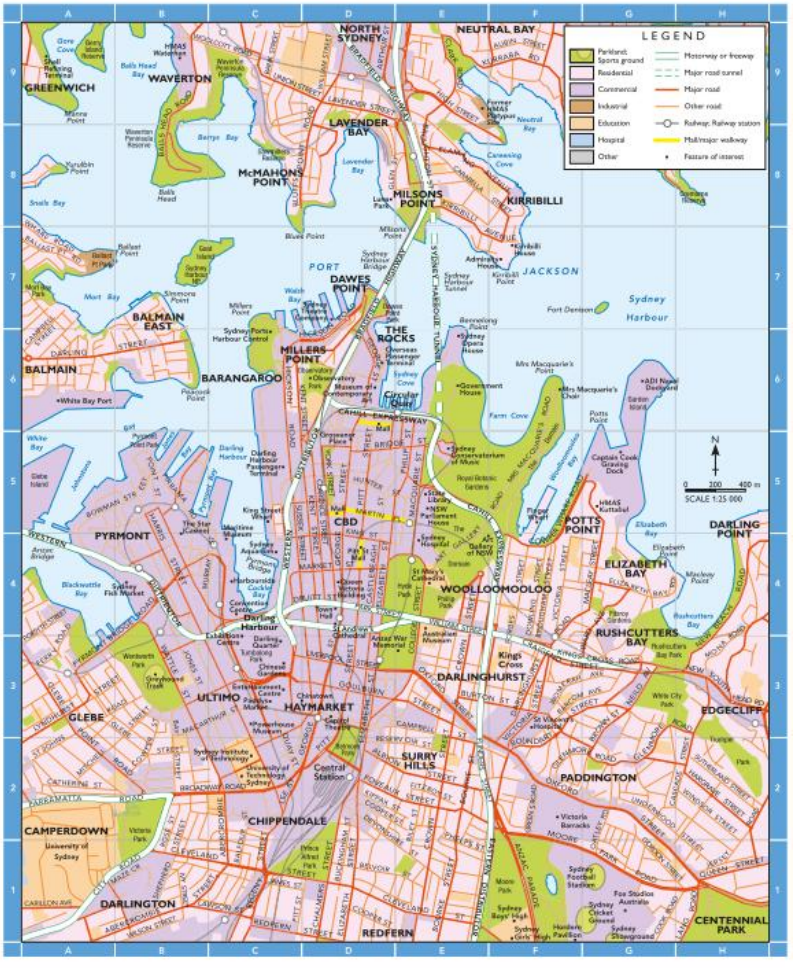
Maps are used for many different purposes, but the most commonly used maps help us to find things we are looking for. These maps are often overlaid with a set of lines that form a grid. These gridlines divide the map into smaller areas and help us find places more easily. There are a number of ways in which you can locate things on maps and a number of methods you can use to help other people find these places. Some of these methods will give you a general idea of where something is, while others can help you pinpoint the exact location of something.

Grid and area referencing

Alphanumeric grid referencing

In maps that use **alphanumeric grid** referencing, the spaces between gridlines are labelled with letters and numbers. The letters appear along the bottom (or top and bottom) of the map while the numbers appear down the left-hand side (or both sides) of the map. For example, in Source GT.39 the grid reference for the Sydney Aquarium is C4.

SYDNEY CBD AND INNER SUBURBS STREET MAP



Source GT.39 Source: Oxford University Press

Area referencing (AR)

The area referencing (AR) method is used on topographic maps that have gridlines. Each line is given a two-digit number. The lines that run up and down the map are known as **eastings** (because the numbers increase as you move east). The lines that run across the map are known as **northings** (because the numbers increase as you move north). A four-figure area reference will pinpoint the bottom left-hand corner of the grid square in which you will find the feature. The eastings are given first, then the northings. For example, in Source GT.40 the park is located in AR2813.

Six-figure grid referencing (GR)

Six-figure grid references (GR) help locate exact points on a topographic map. The area between each easting is divided into 10 further parts (tenths), as is the area between each northing. This is just like adding a finer set of gridlines over the existing gridlines allowing you to be very specific about where things are within each grid square. As with area referencing, the eastings are given first, then the northings. The difference is that one more figure is added to the easting and one more figure is added to the northing. This makes six figures in total. For example, in Source GT.40 the hospital is located at GR297156.

Latitude and longitude

Maps that show large areas of the Earth's surface (such as world maps) use a set of imaginary lines that form a grid. These gridlines, known as **latitude** and **longitude**, help us to locate places accurately.

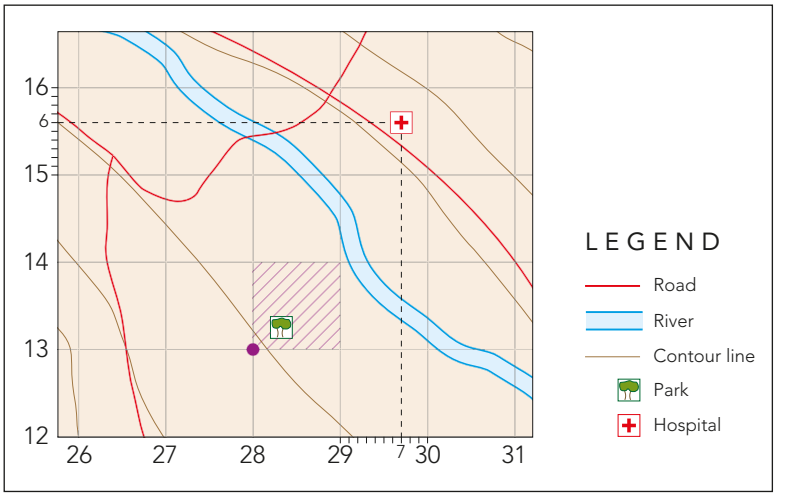
Lines that run from east to west are known as lines (or parallels) of latitude. Lines that run from north to south are known as lines (or meridians) of longitude. Each line is separated by degrees rather than distance because the world is round, not flat.

The line of latitude midway between the north pole (90 degrees north) and south pole (90 degrees south) is known as the **Equator**, which is located at 0 degrees latitude. It divides the Earth into the northern hemisphere and southern hemisphere.

Lines of latitude are measured in degrees north and south of the Equator.

Lines of longitude are measured east and west of the Greenwich meridian (also known as the Prime Meridian), which is located at 0 degrees longitude.

TOPOGRAPHIC MAP EXTRACT SHOWING AR AND GR

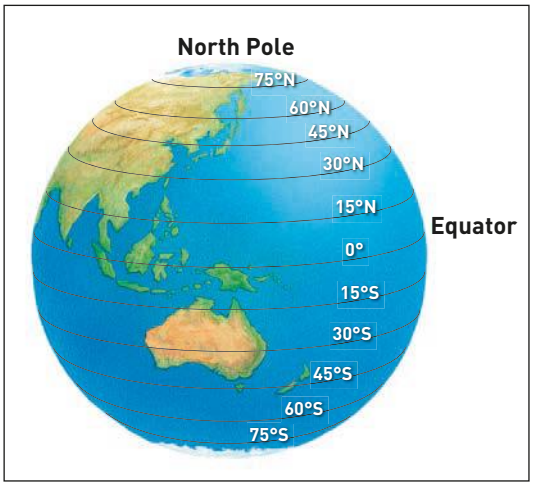


Source GT.40

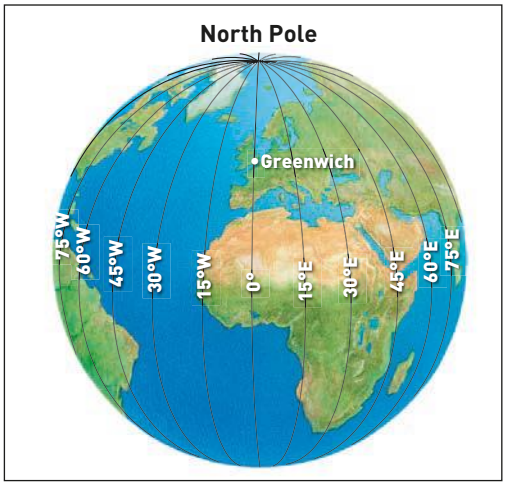
Source: Oxford University Press

REMEMBER:

- Latitude – think 'lat is flat'.
- Longitude – think 'long is down the page'.
- Which one first? Use them in alphabetical order: '*la*titude' before '*lo*ngitude'.



Source GT.41 Lines (or parallels) of latitude



Source GT.42 Lines (or meridians) of longitude

REVIEW GT.3.1

Remember and understand

1 What is a map?

2 What does BOLTSS stand for?

Apply and analyse

3 Look carefully at Source GT.36 and answer the following questions:

a What is the scale of the map? Give your answer in the form of a ratio.

b If you were flying from Marrawah to Port Arthur, in which direction would you be travelling?

Investigate and create

4 On a piece of graph paper, draw a simple map of your bedroom. Include all the furniture (for example, your bed and desk) in the correct location and to the correct scale. Make sure your map has BOLTSS.

GRAPHS AND STATISTICS

Geographers use many different types of graphs, charts and data tables to communicate the information they have collected.

- Data tables allow geographers to present and compare data (or statistics) by organising it under different headings (see Source GT.43).
- Graphs allow geographers to compare data and present it in an interesting and attractive way. There are a number of different types of graphs used by geographers for different purposes. The most common of these are explained next.

Source GT.43 A table showing the estimated populations of Australian states and territories in 2015

State/Territory	Population	Percentage of Australia's population
New South Wales	7 644 200	32.04
Victoria	5 966 700	25.01
Queensland	4 792 900	20.09
Western Australia	2 598 200	10.89
South Australia	1 701 100	7.13
Tasmania	517 200	2.17
Australian Capital Territory	392 000	1.64
Northern Territory	244 500	1.02
Australia	23 860 100	100.0

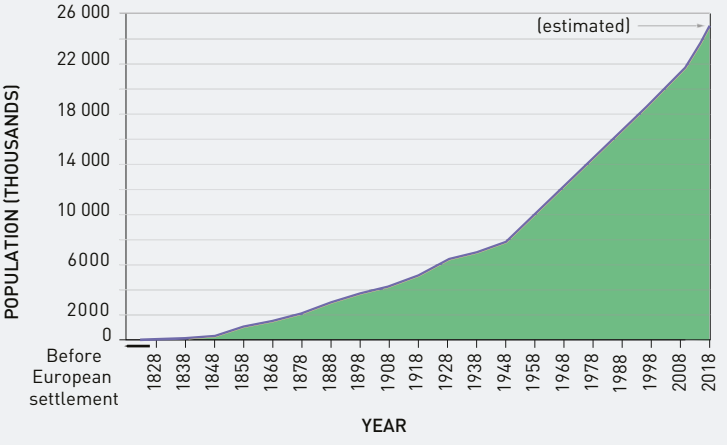
Source: ABS

Simple graphs

Graphs are one of the most effective visual representations when it comes to showing numerical (or quantitative) data. Some kinds of graphs are simple, while others are more complex. You will be learning how to create a number of different types of graphs and interpreting the information that they provide. Some of these graphs are described next.

Line graphs

Line graphs show information as a series of points that are joined up to form a line. The line shows a trend or change over time. The horizontal axis (x) will usually show units of time and the vertical axis (y) will usually show amounts.

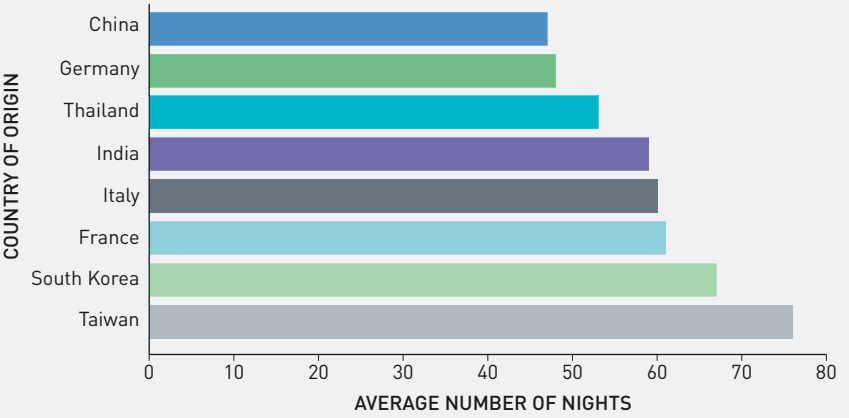


Source GT.44 A line graph showing the increase in Australia's population from 1828 to 2018 (estimated)

Bar graphs

Bar graphs show information as a series of bars that run in a horizontal direction and are stacked one on top of the other. They are most often used to compare quantities.

AUSTRALIA: AVERAGE LENGTH OF STAY FOR SELECTED OVERNIGHT INTERNATIONAL VISITORS

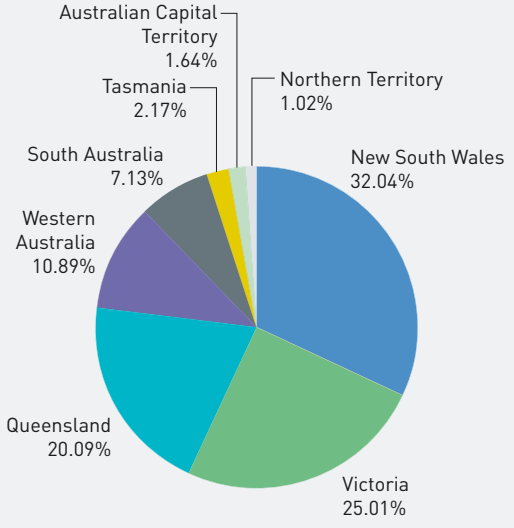


Source GT.45 A bar graph showing average number of nights spent in Australia by tourists from different countries, 2013

Pie graphs

Pie graphs are shaped like a circle and are divided into segments so that the information being shown represents the slices of a pie. The circle of 360 degrees represents 100 per cent, and each slice is a percentage of that. The slices of the pie are organised from largest to smallest in a clockwise direction, starting from 12 o'clock.

AUSTRALIA: STATE AND TERRITORY POPULATIONS

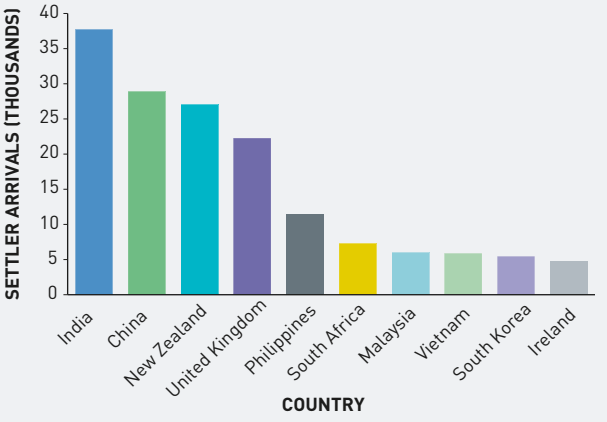


Source GT.46 A pie graph showing state and territory populations as a percentage of Australia's total population, 2015 (estimated)

Column graphs

Column graphs are similar to bar graphs, but they show information as a series of vertical columns that are arranged side by side. They are also used to compare quantities.

AUSTRALIA: TOP 10 SETTLER ARRIVALS



Source GT.47 A column graph showing the top 10 countries of settler arrivals in Australia, 2012–13



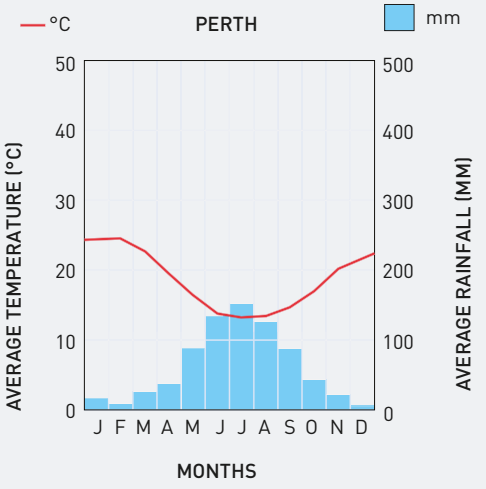
More complex graphs

Over the course of the year you will also be working with a number of other, more complex graphs. You won't necessarily be creating these yourself, but you will be learning how to make sense of the information they provide. Some of these graphs are described below.

Climate graphs

Climate graphs show the average monthly temperature and rainfall for a place over a year. Climate graphs combine line and column graphs. Temperature is recorded as a line graph and rainfall is recorded as a column graph.

PERTH: CLIMATE GRAPH

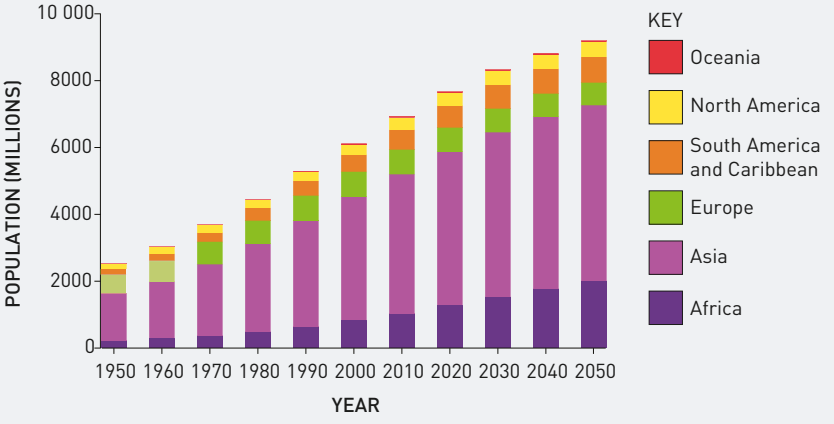


Source GT.48 A climate graph showing the average monthly temperature and rainfall in Perth

Compound column graphs

Compound column graphs are a more complex type of column graph in which each column is split into sections so results can be more easily compared.

WORLD: POPULATION GROWTH BY REGION

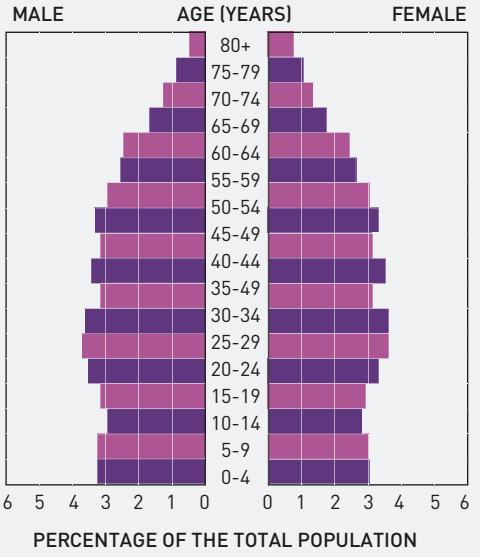


Source GT.49 A compound column graph showing the increase in world population by region, 1950–2050 (estimated)

Population pyramids

Population pyramids are bar graphs that show the percentage of males and females in different age groups in a population. They help geographers identify trends in population growth in a country. Population pyramids are organised so that younger age groups are at the bottom and older age groups are at the top. Percentages of males are placed on the left-hand side and percentages of females are placed on the right-hand side.

AUSTRALIA: POPULATION PYRAMID



Source GT.50 A population pyramid for Australia in 2015. It shows, for example, that there are more females than males over the age of 80.

REVIEW GT.3.2

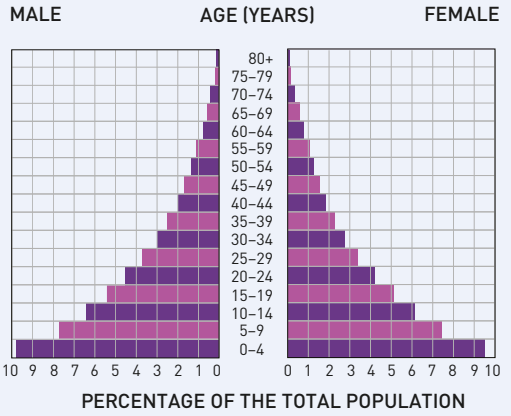
Remember and understand

1 Using Source GT.44, what was Australia's population in 1948?
2 Using Source GT.47, which continent provided the most permanent settlers to Australia in 2012–2013?
3 Using Source GT.49, what is the world's population expected to be in 2050? How many of these people will be living in Asia?

Apply and analyse

4 Create an appropriate graph to display the information in Source GT.43.
5 Why does Niger have a pyramid-shaped age structure?

NIGER: POPULATION PYRAMID



Investigate and create

6 Suggest reasons to account for the differences in the average number of nights spent in Australia by tourists from Taiwan and Germany in Source GT.45.

SPATIAL TECHNOLOGIES

Spatial technologies display and record data by interacting with real-world locations. Geographers use spatial technologies on a daily basis to help them collect, process and communicate geographical information.

You may already be familiar with the following spatial technologies:

- geographic information systems (GIS)
- global positioning systems (GPS)
- satellite imagery (remote sensing).

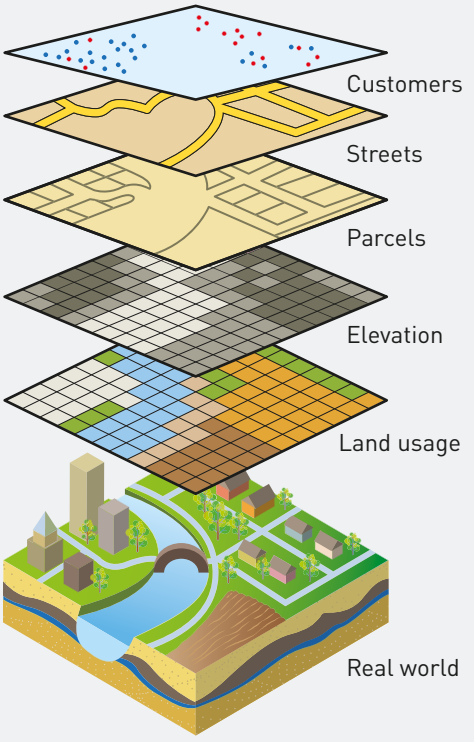
Geographic information system (GIS)

A geographic information system (GIS) is a way of creating, viewing, organising and analysing geographical information through a software application. Modern GIS technologies using digital information allow geographers to access and share an incredible amount of data and look at the world in new ways. GIS is made up of three elements:

- digital base maps
- data that is layered over the base map (such as a chart, overlay or table)
- a software application or platform that links these elements together and allows the user to interact with all of this information.

GIS combines satellite images, graphs and databases to allow you to identify patterns and trends so that you can gain a better understanding of the world around you. It allows you to turn different layers of data on and off in order to isolate exactly what you are looking for. You can even create and share your own maps, look at 3-D models of areas and record video simulations, known as flyovers.

GIS is already a part of many people's everyday life. Governments, companies and individuals all around the world use GIS. There are a number of GIS platforms available today, but one of the most commonly used and free GIS applications is Google Earth.



Source GT.51 This image shows how different layers of information are packed on top of each other to create a GIS map.

Global positioning system (GPS)

GPS is a space-based navigation system that can show your exact position on Earth anytime, in any weather, no matter where you are! In fact, GPS can simultaneously answer five questions:

- Where am I?
- Where am I going?
- Where are you?
- What's the best way to get there?
- When will I get there?

Originally designed by the United States military, GPS has been widely available since 1996 and is used by many people in all types of situations. For example:

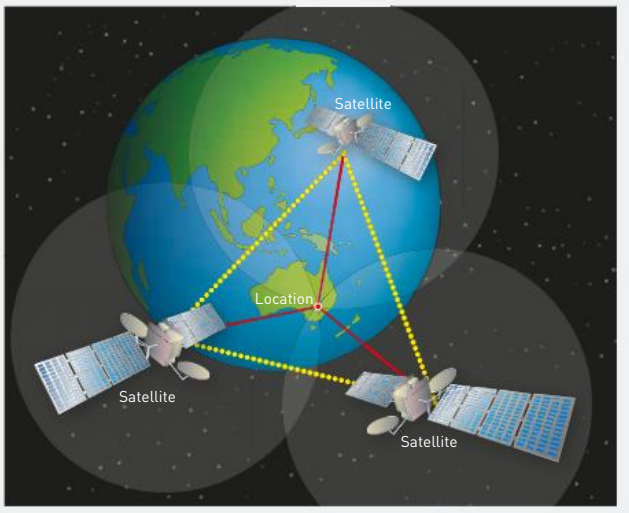
- Scientists use GPS to study the movements and feeding habits of great white sharks.
- Surveyors use GPS to measure the shift of buildings after earthquakes.
- GPS helps settle property disputes between landowners.
- Marine archaeologists use GPS to guide research vessels hunting for shipwrecks.
- GPS data has revealed that Mount Everest is getting taller!

GPS consists of a network of 24 satellites orbiting Earth along six different paths at an **altitude** of 20 370 kilometres. The satellites are always moving,

making two complete orbits of the Earth in just under 24 hours at a speed of 2.6 kilometres per second.

Each satellite constantly transmits a signal that basically says, 'I'm satellite X. My current position is Y, and this message was sent at time Z'. When a GPS receiver (your mobile phone, for example) reads the message, it saves it and updates continually. So, to determine your position, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received by the GPS receiver. The time difference tells the GPS receiver how far away that particular satellite is.

When you add in information from a few more satellites, the receiver can **triangulate** your position within 10 to 15 metres. With a minimum of three satellites your GPS receiver can determine latitude and longitude. With four or more it can determine latitude, longitude and altitude. By continually updating your position, the GPS receiver can also accurately provide speed and direction of travel.



Source GT.52 How GPS works

Satellite imagery

Satellite imagery (remote sensing) consists of images taken by satellites in orbit above the Earth. Although satellite images look like photographs taken from very high altitude, they are not taken by cameras. Sensors on board satellites record infrared signals reflected from the Earth's surface. Different surfaces reflect different signals. Computer processes then convert these signals back into 'lifelike' images or even **false-colour** images to more easily highlight key features.

Source GT.53 is a satellite image of the Sydney Basin. In this image, the pink colour represents the built-up areas of buildings and roads, the green shows vegetation, and the darkest blue the deepest water bodies and ocean.

Satellite imagery enables the study of large areas, is cost-effective and the data can be manipulated in many ways. It is widely used to predict weather, trends in climate and the progress of natural hazards. Satellite imagery is used in many fields, including cartography (making maps), geology (the study of Earth's structure), engineering, oceanography and agriculture.



Source GT.53 A satellite image of the Sydney Basin

REVIEW GT.3.3

Remember and understand

1 What do GIS and GPS stand for?
2 How are they different?

Apply and analyse

3 Describe five different scenarios where you might use GPS data and therefore GIS imagery.
4 Use the 'Layers' function on Google Earth to show the same location with different features highlighted. For example, switch between borders, places, photos, 3D, weather and gallery.

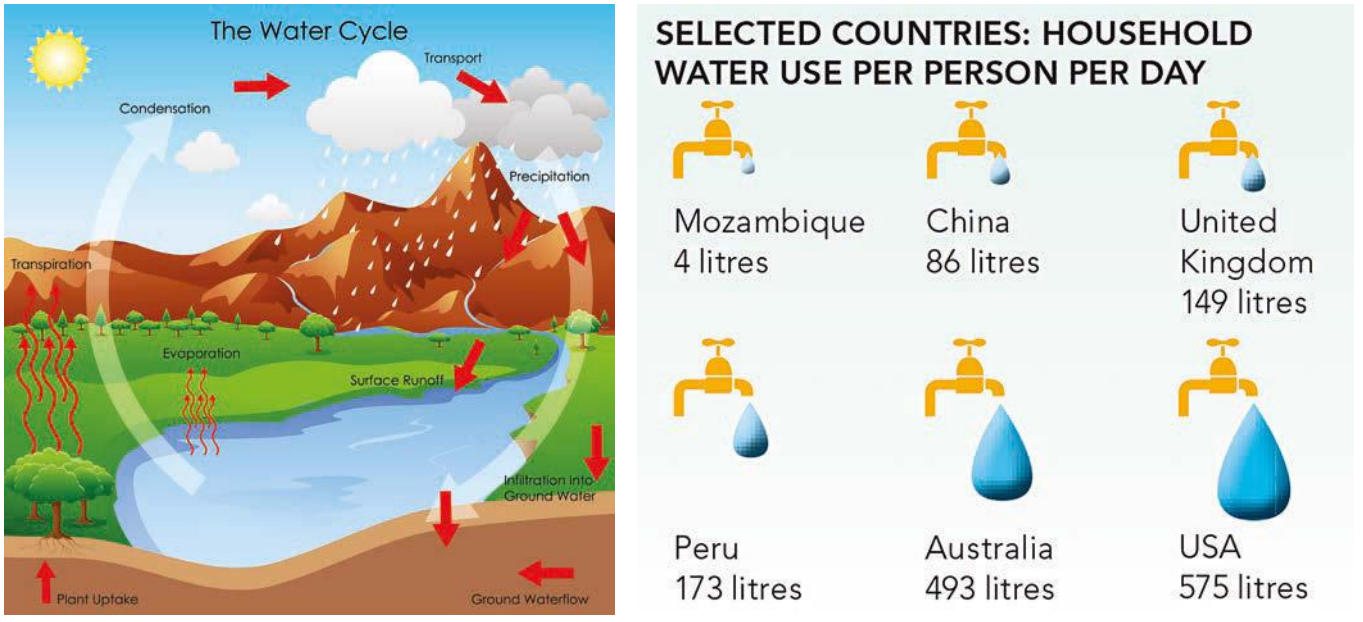
Investigate and create

5 Use National Geographic's MapMaker Interactive to create your own GIS map. Play with the different base maps and layers to see what types of information can be displayed.

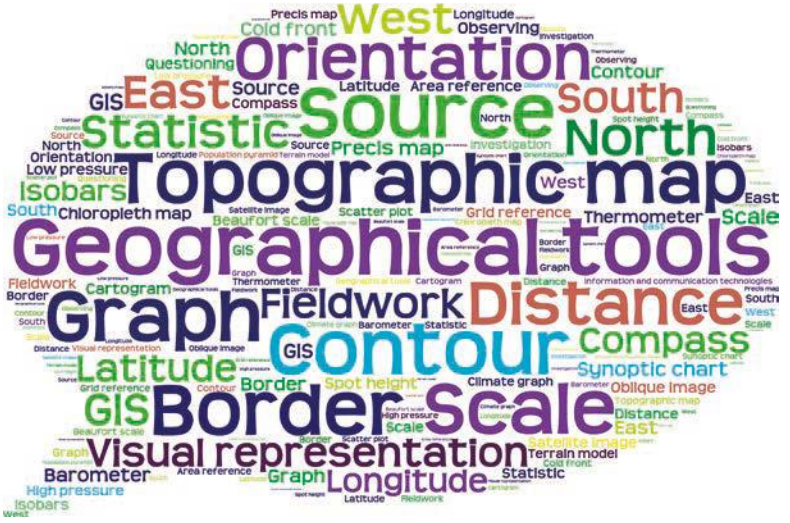
VISUAL REPRESENTATIONS

Visual representations allow geographers to show the features or characteristics of some places or things much more effectively than describing them in words. Certain interesting or complex processes can also be more easily explained and demonstrated with the help of visual representations. For example, look back at Sources GT.41 and GT.42. These visual representations will greatly assist you in the understanding of the concepts of latitude and longitude.

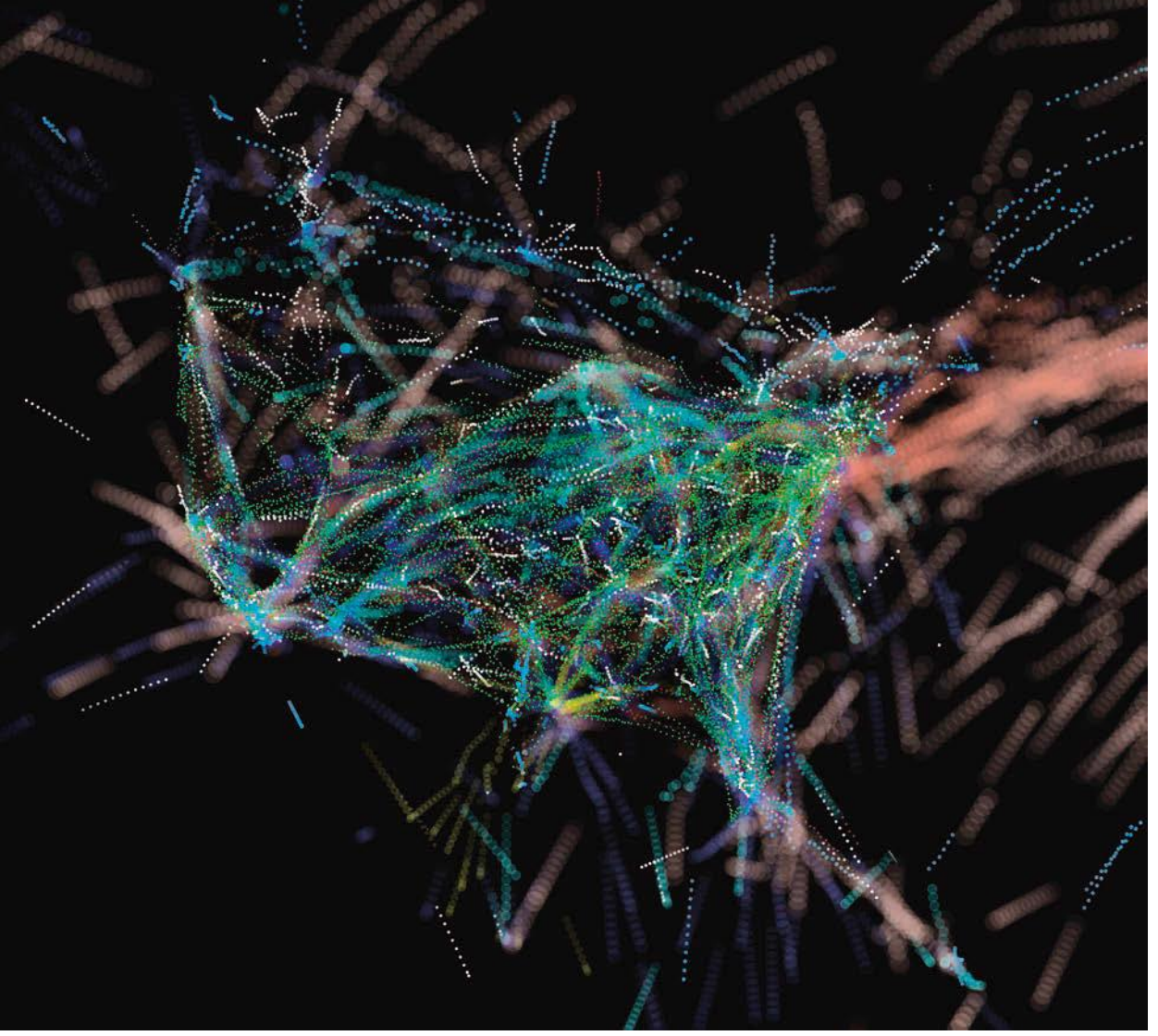
Visual representations take many forms, and can be digital or non-digital. Examples include photographs, **aerial photographs**, illustrations, flow charts, annotated diagrams, multimedia, field sketches, cartoons, word clouds, infographics, mind maps and web tools. Choosing the right visual representation depends on content and context. In some contexts, there are multiple ways to represent the same idea. Using ICT tools provides you with some incredible options for visualising information.



Source GT.54 Two powerful ways to represent content are pictorial notes and pictographs.



Source GT.55 This word cloud is a visual representation of all the geographical tools in your toolbox.



Source GT.56 This colour visualisation is part of an animation that shows the air traffic over the USA over a 24-hour period. The image was created by using special software to plot the aircraft type, location and altitude of aircrafts over the east coast, west coast and central USA.

REVIEW GT.3.4

Remember and understand

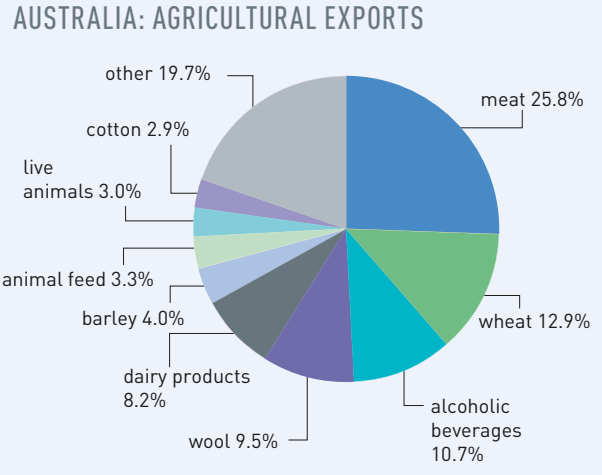
1 List two advantages of using visual representations.

2 Locate five different types of visual representation in the main chapters of this book and explain what each is showing.

Apply and analyse

3 Draw a pictograph to represent the information in the pie graph below.

4 Use the Australian Bureau of Statistics (ABS) Spotlight website to create a unique infographic about you.



Investigate and create

5 Investigate the meaning and origin of the expression, 'A picture is worth a thousand words'.

6 Use an online 'word cloud' tool (such as Tagul, Tagxedo or TagCrowd) to create your own word cloud from a piece of your own writing, a news article or a web page.

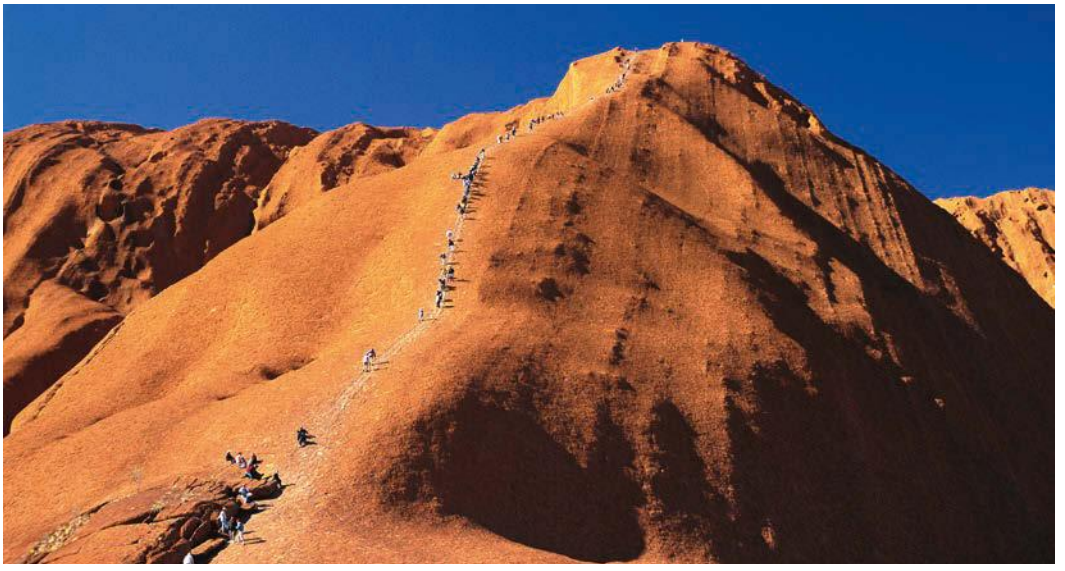
FIELDWORK

Fieldwork is any geographical study that takes place outside the classroom or, as geographers say, 'in the field'. The 'field' is the source of geographical information (primary data). It can be conducted at a number of scales – in your school grounds, within your local community, in another state or even in another country. Fieldwork is an essential part of geography because the world outside the classroom is the geographer's 'laboratory'. Working in the field provides opportunities for first hand investigation of both natural and human environments.

Fieldwork provides an opportunity to develop skills associated with observing, measuring, collecting and recording, developing and conducting surveys and interviews. Different forms of geographical data can be collected and then analysed to find relationships between the natural and human environments. The results of a fieldwork investigation are presented and communicated in a fieldwork report. Fieldwork instruments such as compasses, GPS, GIS, vegetation identification charts and weather instruments are often used by geographers.

Fieldwork also involves identifying issues or problems and finding possible solutions. It is a way to engage with the real world and make a contribution to developing more sustainable and fair ways to manage the Earth's resources.

Fieldwork often looks at a key feature, issue or problem. For example, many tourists visit Uluru each year with the intention of climbing 'The Rock'. In doing so, they ignore the wishes of the traditional owners of the land, the Anangu people (see Source GT.57). They also put themselves and others at risk. More than 35 people have died while climbing Uluru, and countless others have been injured or rescued. Geography students visiting Uluru may try to find out why people continue to climb it, and study the impacts of this activity on people and the natural environment.



Source GT.57 Every tourist that climbs Uluru must pass a sign asking them not to climb the rock out of respect for the traditional owners, the Anangu.

Conducting successful fieldwork

Fieldwork is a type of geographical inquiry, so whenever you take part in fieldwork you will need to follow the stages that are outlined in this toolkit, namely:

1. acquiring geographical information
2. processing geographical information
3. communicating geographical information.

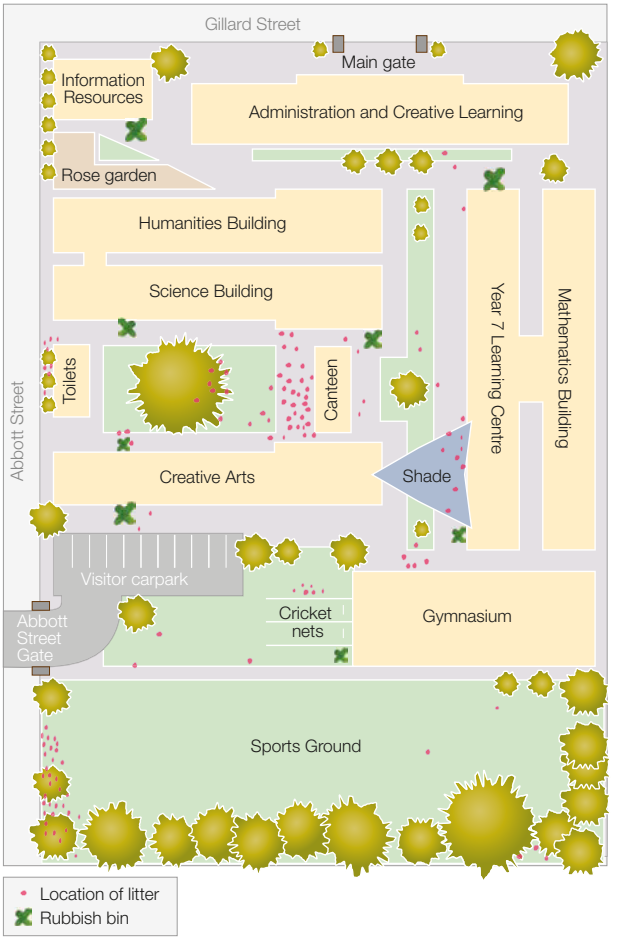
The first stage is vital as this gives you a focus for your fieldwork. It also allows you to make a judgment about whether your fieldwork investigation has been successful.

Stage 1: Acquiring geographical information

Begin by identifying an issue or problem and compile a set of related geographical questions that you would like to investigate. Plan your fieldwork so that you can collect the evidence and data that you will need. For example, take photos, draw sketches, conduct tests, and construct questionnaires and surveys. You will then need to use this data to create graphs and maps for analysis. You may also need to consider members of the public, including Indigenous people and their beliefs and feelings about places in the landscape. If your class is planning a field trip to a natural environment, such as a forest or beach, you will need to ensure you do not damage the environment by trampling on plants or animals or by dropping litter.

Stage 2: Processing geographical information

Interpret and analyse the data you have collected and look for patterns or clues that will help you to answer your key inquiry question and come to a conclusion. There are a number of different tools and methods you can use to do this, including PQE and SHEEPT.



Source GT.58 A sketch map of the schoolyard showing the locations of the bins and litter at Gumtree College

Stage 3: Communicating geographical information

Communicate what you have found to an audience in the form of a report, a presentation or an annotated visual display (AVD). Think about your fieldwork findings and reflect on ways to improve your investigation process. Finally, decide on a course of action, if this is appropriate.

A fieldwork example: Gumtree College litter investigation

In the following example, a Year 7 geography class at Gumtree College (7G) decided to conduct fieldwork to explore a problem in their school – litter. As a class, they followed a process of inquiry to understand the issue and try to resolve it.

Stage 1: Acquiring geographical information

During a brainstorm session, a range of investigation questions were raised by 7G. These included:

- What are the most popular foods sold in the school canteen?
- Does our school have the worst litter problem in the city?
- Does our school have enough bins in the yard?



Source GT.59 A questionnaire of students in the canteen



Source GT.60 A litter survey

During discussion it was decided that the first question wasn't really about litter. It was also decided that the second question was too broad and complex to answer in one fieldwork inquiry. The class agreed that the third question was the best one for the class to investigate.

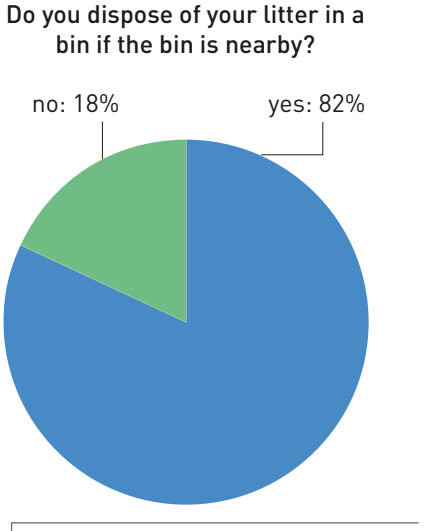
The next stage was to plan what data had to be collected in order to answer the question and choose the methods used to collect this data. As geographers, 7G had to carefully consider other people and the environment when collecting data in the field. For example, they had to be careful not to disturb other classes while collecting their data.

After some discussion, 7G decided to gather the information they needed to answer their inquiry question in three ways:

- A sketch map of the schoolyard showing the locations of the bins and the litter – To complete this map, a group of students would look for rubbish at the end of every lunchtime for five days and show their findings on a dot distribution map (see Source GT.58).
- A litter survey – This would involve another group of students looking closely at the rubbish and classifying each piece of rubbish using certain headings (see Source GT.60).
- A questionnaire of students in the canteen – Another group of students would ask other students about litter and how they disposed of it (see Source GT.59).

Stage 2: Processing geographical information

After asking questions and collecting evidence through fieldwork, 7G needed to interpret and analyse this data so that they could come to some conclusions about what they had found. Their aim was to use the evidence to answer the key question. By looking closely at their map and applying the PQE method, 7G students identified that most of the litter in their schoolyard was located close to the canteen where there were no bins. It was found that in places where bins were provided, they were generally used. The results of the student questionnaire were graphed (see Source GT.61); the results confirmed that 82 per cent of students used bins if they were nearby.



Source GT.61 A pie graph showing the results of the student questionnaire

Stage 3: Communicating geographical information

Based on the data they had collected, 7G prepared an AVD about this issue and presented it to the school council. The AVD included a simple map so people could easily see and understand the information and proposal. The students argued that three new bins had to be installed in the schoolyard – two near the canteen and one next to the sports ground. This information was passed on to the school principal.

The bins were installed within a week, but 7G also decided that students at Gumtree College needed to take more responsibility for their own litter and placed some posters in the canteen to remind students why littering was bad for the school.

In the final stage of their fieldwork, the 7G students had a class discussion to reflect on the ways in which they had carried out their fieldwork. Most of the students felt that the process worked well, but a few thought that the key question about bins was a little too simple.

They decided to use the same method to explore a more complex problem in the local community.

REVIEW GT.3.5

Remember and understand

1 What is meant by studying geography 'in the field'?
2 List two ways in which the results of a fieldwork investigation may be presented.
3 What is the main aim of all fieldwork investigations?

Apply and analyse

4 In what ways did 7G gather the information they needed to answer their fieldwork question?
5 Which of these methods do you think would have given them the most valuable and reliable data? Why?

Investigate and create

6 Look again at the geographical questions shown in Source GT.11.

Imagine that you are on a field trip to Uluru to study the impact of visitors on the natural and cultural environment.

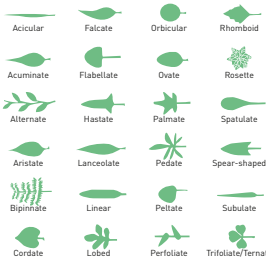
a In small groups, decide on an issue related to Uluru that you would like to investigate.
b Generate a set of inquiry questions and decide on the one you would most like to explore in detail.
c Create a set of questions for a visitor questionnaire that you think will help you get the information you need to answer your key inquiry question.
d Share your key inquiry question with the class and read out the questions you decided to include in your visitor questionnaire. What do your classmates think of your ideas?

Fieldwork instruments

As part of your fieldwork investigations, you may need to use special tools to help you acquire geographical information. These tools are known as fieldwork instruments and include weather instruments, vegetation identification charts, compasses, **global positioning systems (GPS)** and geographic information systems (GIS). Fieldwork instruments can be very simple, for example, a rain gauge is a simple fieldwork tool for measuring **precipitation**. Other fieldwork instruments are highly technical and require expert training to operate.

Some of the most commonly used fieldwork instruments are described in Source GT.62.

Source GT.62 Common fieldwork instruments

		Fieldwork instrument	Useful for	Need to know
Weather instruments		rain gauge	measuring precipitation	unit of measurement millimetres (mm)
		anemometer	measuring wind speed	unit of measurement kilometres per hour (km/h)
		wind vane	measuring wind direction	cardinal points North, South, East and West (N, S, E, W)
		barometer	measuring air pressure	unit of measurement hectopascals
		thermometer	measuring air temperature	unit of measurement degrees Celsius (°C)
		hygrometer	measuring moisture content in the air	unit of measurement millilitres per cubic centimetre (mL/cm^3)
Species investigation		vegetation identification chart	identifying plant species	available from libraries or online sources

		Fieldwork instrument	Useful for	Need to know
Species investigation		quadrat	investigating and quantifying the species (usually plants) in a randomly selected area	usually a 1 m x 1 m square and may contain further wires to mark off smaller areas inside
		transect	quantifying the species (usually plants) along a selected line	a fixed line, usually a long tape measure or rope
Compasses		magnetic compass	navigation and orientation	determines the direction of magnetic North
		orienteering compass	navigation and orientation with maps	includes a baseplate and protractor
		smartphone compass	navigation and orientation	most smartphones include a compass app that uses the phone's internal magnetometer
GPS		global positioning system (GPS)	navigation and location	space-based navigation system that uses satellites to provide location
GIS		geographic information system (GIS)	electronic mapping and other complex spatial analysis	the name for any electronic system that captures, processes, stores, manipulates and analyses spatial information and geographical data
Other measurement tools		clinometer	measuring tilt and elevation	unit of measurement tilt: degrees (angle) elevation: metres (m)

REVIEW GT.3.6

Remember and understand

1 Which fieldwork tool would you use for measuring wind speed?
2 What does GIS stand for?
3 What unit of measurement is used in a rain gauge?

Apply and analyse

4 Why do you think quadrat sampling is more useful for quantifying plants than animals?
5 Which of the fieldwork instruments in Source GT.62 would you select for the following investigations?
   a an investigation of marine vegetation species at Bronte Beach
   b an investigation of the climate in the Strzelecki Desert
   c an investigation of your school grounds

Investigate and create

6 Download a vegetation identification chart for your local area from the Internet. Use it to identify three different plant species from your school or home environment. Draw each species and write a brief description.



1

LANDSCAPES AND LANDFORMS

1 CHAPTER
THE EARTH'S CHANGING LANDSCAPES AND LANDFORMS

2 CHAPTER
VALUING, MANAGING AND PROTECTING LANDSCAPES AND LANDFORMS

3 CHAPTER
LANDSCAPE HAZARDS



Dubai: A city built on sand. Dubai is located on the Persian Gulf coast of the United Arab Emirates. The city – a human landscape has been built within the Arabian Desert and is home to the world's tallest tower. The Emirate has no natural rivers or oases. The Dubai Creek is a natural inlet that has been dredged to allow the passage of large vessels. Beyond the desert is the Western Hajar chain of mountains.

CHAPTER

1



Source 1.1 This satellite image of Las Vegas shows many different landscapes and landforms.

THE EARTH'S CHANGING LANDSCAPES AND LANDFORMS

The Earth's surface is made up of a number of elements that together create distinctive shapes and formations known as landforms. A landform can be created in just a few years or over hundreds of millions of years. To study and understand landforms, geographers organise them into groups based on their geomorphic process of formation as well as descriptive features such as climate, topography and latitude, that are characteristic of an area. These distinctive groups are referred to as landscapes and are broadly divided into two categories – natural and human. There are many different types of natural landscapes on Earth including mountain landscapes, desert landscapes, coastal landscapes and riverine landscapes. Natural landscapes are made up of a variety of landforms such as valleys, cliffs and canyons. Landscapes created by people are called human landscapes. An example of a human landscape is a city.



WHY IS THERE A DIVERSITY OF LANDSCAPES AND LANDFORMS ON EARTH?

1.1 SECTION

In this section you will investigate:

- different landscapes and the geomorphic processes that create distinctive landforms

CHECKPOINT 1.1

WHAT ENVIRONMENTAL AND HUMAN PROCESSES FORM AND TRANSFORM LANDSCAPES AND LANDFORMS?

1.2 SECTION

In this section you will investigate:

- the human causes and effects of land degradation

CHECKPOINT 1.2



GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Change:** changes to resources, landscapes and places over time through natural and human geographical processes and events
- **Space:** spatial distribution of landscapes
- **Environment:** processes that form and transform landscapes and landforms across the world

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** topographic maps, sketch maps
- **Graphs and statistics:** data tables
- **Spatial technologies:** satellite images, virtual maps
- **Visual representations:** photographs, aerial photographs, illustrations, annotated diagrams

1.1 THE EARTH'S LANDSCAPES

WHY IS THERE A DIVERSITY OF LANDSCAPES AND LANDFORMS ON EARTH?

A **landscape** is part of the Earth's surface. It consists of a variety of geographical features that are characteristic of an area. Landscapes are divided into two main categories – natural and human. Natural landscapes (for example, mountains and deserts) are mainly unaffected by human activity and are typical to particular areas of the world. Human landscapes (for example, cities and farms) have been created and modified by people. Human landscapes are sometimes also referred to as cultural or built landscapes. Some different types of landscapes are described on the following pages.

WORLD: EXAMPLES OF DIFFERENT LANDSCAPES



Source 1.2

Source: Oxford University Press

1 Mountain landscapes

Mountain landscapes are formed by **tectonic plates** on the Earth's surface pushing against each other. This movement and pressure causes the shape of the land to change. The land is pushed up in a vertical direction and over time forms mountains. Mountains rise high above their surroundings. Mountains can stand alone, be grouped in ranges, or form ridges.



Source 1.3 The Himalayas in Asia are an example of a mountain landscape.

2 Coastal landscapes

The coast is where a land mass meets the sea. Coastal landscapes are shaped by the natural forces of the wind and waves. These geographical forces erode (wear away) or construct (build up) the natural environment, constantly changing its shape. Features of coastal landscapes include beaches, dunes, bays, cliffs, platforms, spits and lagoons.



Source 1.4 Peggy's Cove in Nova Scotia, Canada, is an example of a coastal landscape.

3 Riverine landscapes

A riverine is a landscape formed by the natural movement of a water system such as a river. A riverine landscape includes the **ecosystems** (all living things including plants and animals) in and around the area of a river. A riverine may also be defined as a network of rivers and the surrounding land. Riverine landscapes are excellent for agricultural uses such as farming because the land is rich and fertile. They are a valuable resource for growing food.







Source 1.5 The Whanganui River system in New Zealand is an example of a riverine landscape.



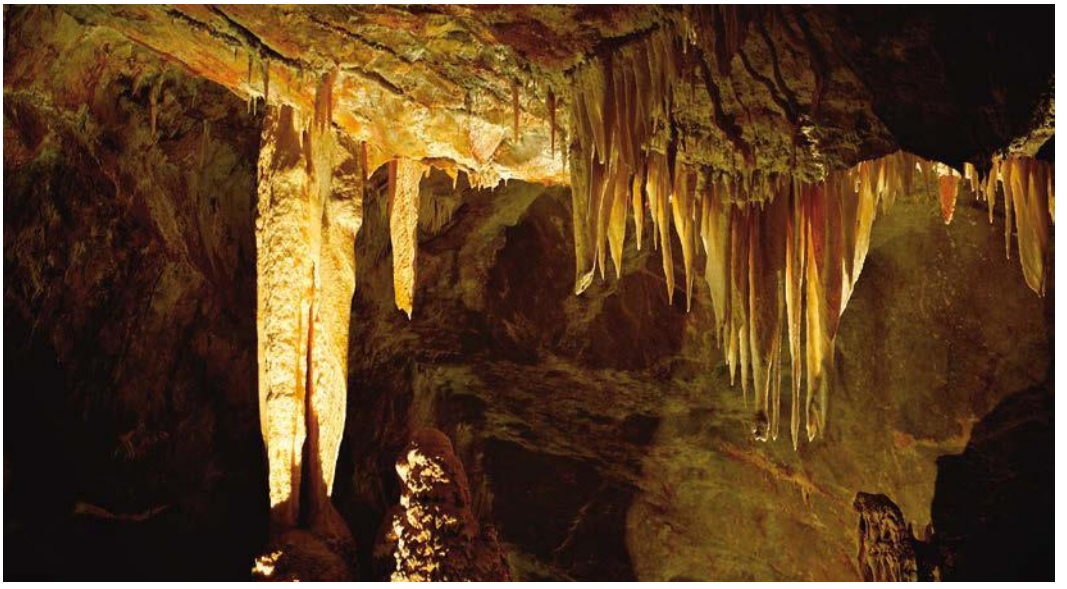
Source 1.6 The Sahara desert in North Africa is an example of a desert landscape.

4 Desert landscapes

An arid desert is defined as an area of land that receives no more than 250 millimetres of rain per year, whereas a semi-arid desert receives between 250 and 500 millimetres of rain per year. Deserts cover about one-third of the Earth's surface and contain some of the most uninhabitable regions on Earth. There are two types of deserts – hot deserts and cold deserts. Hot deserts are located along the tropics of Cancer and Capricorn (the latitude lines to the north and south of the Equator). Cold deserts are located closer to the Arctic and Antarctic circles (the circles of latitude in the far north and far south). Because of the lack of rain they have little vegetation (plant life). Instead, deserts are characterised by sand dunes, rock and gravel.

5 Karst landscapes

A karst landscape is formed when easily dissolvable bedrock (the rock below the surface of the land, such as limestone) is worn away by slightly acidic water from an underground source or a source on the Earth's surface. These flows of water form unique features such as caves, stalactites, springs and sinkholes. Karst landscapes are extremely unstable areas of land. Sinkholes are formed when rock beneath the Earth's surface has eroded away and sections of land on the surface collapse. Sinkholes can range in size from a few metres to over 1 kilometre deep and have been known to occasionally collapse, swallowing up everything on the surface including cars and buildings.



Source 1.7 The Jenolan Caves in New South Wales are an example of a karst landscape.

STRANGE BUT TRUE

Australia has some of the oldest geological features in the world, with the oldest known rocks dating from more than 3000 million years ago, and rare zircon crystals dating back 4400 million years located in much younger rocks. The zircons evolved very soon after the planet was formed. These ancient features compare with the oldest known rock on Earth in north-western Canada. Scientists say that rock was formed 4031 million years ago.



6 Human landscapes

Unlike the types of naturally occurring landscapes described above, human landscapes are created by humans. These landscapes provide evidence of human settlement and occupation of an environment. Features of human landscapes include elements of infrastructure such as buildings, roads, transport, energy, sewerage and telecommunication systems. The construction of human landscapes often results in the damage or destruction of natural landscapes, but commonly incorporates some natural geographical features in its design, for example harbours, rivers and mountains.



Source 1.8 The capital city of China, Beijing, is an example of a human landscape.

REVIEW 1.1.1

Remember and understand

1 Describe the meaning of the geographical term 'landscape'.

2 Which types of landscapes are found around the tropics of Capricorn and Cancer?

3 Why do you think human landscapes are included in the definition of the word 'landscape'?

Apply and analyse

4 Look carefully at Sources 1.2 to 1.8. Create and complete the following table by listing the different types of unique landscapes shown in Source 1.2. The first one has been done for you.

Unique landscape	Characteristics including landform(s) you would expect to find in this landscape	Dominant geomorphic force
Mountain landscapes, e.g. the Himalayas, Asia	High elevation, steep slopes, snow-capped jagged peaks, no visible vegetation on peaks	Tectonic plates forcing land to fold upwards

5 You will need a blank outline map of Australia, which can be downloaded from your obook, and an atlas to complete this question.

- **a** Annotate the map of Australia to show an example of each type of landscape.
- **b** Compare the physical map of Australia to a physical map of China. Identify one difference and one similarity.

6 Write a description of the location of desert landscapes. Give possible reasons to explain why they are there.

Investigate and create

7 Investigate one landscape that interests you. It may be a well-known landscape or one in your local area. In your investigation, include its location, what makes the landscape unique and provide information of how it is used. Why is this landscape different from the areas around it? Present your information creatively.

THE EARTH'S LANDFORMS

You have already discovered that the Earth has a great range of natural landscapes, including mountain, desert, coastal and riverine. Within these landscapes, distinctive landform features can be found. A **landform** is a specific shape or physical feature of the Earth's surface which has been produced by a **natural process**. Natural processes are also called **geomorphic processes**. Examples of landforms include valleys, cliffs, beaches, sand dunes and plateaus. Geomorphic processes can include **erosion, deposition**, **weathering** and **tectonic activity.**

Source 1.9 Some common landforms found in different natural landscapes



COASTAL LANDSCAPES

Atoll
Ring-shaped coral reef or a string of closely spaced small coral islands encircling a shallow lagoon

Archipelago
Group or chain of islands

Bay
Broad, curved indentation in the coastline

Beach
Deposited rock particles – such as sand, gravel or pebbles – along the coastline

Cliff
Steep rock face formed by the action of the waves

Coral reef
Underwater ridge formed by the growth and deposit of coral

Headland
Narrow, high land jutting out from a coastal cliff into the sea

Island
Area of land surrounded by water

Isthmus
Narrow strip of land or sand that connects an island to the mainland

Spit
Narrow strip of sand protruding into the sea

Stack
Tall pillar of rock formed by wave action eroding a cliff

MOUNTAIN LANDSCAPES

Cirque
Bowl-shaped hollow at the head of a valley or on a mountainside formed by glacial erosion

Glacier
Large frozen river of ice that slowly moves down a valley in response to gravity

Mountain
Steep-sided, lone peak rising over 600 metres above the surrounding land

Mountain range
Chain of connected mountains

Ridge
Long, narrow elevation of land

Volcano
Opening in the Earth's crust where molten rock, ash and gas can escape

RIVERINE LANDSCAPES

Delta
Fan-shaped, low-lying area of deposits at the mouth of a river

Drainage basin
Area providing water to a river system

Estuary
River mouth broadening into the sea

Floodplain
Flat area over which water spreads in times of flood

Gorge
Deep, narrow, steep-sided valley

Lake
Large body of water surrounded by land

Meander
Bend in a river

Oxbow lake
Crescent-shaped lake on a river floodplain

River
Natural waterway that takes water downhill by gravity to the sea

Tributary
Small river that joins a larger river

V-shaped valley
Narrow, steep-sided valley carved out by the upper reaches of a river

Waterfall
River-water spill over resistant rock

Watershed
High point from which water flows into a drainage basin

DESERT LANDSCAPES

Butte
Flat-topped hill

Desert dune
Wind-blown particle formation

Hamada
Area covered in boulders and large stones

Inselberg
Isolated, steep-sided hill of resistant rock on a plain

Mesa
Flat-topped, steep-sided plateau

Oasis
Desert area with a water supply provided by groundwater

Wadi
Dry watercourse in a narrow valley that divides a plateau



REVIEW 1.1.2

Remember and understand

1 Describe the meaning of the geographical term 'landform'.

2 Identify four geomorphic processes.

Apply and analyse

3 Identify an Australian example of at least five of the landforms described in Source 1.9.

Investigate and create

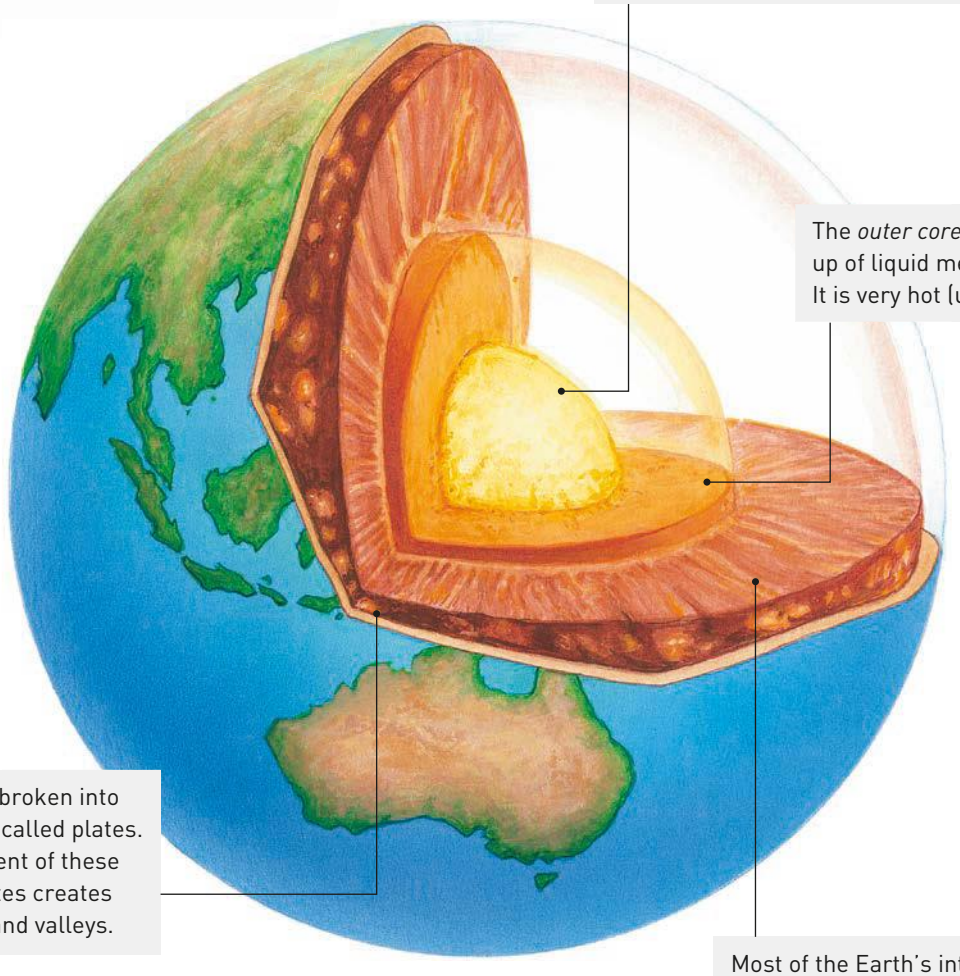
4 Create a travel brochure for the NSW tourism government agency promoting one of the landforms shown in Source 1.9. Investigate the landform and provide a description including information about how it was formed. You should include persuasive text that aims to encourage tourists to visit your chosen landform.

TECTONIC ACTIVITY

Natural and human landscapes are formed and transformed by many different processes, including geomorphic, hydrological, atmospheric, biotic and human processes. You are about to explore four of the geomorphic processes that form and transform the Earth: tectonic activity, erosion, deposition and weathering. To understand these processes, you first need to know about the world beneath your feet.

You may be used to thinking of the Earth as a solid ball like a giant shot-put, but this is far from the reality. The Earth is more like a giant peach with a thin skin and a core at the centre surrounded by soft flesh. Scientists believe that the Earth is made up of four layers (see Source 1.10).

Source 1.10 The Earth's layers



Tectonic plates

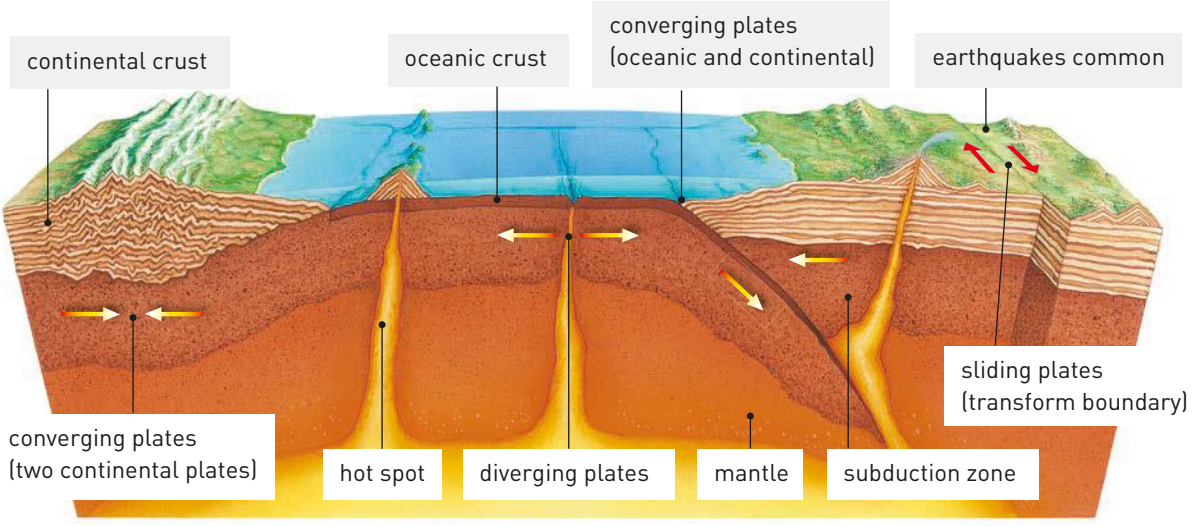
The outer layer of the Earth's surface (known as the crust) is broken into large pieces called tectonic plates. These plates are around 100 kilometres thick and fit together like enormous pieces of a jigsaw puzzle. Currents in the red-hot molten material (**magma**) under these tectonic plates cause them to move about (see Source 1.11).

In some places, they are being pushed into one another (**converging**). This process creates mountain ranges. The world's highest mountain ranges such as the Himalayas and the Andes are located along a converging plate boundary.

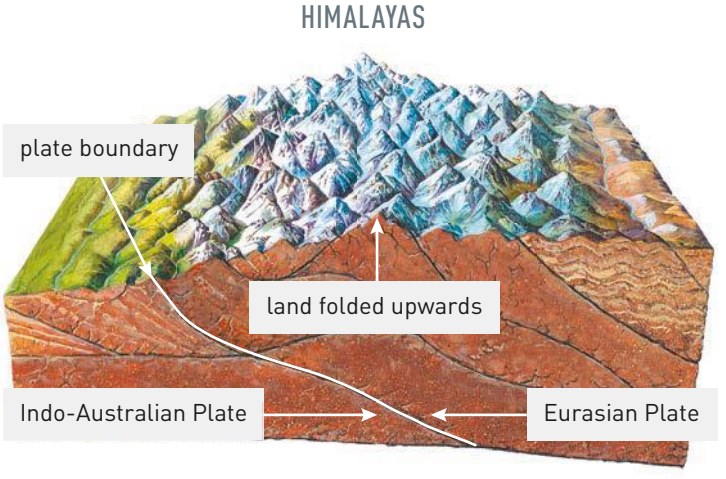
In other places, tectonic plates are being pulled apart from one another (**diverging**). This process creates rifts in the Earth's surface that allow hot magma to ooze to the surface and create new land. The world's longest mountain range, the mid-Atlantic Ridge, is an undersea mountain range formed along a diverging plate boundary.

The movement of tectonic plates is also responsible for many other features and natural events on the Earth's surface, such as volcanoes and earthquakes. Volcanoes are formed when magma is pushed through an opening in the Earth's crust. Earthquakes are caused when the edges of tectonic plates slide against one other along a **transform boundary**.

Source 1.11 Tectonic plate movement

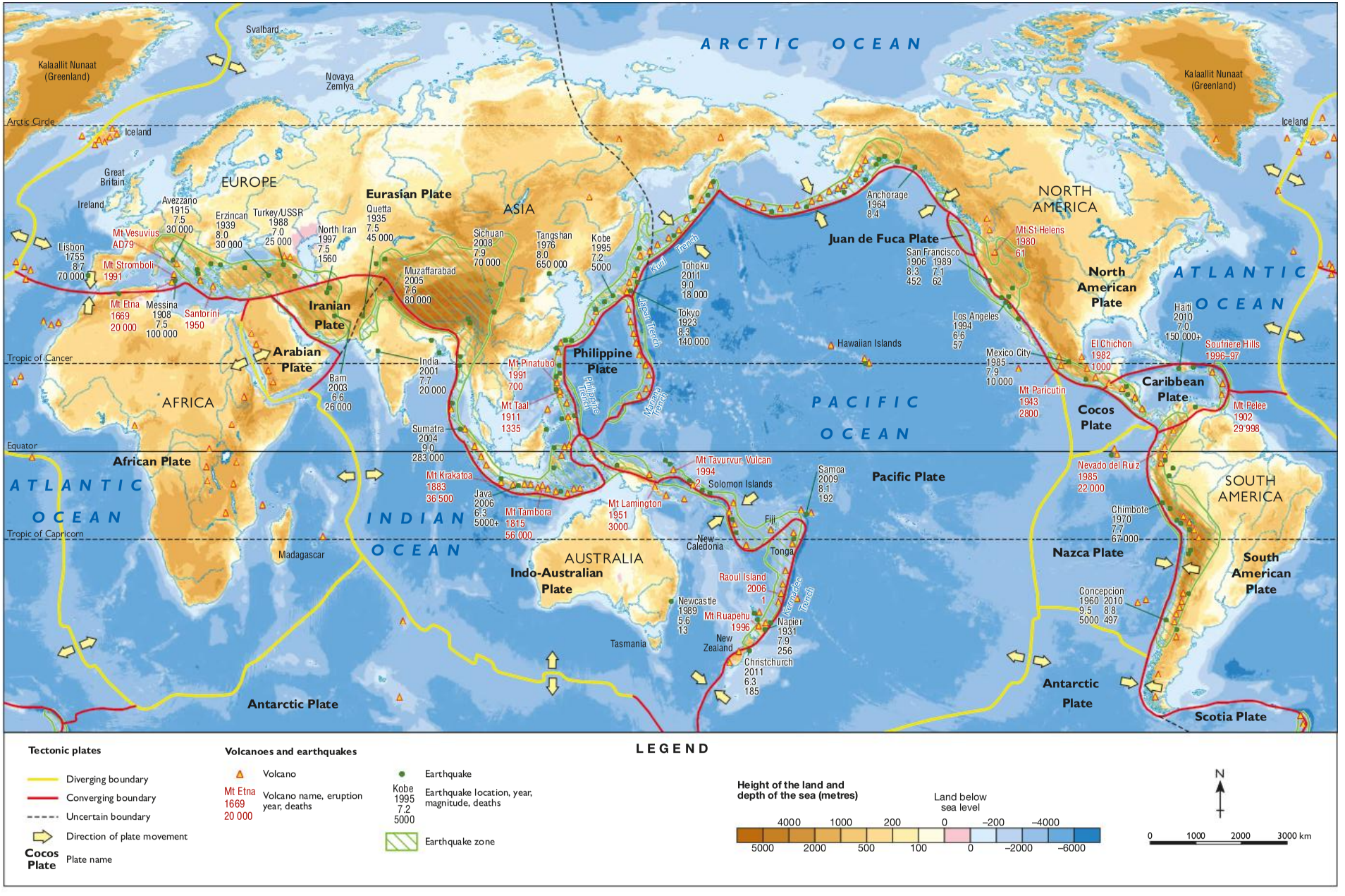


Source 1.12 The collision of tectonic plates (left) caused the formation of the Himalayas (right) between 50 and 70 million years ago when India collided with Asia.





WORLD: TECTONIC PLATES



Source 1.13 The plate boundaries are shown to be either converging (pushing into each other) or diverging (pulling apart). This activity on the boundaries has a number of effects on the Earth's surface.

Source: Oxford University Press



Source 1.14 In South America, four plates are colliding with each other (converging), creating the Andes.



Source 1.15 In Africa, three plates are moving apart (diverging), creating the Great Rift Valley.



Source 1.16 In North America, two plates are sliding past each other (transform boundary), creating the San Andreas Fault.

REVIEW 1.1.3

Remember and understand

1 What are the four layers of the Earth?
2 What is the name given to the huge pieces of the Earth's crust?
3 How do the Earth's tectonic plates move?
4 What is the name given to the plate boundary where the plates are being pushed together?

Apply and analyse

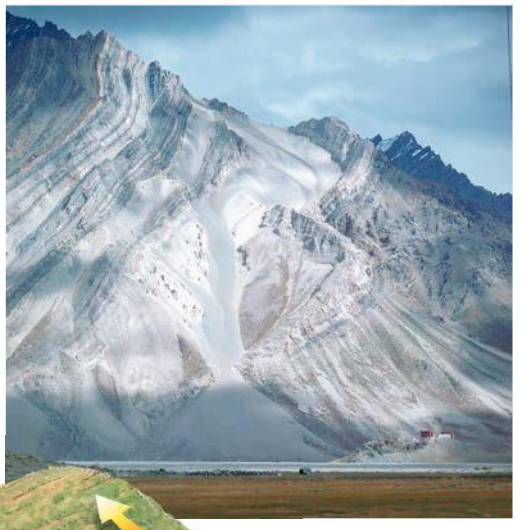
5 Refer to Source 1.13.
   - **a** Describe the plate boundary you would expect to find in the middle of the Atlantic Ocean.
   - **b** Explain the difference between that plate boundary and the one to the north and east of Australia.
   - **c** On which plate is Australia located?
   - **d** In which direction is this plate moving?

Investigate and create

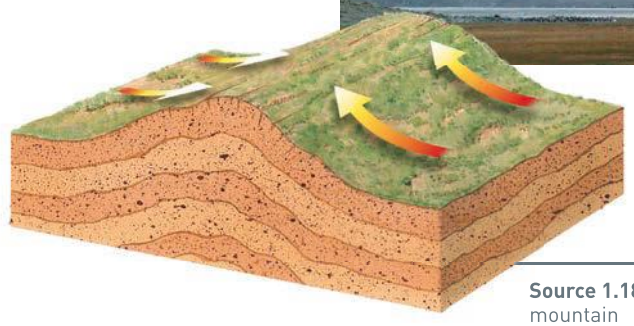
6 Identify any possible links you notice between the three types of plate boundaries (converging, diverging and transform) and:
   - **a** landforms such as mountain ranges
   - **b** volcanoes
   - **c** phenomena such as earthquakes.

HOW MOUNTAINS ARE FORMED

Mountains are formed where the surface of the Earth has been pushed upwards. Tremendous forces inside the Earth can crumple the surface into long mountain chains, such as the Andes or Himalayas, or punch right through the surface to create volcanoes, such as Kilauea on the island of Hawaii and Mount Kilimanjaro in Tanzania.



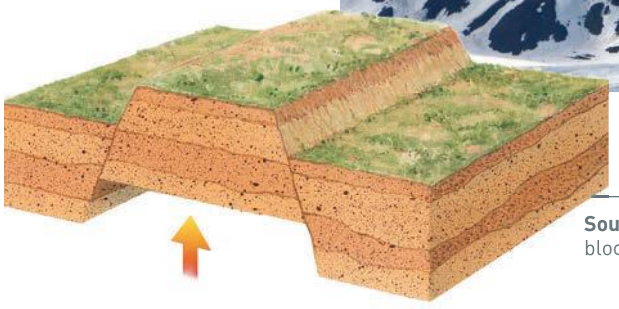
Source 1.17 These mountains on the edge of the Zanskar Valley in Ladakh, India, are clearly distinguishable as fold mountains.



Source 1.18 Creation of a fold mountain



Source 1.19 Block mountains in the Arctic region of Norway



Source 1.20 Creation of a block mountain

Types of mountains

Mountains are classified according to how they were formed. There are three main types of mountains:

- fold mountains
- block mountains
- volcanic mountains.

Fold mountains

Fold mountains are created by upward pressure where two tectonic plates collide. As the plates converge, layers of rock buckle and are pushed upwards, creating fold mountains. Most of the world's highest mountain ranges are fold mountains.

The world's largest fold mountains are the Himalayas, which separate southern Asia from central Asia. They have been formed by the collision between the Indo-Australian plate and the Eurasian plate over the last 55 million years. Currents within the mantle are moving the Indo-Australian plate northwards, and its front edge is bulldozing into the Eurasian plate, folding the edges of both plates upwards.

Block mountains

Block mountains are created when cracks in the Earth's crust, known as faults, force blocks of land upwards. Rocks that are cooler because they are close to the surface tend to crack and break apart when compressed from the sides. Rather than folding, they are often lifted up in giant blocks along fault lines to create block mountains. Geologists refer to this mountain-building process as faulting.

Volcanic mountains

Volcanic mountains are created by volcanoes, as the name suggests. They are created when magma pushes its way from beneath the Earth to the crust. The material that comes out of a volcano builds up the Earth's surface, creating new land and new landforms.



Source 1.21 Rangitoto Island in Auckland, New Zealand, is an example of a shield volcano.

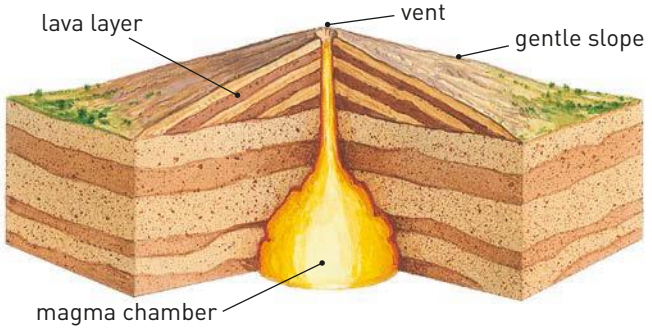
Each eruption brings new material to the surface, as **ash** or **lava** or both. As lava flows across the surface, it covers the rocks from previous eruptions and builds up the height of the land in layers. Runny lava can travel many kilometres from the crater and leave behind a shallow layer of new rocks over a wide area. These types of volcanoes are known as **shield volcanoes** (see Source 1.23). Rangitoto Island is an example of a shield volcano (see Source 1.21).

The more familiar steep-sided **volcanic cones** (see Source 1.24), such as Mount Fuji in Japan, are formed when lava and ash do not travel far from the crater. These materials are then left as a new layer on the sides of the cone, building it higher.

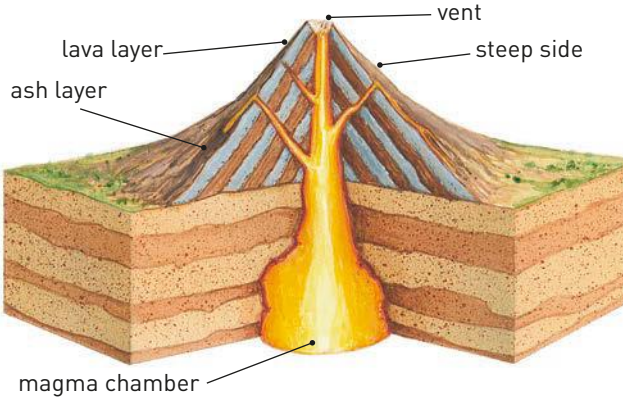


Source 1.22 Mount Fuji in Japan is an example of a volcanic cone.

Most of the world's volcanoes are located on or near plate boundaries where plates collide and one plate is forced downwards into the mantle. This causes pressure to build up and molten rocks, called magma, to rise to the surface and force their way out through a weakness in the crust. This is what we see as an eruption. Other volcanoes are located in **hot spots**, which are areas that are often in the centre of a plate where the mantle is particularly hot. In these places, molten rock from the mantle is forced upwards through the moving crust.



Source 1.23 A cutaway diagram of a shield volcano



Source 1.24 A cutaway diagram of a volcanic cone

REVIEW 1.1.4

Remember and understand

1 Describe the process of folding.

2 How does a volcanic eruption change the shape of the land?

Apply and analyse

3 What are the similarities between folding and faulting? What are the important differences?

4 Sketch and label a diagram of the block mountains in Norway (Source 1.19) to show how they are formed.

5 Explain why some volcanoes are steep-sided cones and some are not.

6 Why is every volcano in the world a different shape?

Investigate and create

7 Use a search engine to identify a mountain and research it to create a fact file to share. Provide the following details: name, location, age, elevation, mountain range, how it was formed and an interesting fact. Also include a photograph or a drawing of the mountain.

WEATHERING, EROSION AND DEPOSITION

While tectonic activity causes the Earth's surface to be uneven (think of mountains and volcanoes), **gradational forces** work to smooth out the landscape. The landforms and features created by tectonic processes come under attack when they are exposed to atmospheric processes and gravity. Gradational forces wear down the high places and fill in the low places.

The different types of gradational forces are weathering, erosion and deposition. The agents include wind, water, ice, sunlight and chemical decomposition.

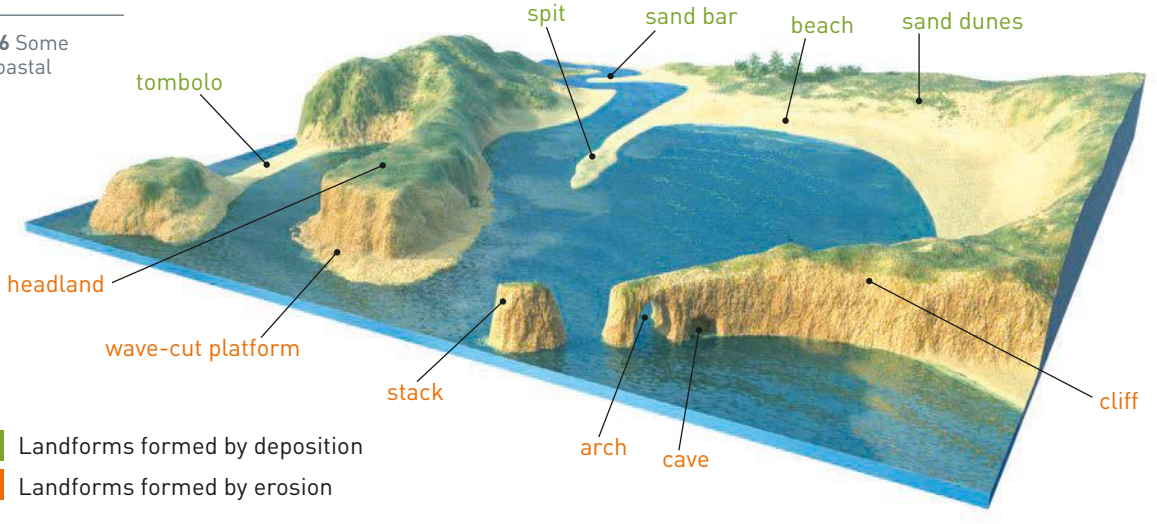
Source 1.25 Gradational forces

Gradational force		Process	Landforms
Weathering		This is the breakdown or decay, but not the removal, of rocks and minerals at or near the surface.	Weathered landforms can include unique rock features such as fins, alcoves, arches (pictured) and hoodoos.
Erosion		The land surface is worn down by running water, ice, wave action or wind. The debris is then transported either by the running water, ice, waves or wind.	Erosional landforms can include river valleys created by running water, cirques and U-shaped valleys created by glaciers (pictured), mesas and buttes created by wind, and stacks and bays created by wave action.
Deposition		This occurs once the weathered and eroded material has been transported by running water, ice, waves or wind, and is said to be 'laid down'.	Depositional landforms can include deltas formed by running water; terminal moraine left by glacial retreat; sand dunes created by wind; and beaches, spits and tombolos created by wave action.

Erosion and deposition in coastal landscapes

Constant movement of water and wind carve coastal landscapes into an amazing variety of landforms. Coastal landforms can be formed in two different ways, either by erosion (the wearing away of land by waves and wind) or by deposition (the building up of land through deposits of sand and other materials). Because of these processes, there is no 'typical' or

Source 1.26 Some common coastal landforms



'average' coastal landform: every **arch**, **stack**, **cave** or **headland** will be unique. There are, however, common features for each type of landform. Geographers examine and describe the similarities and differences of these features, and use them to explain how they were formed.

KEY CONCEPT: CHANGE

A day at the beach

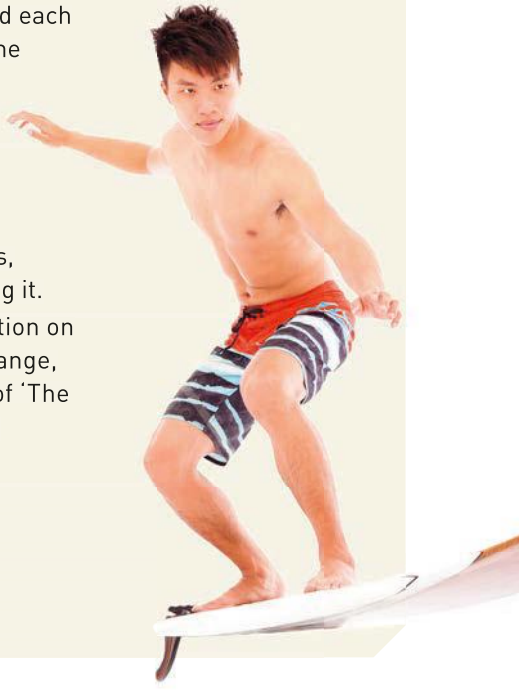
Like all landscapes, coasts are constantly changing. During a five-hour visit to a beach, about 2500 waves hit the shore. Each wave picked up millions of grains of sand and moved them. Some grains were moved further inland, some along the beach, some out to sea, and some were picked up and put back in the same place. The wind picked up millions of particles of dry sand and blew them onto the dunes. People walked through the dunes, trampling the plants and creating a wind tunnel that sped up erosion. In the course of the day, the sea level rose and fell about 2 metres as the Moon's gravity pulled the oceans towards shore and away from it, creating tides.



Source 1.27 Bondi Beach in Sydney is located between two headlands.

What makes beaches perfect for geographers to study is the rapid rate of change that takes place there. This is mainly because:

- one wave crashes about every 8 to 10 seconds and each of them changes the coast
- sand is easily eroded and deposited
- people use the coast in many ways, constantly changing it.



For more information on the key concept of change, refer to section GT.1 of 'The geographer's toolkit'.

REVIEW 1.1.5

Remember and understand

1 Describe how gradational forces differ from tectonic activity.
2 List and describe the three major gradational forces.
3 How do beaches change?

Apply and analyse

4 By referring to the image of common coastal landforms, describe how you think an arch is formed.
5 Sketch the image in Source 1.27 and label five landforms.

Investigate and create

6 Choose one landform from the list below and carry out some research on its formation. Include where you would expect to find the landform, whether or not it is formed by erosion or deposition, and the processes that have been involved in its formation. Give an example of the landform and provide an image of it.
   - desert landforms: inselberg, butte, mesa
   - coastal landforms: spit, tombolo, beach, cliff
   - mountain landforms: cirque, V-shaped valley
   - riverine landforms: delta, floodplain, gorge
7 Design an experiment in which you could demonstrate erosion and deposition by wind, water or ice.

EROSIONAL LANDFORMS



Source 1.28 A section of coastline near the town of Port Campbell in Victoria

Coastal landforms are created in two main ways. This is because when waves hit the shoreline their effects can be varied. They can help to create landforms that allow plants and animals to live and thrive, or they can destroy landforms, killing plants and animals or driving them away.

The types of waves that erode and destroy sections of coast are known as **destructive waves**. Destructive waves are tall and frequent, which means they crash into the shoreline, digging out large chunks of land and eroding the beach. Their **swash** is weaker than their **backwash**, causing soil and nutrients to be drawn back into the sea rather than deposited on land.

Destructive waves begin in a large, stormy ocean. The waves travel thousands of kilometres, building up energy that is unleashed onto the rocks and sands of the coast. These waves carve the coastline into amazing shapes in much the same way that a sculptor carves shapes from a piece of marble. This process of wearing away is known as erosion, and the landforms created this way are known as erosional landforms.

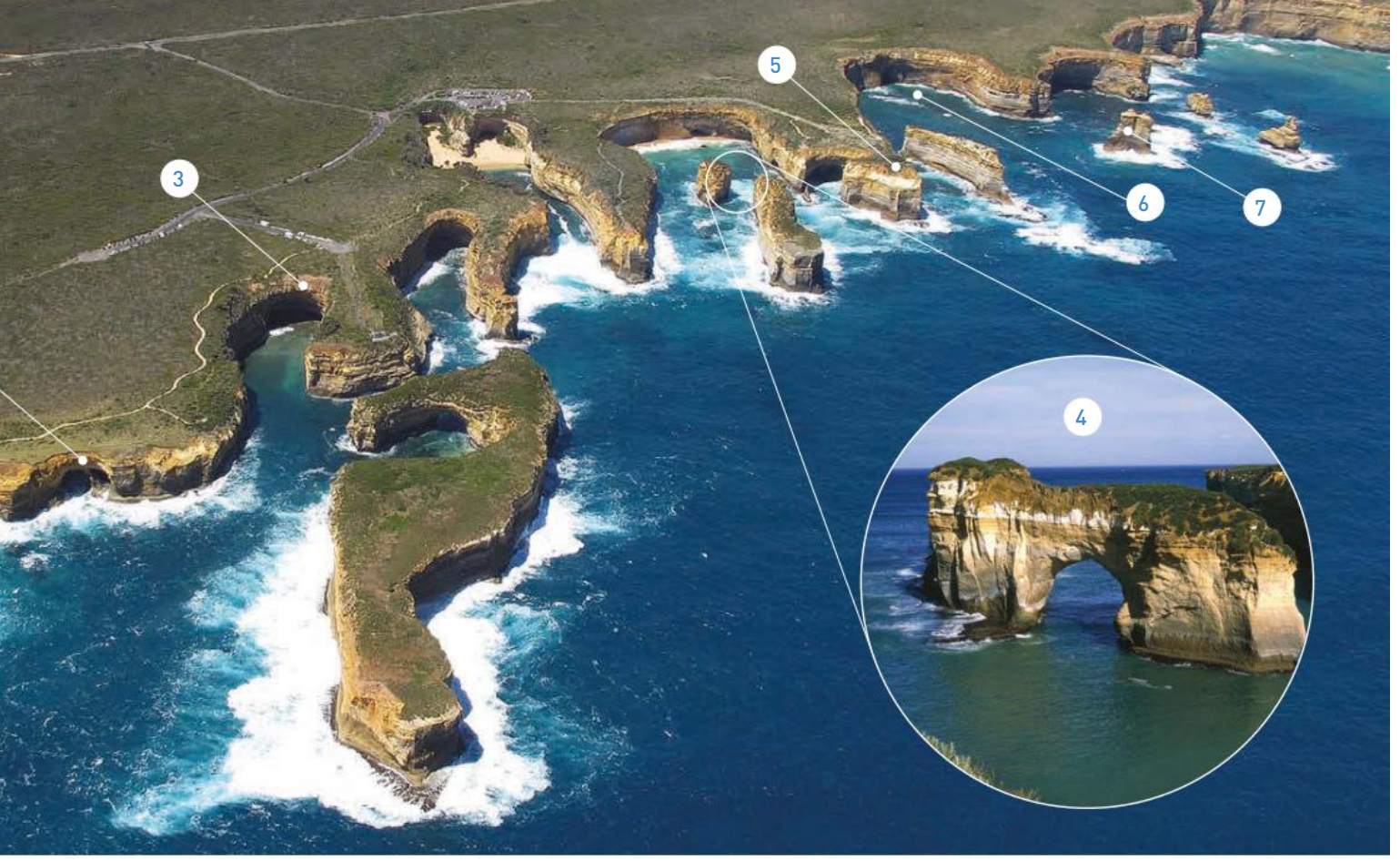
A stretch of coastline close to the town of Port Campbell in southern Victoria (Source 1.28) provides a good example of erosional landforms. This part of Australia's coast is constantly being battered by waves from the Southern Ocean. As a result, the limestone cliffs in the area are being slowly chipped away, creating an ever-changing coast.

1 Cliff

Cliffs along coasts are formed by the action of waves on rock. The power of the waves erodes softer rock, leaving the more durable rock behind.

2 Cave

As waves approach the coast they tend to bend around headlands and islands and attack them from the side in a process known as **refraction**. When waves encounter a weak spot in the cliff (such as a section of soft limestone) they wear away the rock. They create a small opening, which is soon enlarged into a cave. The waves can now enter the cave and erode the sides and top.



3 Gorge

Some caves can be hundreds of metres long. Waves entering long caves can wear away the roof, causing it to collapse and forming a deep gorge.

4 Arch

As waves erode the back of a cave they may penetrate right through the headland and produce an arch. Waves may pass through the arch, eroding the sides and top. The arch here (inset) has recently eroded and fallen into the sea creating two stacks (main image).

5 Headland

Some sections of the coastline are made up of harder rock than other sections. These can resist the energy of the destructive waves longer than the softer parts and remain as headlands – high, rocky outcrops of land.

6 Bay

The softer parts of a coastline wear away more quickly than headlands and become bays.

7 Stack

As the soft rock of arches is eroded by the destructive waves, the rock above the arches eventually falls into the sea, leaving behind stacks – vertical columns – of rock.

REVIEW 1.1.6

Remember and understand

1 Describe what a destructive wave is in your own words.

2 Why do some rocks erode more quickly than others?

Apply and analyse

3 Study Source 1.28.

a How many caves, arches and stacks can you identify?

b Describe the waves in this landscape. What evidence is there that they are destructive waves?

Investigate and create

4 Predict what changes might occur in the next few thousand years in the landscape shown in Source 1.28. On a sketch or copy of the photograph, sketch and label the following features of a future landscape:

- a collapsed stack
- a new arch
- a new stack
- the shape of the new coastline
- a new gorge.

5 This coastline is moving inland at the rate of about 2 centimetres a year. The Great Ocean Road, which you can see in the background, is about 200 metres from the coast at present.

a Estimate the date at which it will fall into the sea.

b What other features of the human environment in this region will also change by then?

DEPOSITIONAL LANDFORMS



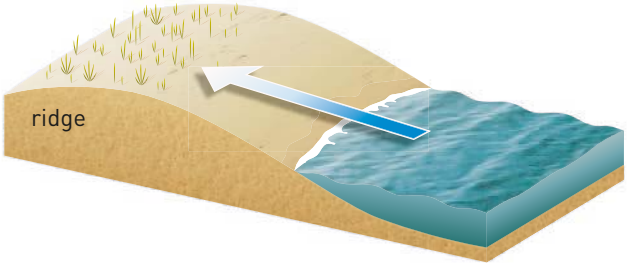


Unlike destructive waves, **constructive waves** help to create landforms that allow plants and animals to live and thrive. Constructive waves are long and low. They begin far out at sea and gently roll onto the shore, allowing for a smooth and gentle landing. In this way, soil and plants are deposited onto the shore. The swash of these waves is slow and strong, which means that materials from the sea can be brought further inland. The backwash, in contrast, is very weak, which means materials are not dragged back into the sea. In this way, a wide, gently sloping beach is formed. Plants can grow and thrive, and the animals that feed on them will settle there.

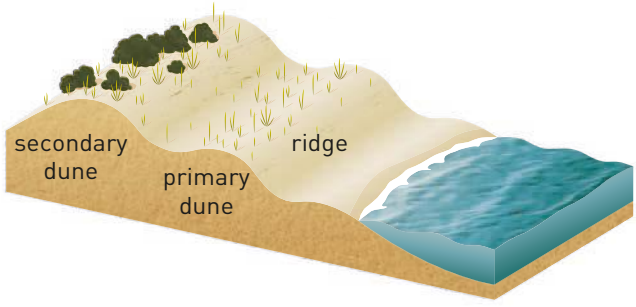
Source 1.29 Whitehaven Beach, Queensland, is an example of a depositional landform.

When waves are small and gentle, they do not generate enough energy to erode the land or cause great and sudden destruction. This is generally the case in bays and harbours that are sheltered from strong winds, such as Port Phillip Bay in Melbourne and Sydney Harbour. Sandy soil is moved from the base of cliffs and from the mouths of rivers by the action of the water. It is carried by constructive waves to new sites along the shore and gently deposited there. Whereas erosional landforms are the result of the removal of material from the shoreline, depositional landforms are the result of this addition of material. Constructive waves and the shapes they create are called depositional landforms.

The most common depositional landforms are beaches. A beach is formed when constructive waves carry sand, pebbles and broken coral or shells in their swash and deposit them on the shore (see Source 1.30). These small waves do not have enough energy in their backwash to take the sand back to sea, so it remains as a beach. Storms may bring destructive waves several times a year and wash away parts of the beach, but the slow, gradual process of beach building repairs this damage.



Source 1.30 Constructive waves carry sand onto the shore where it collects and forms a beach. Wind picks up dry sand and blows it inland.



Source 1.31 Sand is trapped by plants and collects in dunes. Over time larger plants grow over the dunes, holding them together and making them stable.

As the tide goes out, the sand dries out and the wind can then pick up individual grains and blow them inland. As the grains move, they may be trapped by an obstruction, such as plants, or they may collect in areas sheltered from the wind. As the sand piles higher it forms **sand dunes** (see Source 1.31). Plants grow on these dunes and hold them together, which allows even larger plants to take root and grow. But if the plants are removed, entire dunes can gradually move further inland, covering roads, car parks, paddocks and plants. These are called **blowout dunes** (see Source 1.32).



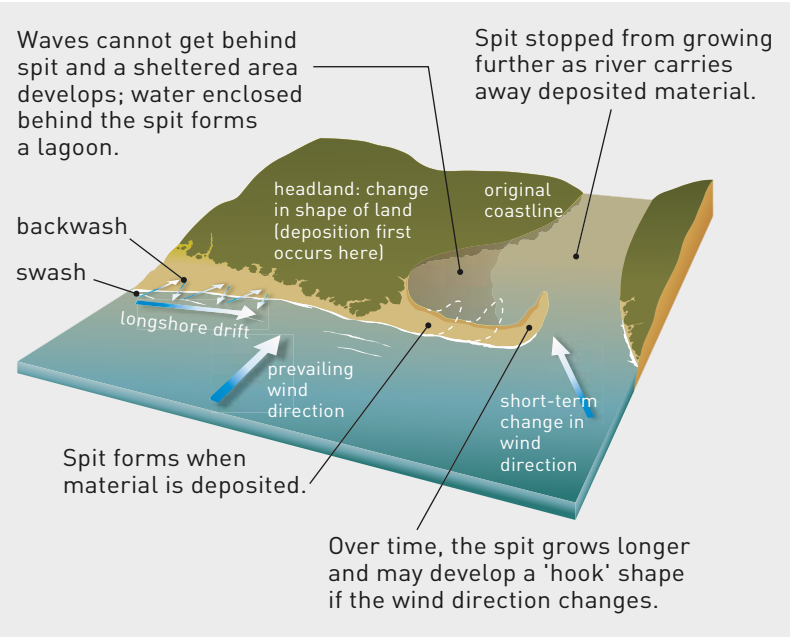
Source 1.32 A massive blowout dune inches its way across Fraser Island away from the beach.

As well as moving inland, sand moves along the coast as a result of longshore drift. As sand is deposited along coasts, other landforms can be created by the forces of water and wind.

A **spit** is a long, curved landform that is built up at the mouth of a river, which is where the river widens and ends. A river carries soil and rocks from upstream in its swiftly moving water. This material is dumped at the river mouth, forming a spit. Over time further soil and rocks collect at the river mouth, making the spit larger and more secure. This more stable environment encourages the growth of plants, which, in turn, provide habitats for animals.

Some spits grow so large that a river may be forced to change its course to reach the sea. Over thousands of years, the river mouth may move hundreds of metres along the coast and a stretch of calm water behind the spit, known as a **lagoon**, is formed. These are often home to communities of plants and wading birds, such as herons and egrets.

A **tombolo** is formed when waves curve around an island close to shore and deposit a bar of sand or other sediment on the lee side of the island (the side closest to the mainland). Eventually, enough material builds up on the leeward side that a permanent connection, or tombolo, is made between the island and the mainland (see Source 1.26).



Source 1.33 How spits form

REVIEW 1.1.7

Remember and understand

1 Why do constructive waves tend to add sand to a beach rather than take it away?

2 What role does the wind play in the formation of sand dunes?

3 What is a lagoon and how does it form?

Apply and analyse

4 Why are waves important to the formation of a tombolo?

5 Is the dune in the photograph of Fraser Island (Source 1.32) advancing towards the camera or away from it? How can you tell?

6 Describe three key steps in the formation of a spit.

Evaluate and create

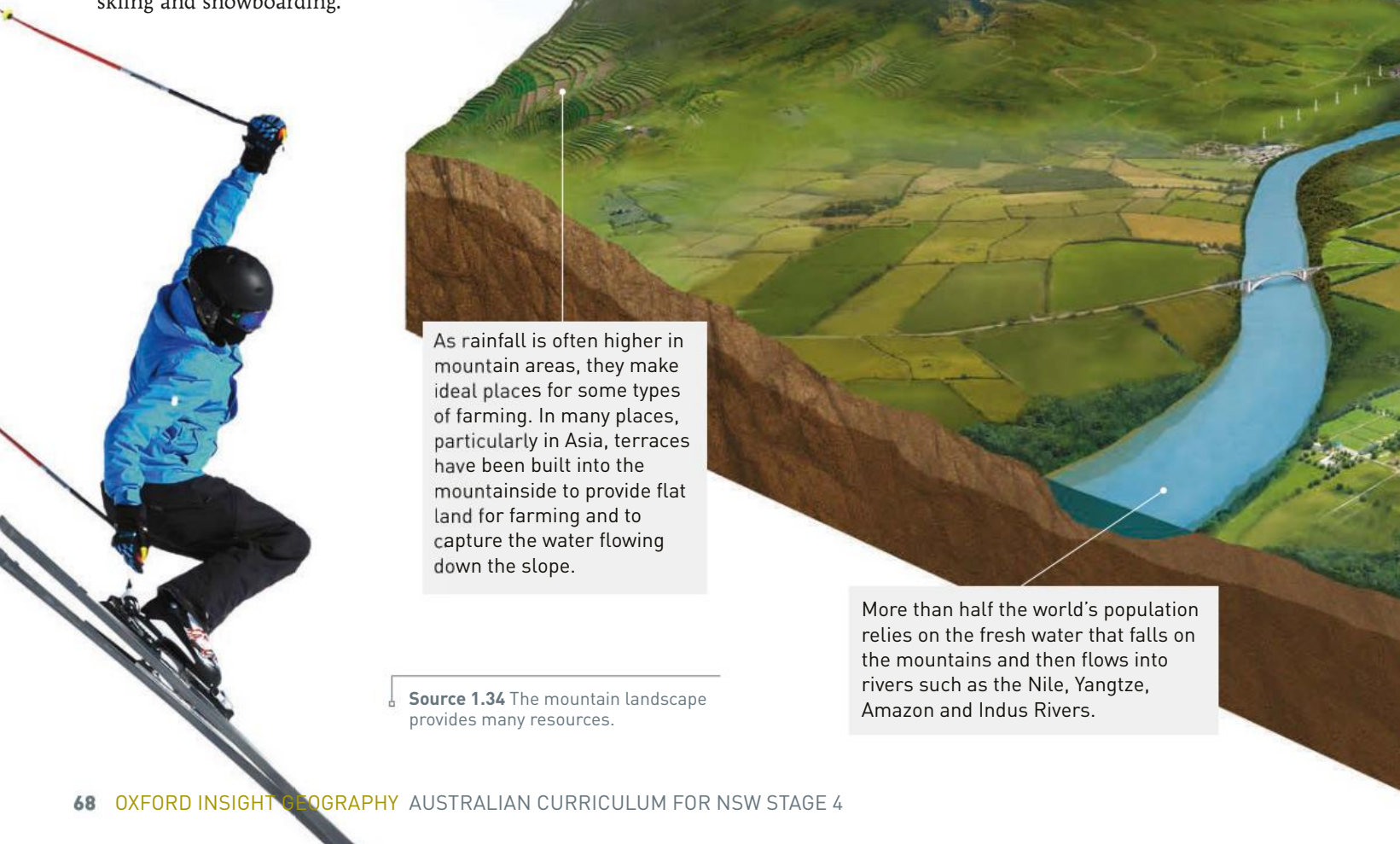
7 Draw a sketch map of Whitehaven Beach (Source 1.29) showing the locations of sand, sea, rivers and forest. Remember that a map is a view from above, not on an angle as in the photograph. On your sketch map, use arrows to show the movement of sand.

USING MOUNTAIN LANDSCAPES

Like many of the world's landscapes, mountains are used by people as a resource. Billions of people rely on them to satisfy certain needs and wants. Some of the ways in which we use mountains do not change them at all, while others can affect them dramatically.

Mountain landscapes are often fragile. Small changes caused by human activities can greatly affect the plants and animals, soil and even the climate in these areas.

Depending on the society and culture into which people are born, and their personal circumstances, they will view and value different parts of the natural world in very different ways. For example, a tribesperson from the highlands of Papua New Guinea may value mountains as a place to live and grow crops; an Indian farmer may value mountains as a source of fresh water for irrigation; and an Australian city-dweller may value mountains as a holiday destination for skiing and snowboarding.



Source 1.34 The mountain landscape provides many resources.



REVIEW 1.1.8

Remember and understand

1 Which use of mountain landscapes shown in Source 1.34 do you think has the greatest impact on the natural environment? Justify your answer.
2 List three uses that have little or no impact on the natural environment.
3 In what ways do you use mountains as a resource?
4 Can you think of any other uses of mountains not shown in Source 1.34?

Apply and analyse

5 In what ways does tourism change the natural environment?
6 How might tourism benefit people who live in mountainous places?

Investigate and create

7 Select two uses of mountains that can coexist without affecting each other. Explain why there is no conflict between these uses.
8 Select two uses that conflict or compete with each other. Explain why there is this conflict. Can you think of any real-life examples of this type of conflict?
9 In small groups, rank the uses of mountain landscapes shown from most to least harmful to the environment. When you have decided on the most harmful, brainstorm exactly what these impacts might be. Share your ideas with the rest of the class and be prepared to add to your list of potential impacts.

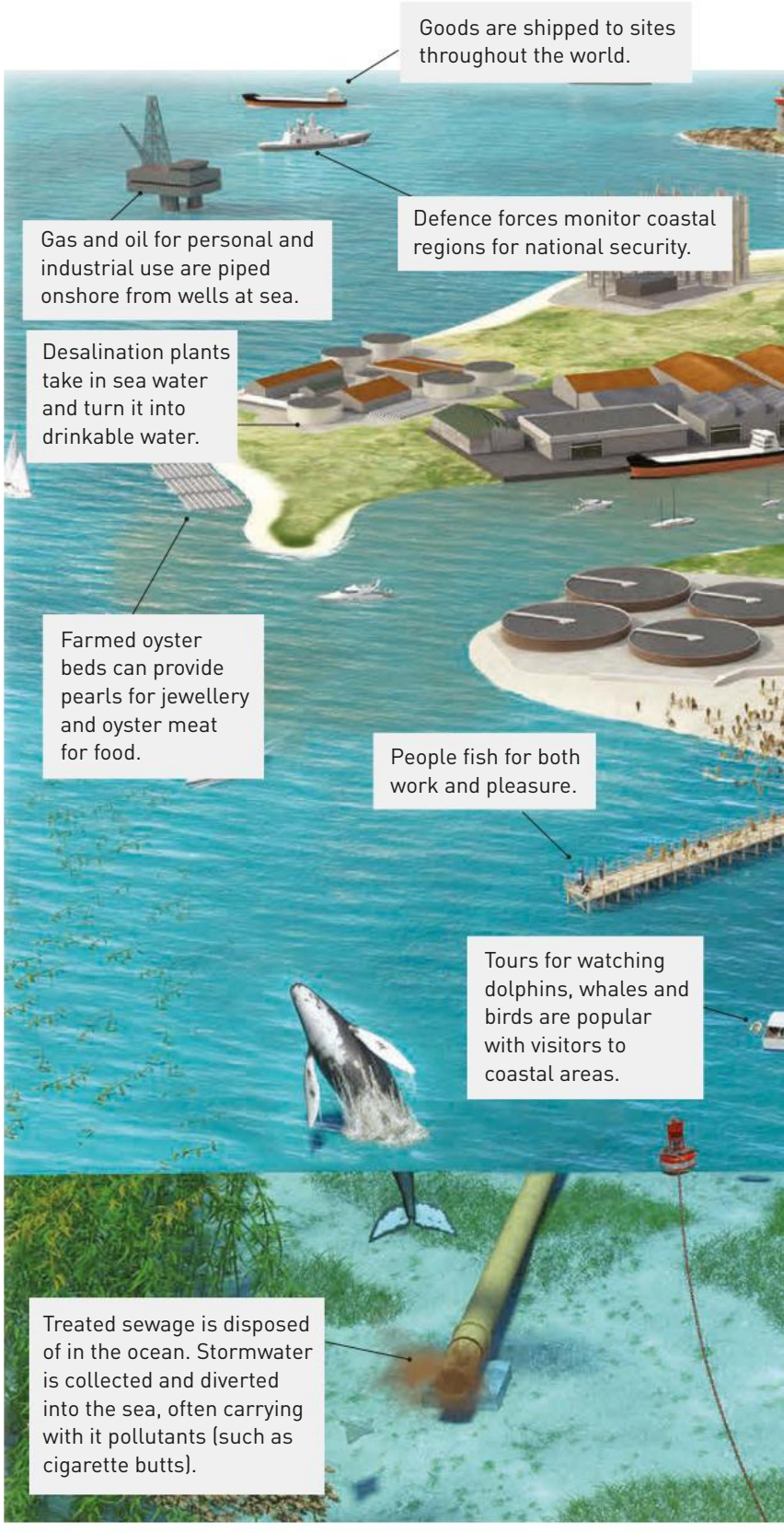
USING COASTAL LANDSCAPES

Coastal landscapes are some of the most highly populated areas on Earth. About 3.5 billion people – more than 50 per cent of the world's population – live on or near a coast. Some geographers estimate that this number will double over the next 15 years.

In Australia, this figure is already much higher – 85 per cent of us live within 50 kilometres of the sea. Many coastal towns and cities are currently experiencing rapid population growth, increasing this figure even more.

Coastal areas are used for much more than places to live. Source 1.35 shows some of these uses and their impacts on the environment.

Source 1.35 How and why people use coastlines



REVIEW 1.1.9

Remember and understand

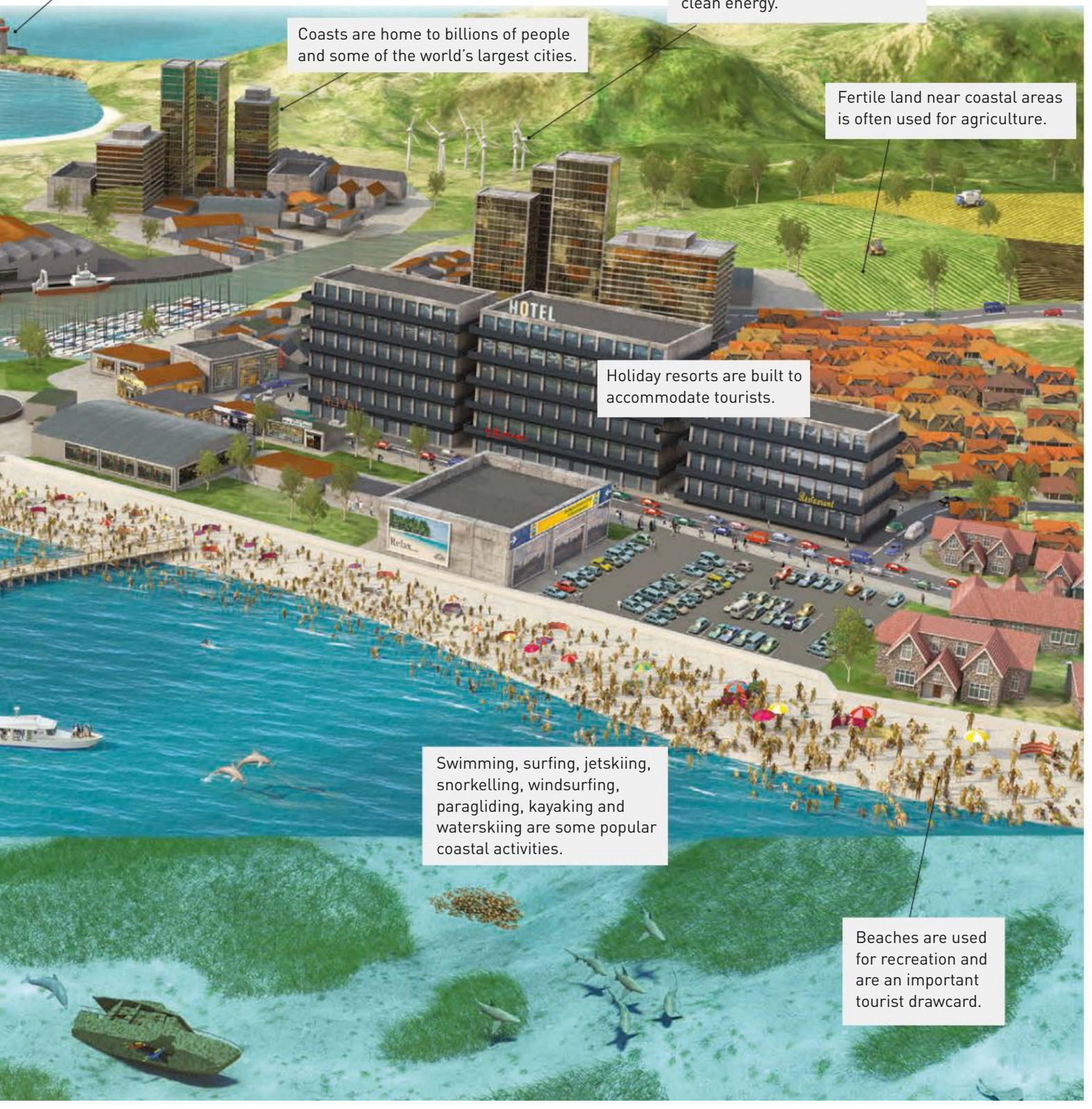
1 Name two ways in which ships and boats are used in a coastal landscape.
2 Which parts of the coastal landscape in Source 1.35 have attracted the most people? What are these people doing?

Apply and analyse

3 How do you use the coast? Which of the labels on Source 1.35 describe ways you use the coast?
4 How does tourism change coastal areas?
5 Why do you think so many people live near the coast?

Investigate and create

6 Can you think of any uses of the coast not shown in Source 1.35?
7 Which activities shown in Source 1.35 would have no or very little impact on the natural environment? Which three would have the greatest impact?
8 Identify one activity shown in Source 1.35 that you believe has the greatest impact on the environment. Work with a partner to discuss some ways in which people could reduce the impact of this activity on the environment.
9 Use a street directory (or Google Maps) to examine a coastal city in Australia. Carefully examine the coastline of this city and list all the ways in which the people of the city have changed the coast or used it in some way. What are some common changes or uses and what are some surprising ones?


Lighthouses are important landmarks that help ships navigate their way safely along dangerous stretches of coastline.
Coastal winds can be harnessed with wind turbines to produce clean energy.
Coasts are home to billions of people and some of the world's largest cities.
Fertile land near coastal areas is often used for agriculture.
HOTEL
Holiday resorts are built to accommodate tourists.
Swimming, surfing, jetskiing, snorkelling, windsurfing, paragliding, kayaking and waterskiing are some popular coastal activities.
Beaches are used for recreation and are an important tourist drawcard.

1.1

CHECKPOINT

WHY IS THERE A DIVERSITY OF LANDSCAPES AND LANDFORMS ON EARTH?

- **Investigate different landscapes and the geomorphic processes that create distinctive landforms**

1 Describe how the mountain landscape of the Andes in South America was formed in terms of plate tectonics. [5 marks]

2 Explain why Japan has active volcanoes and experiences earthquakes on a daily basis. [5 marks]

3 Explain the difference between weathering and erosion. [4 marks]

4 Explain how throughout a river's course, from its headwaters to its delta, there will be a range of erosional and depositional landforms. Name and describe the landforms that occur along a river's course. [6 marks]

TOTAL MARKS [/ 20]

RICH TASK

The mountains of Antarctica

Antarctica is the world's highest continent. Its average height above sea level is 2500 metres whereas Australia's is about 340 metres. Antarctica's great height is largely due to the two enormous ice sheets that cover virtually the whole continent. Up to 4 kilometres thick, these ice sheets hold 90 per cent of the world's ice and 70 per cent of its fresh water. Antarctica is also home to vast mountain ranges. Most of its mountains lie hidden beneath the ice, but some are tall enough to poke through the ice. One range, the Transantarctic Mountains, is more than 3000 kilometres long and tall enough to hold back the world's largest ice sheet.

Acquiring geographical information

1 Use Source 1.36, Source 1.37, Skill drill: using a map legend and other information from Section 1.1 to complete an investigation into the landscapes and the geomorphic processes that create distinctive landforms in Antarctica.

- **a** Use the map of Antarctica (Source 1.37) to describe the distribution of mountains on that continent.
- **b** How do you think the Transantarctic Mountains were formed? Give reasons for your answer.
- **c** Mount Erebus, located on the edge of the Ross Ice Shelf, is an active volcano. Do you think it is located over a hot spot? Give some reasons for your answer.



Source 1.36 The Transantarctic Mountains in Antarctica

SKILL DRILL

Using a map legend

In order to show the features on maps clearly, various symbols and colours are used. To help us unlock the information on the map these symbols are explained in a legend (or key). There are three main types of map symbols:

- *point symbols* – show features in one particular place (such as a railway station or a scientific base)
- *line symbols* – show features that connect places on the map (such as roads and rivers)
- *area symbols* – use colours or patterns to represent large areas (such as lakes and ice sheets).

Apply the skill

1 Study Source 1.37.

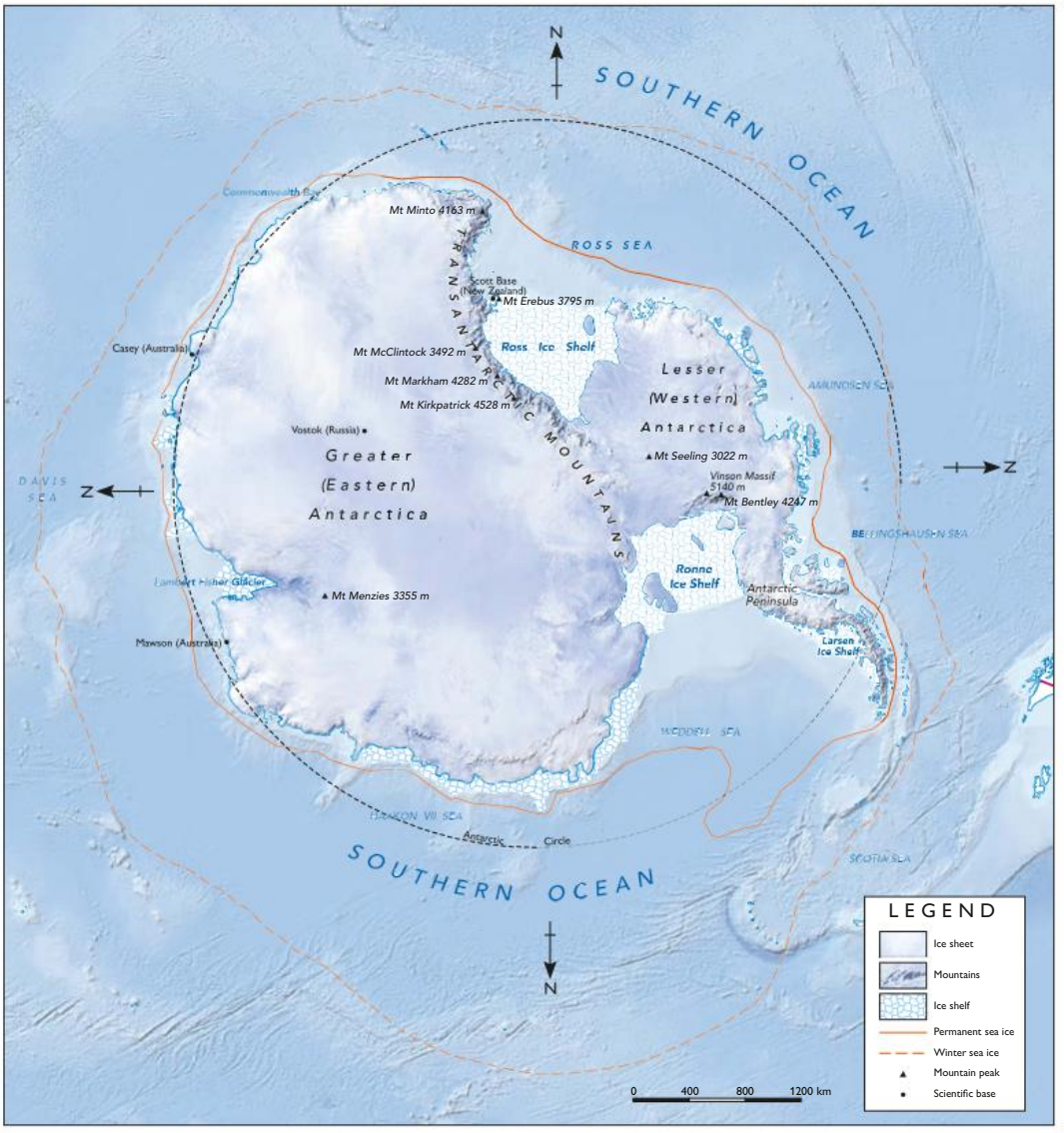
a What symbol has been used for mountain peaks on this map?

b Give an example of an area symbol used on this map.

c How many scientific bases are on this map?

d What do you notice about the location of the ice shelves on this map?

ANTARCTICA



Source 1.37

Source: Oxford University Press

In this Checkpoint and Rich Task, you will be learning and applying the following geographical concepts, inquiry skills and tools:

- Concepts: Space, Change
- Inquiry skill: Acquiring geographical information
- Tools: Maps, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHECKPOINT

1.2 LANDSCAPES ARE ALWAYS CHANGING

WHAT ENVIRONMENTAL AND HUMAN PROCESSES FORM AND TRANSFORM LANDSCAPES AND LANDFORMS?

The Earth is dynamic. It is constantly moving and changing, transforming landscapes and landforms. The characteristics of most places are influenced by a combination of environmental processes, such as flooding and earthquakes, and human processes, such as mining and construction of cities. Some of these changes are very slow and take place over millions of years, for example, the formation of the Grand Canyon in the US state of Arizona. Other changes take place very quickly, as did the formation of a new island in the South Pacific, just four months after the eruption of an underwater volcano in Tonga.



Source 1.38 The Grand Canyon in Arizona, United States, is thought to have taken more than 17 million years to form as we see it today.



Source 1.39 In 2015, a new island formed in the South Pacific, 45 kilometres north-west of Tonga's capital, Nuku'alofa, four months after the eruption of an underwater volcano.

STRANGE BUT TRUE

The world's population is approximately 7.4 billion people. In 1999, it was six billion. The United Nations estimates that by 2050 the world's population will be more than 9.7 billion.



Humans change landscapes

Without doubt the most constant force of change is us. Humans have been changing landscapes to obtain food and other essential elements for thousands of years. We clear forests and change the shape of the land to graze animals and grow crops. We move mountains and divert rivers to build cities and towns. We even create new land from the sea in coastal areas. In fact, humans have transformed landscapes so much that today very few truly natural landscapes remain. As the world population increases, so too does our demand for resources from the land.



Source 1.40 The rice terraces of Luzon Island in the Philippines were built by the native Ifugao people.



Source 1.41 Palm Jumeirah is an artificial island on the coast of Dubai, United Arab Emirates, constructed from dredged sand and rock breakwaters.

Land degradation



Source 1.42 The Ranger Uranium Mine in the Northern Territory provides a clear example of the way in which places are changed and managed by humans. Here, uranium (used to fuel nuclear power plants) is mined and sold to countries across Asia, Europe and North America. Although the mine is technically separate from Kakadu, it is surrounded by the park on all sides.

Land degradation affects 33 per cent of the Earth's land surface. It reduces the quality of the land and its capacity to produce food. Human activities are the main cause of land degradation. Overgrazing, crop growing without resting the fields, deforestation and land clearing, collection of wood for fuel, and industrialisation including mining are all examples of human activities that cause land degradation. According to the United Nations Food and Agriculture Organization (FAO), the world on average has just 60 more years of growing crops if we do not modify our current practices. To keep up with the global food demand, the FAO estimates 6 million hectares of new farmland will be needed each year. Instead, 12 million hectares a year are lost through land degradation.

Through the ages, people have extracted minerals from rocks (ores) to use for different purposes. The discovery of ores, and people's ability to extract the metals within them, has been crucial for technological development. Today our modern technology and lifestyles depend on the use of a large range of minerals; for example, glass is made from silicates and feldspar and steel is made from iron ore. All these minerals come from the rock in the Earth's crust. If the rock containing the mineral is close to the Earth's surface, it can be dug up by open-cut mining (see Source 1.42). Mining and the processes used to extract minerals from the ore damage our environment. Even where mining occurs underground, crushed rock is dumped in piles around the mine after the valuable minerals have been extracted from it.

REVIEW 1.2.1

Remember and understand

1 Explain why land degradation is an important issue.
2 Is land degradation inevitable?
3 List some of the human activities responsible for land degradation.

Apply and analyse

4 Look carefully at Source 1.42. Create and complete the following table by considering:
   a the environmental impacts of the mining activities
   b how the impacts could be minimised.

Mining activity	Potential environmental impacts	Minimisation of impacts
Using local roads		
Clearing Kakadu bushland		
Using large, heavy machinery		
Removing topsoil		
Dumping crushed rock (mine waste)		
Using explosives to remove material		

5 How can humans accelerate the process of erosion?
6 Identify a natural landscape that has not been changed by humans. Explain why this is possible.

Investigate and create

7 Of the 35 countries most dependent on mining, all but Australia and South Korea are developing countries. Account for two advantages and two disadvantages of this dependence on mining to a developing country.

CAUSES OF LANDSCAPE DEGRADATION

STRANGE BUT TRUE

Did you know that it takes around 100 years to generate 1 millimetre of soil, and that half of all the topsoil on the planet has already been lost over the last 150 years? It has simply been washed or blown away.



All around the world natural landscapes are being transformed by humans. Natural vegetation is cleared and replaced with single plant species, crops and pastures for grazing. Trees are cut down for fuel, paper and building material. Soil is damaged by overfarming and other poor agricultural practices, affecting its ability to support plants and animals. Water diverted from rivers and underground sources to grow crops and raise animals may become polluted through the use of fertilisers and pesticides. All these changes can cause degradation of the natural landscape. Industrialisation increases the stress on the land further by building, mining, energy production and pollution. It is estimated that more than half of the world's **arable** land is moderately or severely degraded. **Soil erosion**, **desertification** and **salinity** are three common forms of land degradation brought about by land clearing and farming.



overgrazing (35 per cent)



deforestation (30 per cent)

THE FIVE MAIN CAUSES OF LAND DEGRADATION AND THEIR ESTIMATED CONTRIBUTIONS



crop growing (28 per cent)



collection of firewood for fuel (6 per cent)



industrialisation (1 per cent)

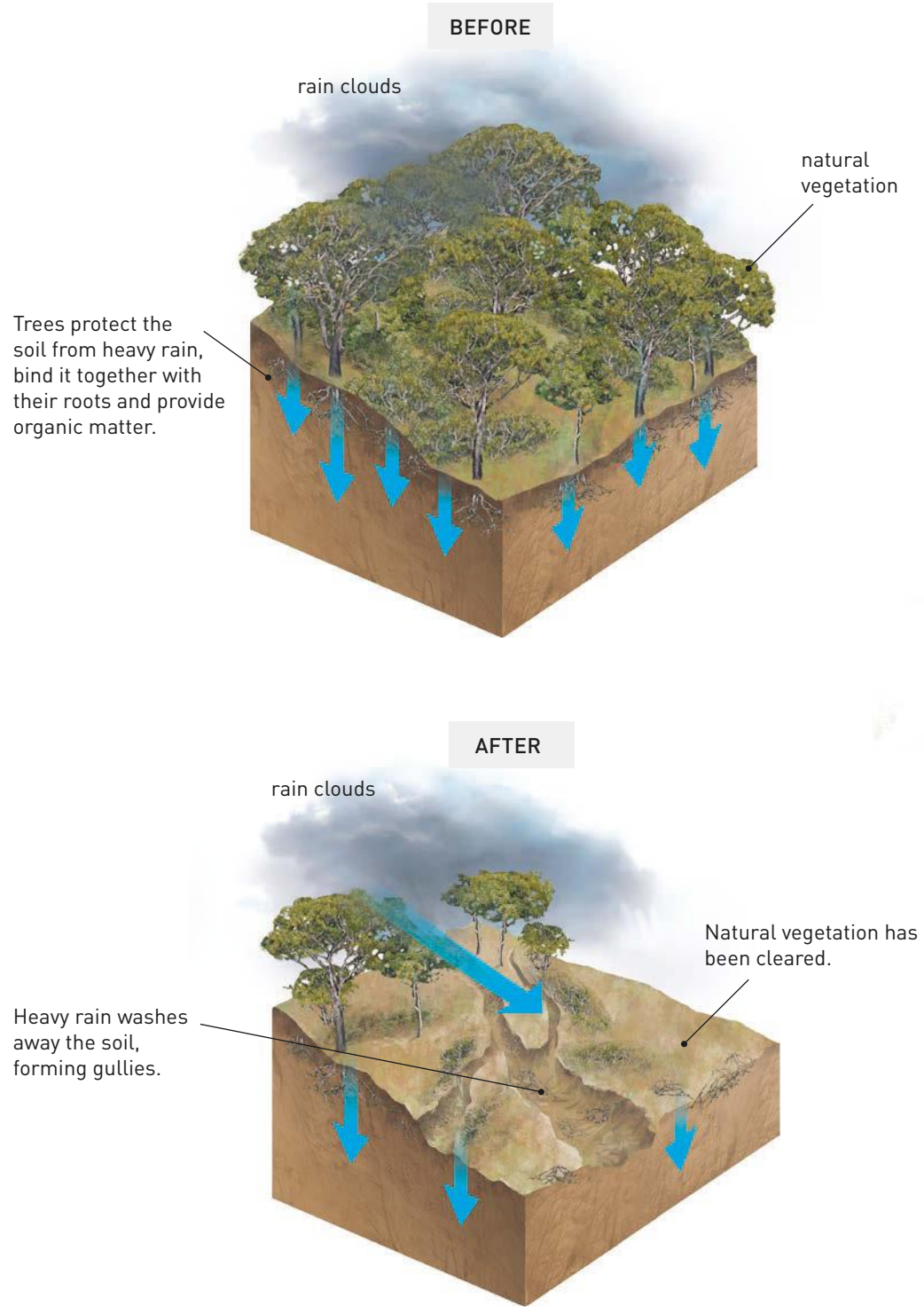
Source 1.43 Causes of land degradation

Soil erosion, desertification and salinity

Soil erosion

Soil erosion is the removal of topsoil faster than the soil-forming processes can replace it. Natural vegetation protects the soil. When land is cleared for farming it loses topsoil easily, often resulting in a lowering of soil nutrients and productivity. Each year, 5 to 7 million hectares of farmland are lost to soil erosion worldwide.

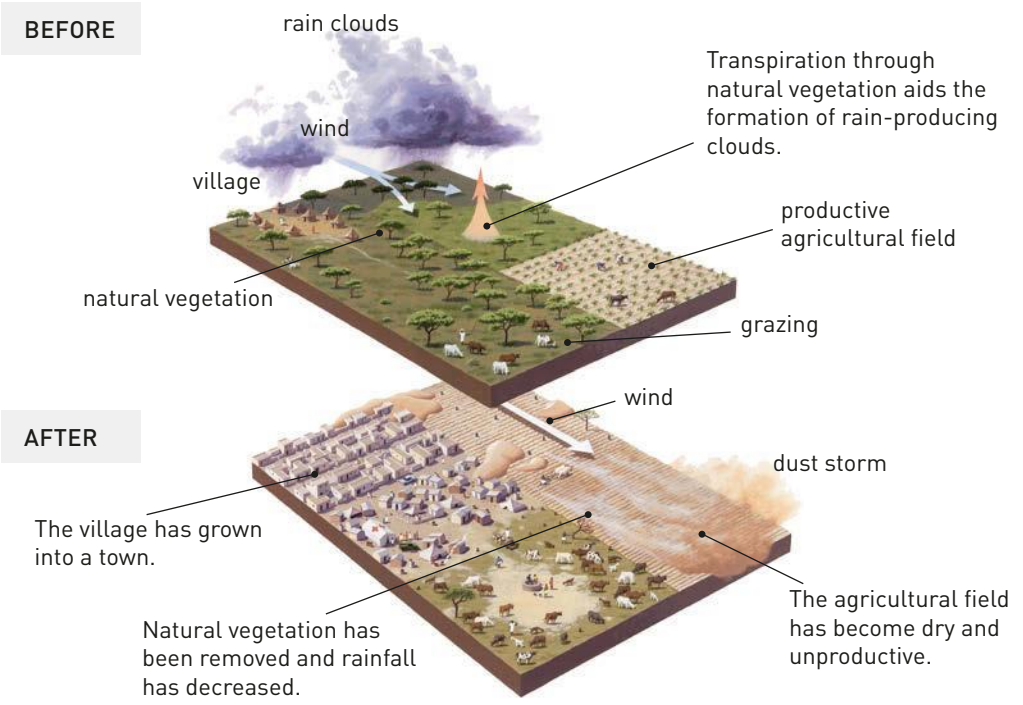
Source 1.44 Soil erosion



Desertification

Desertification is the transformation of fertile land into dry, desert-like areas. Human activities such as deforestation, overgrazing and poorly managed agriculture can cause desertification. Unprotected, dry soil surfaces blow away with the wind or are washed away by rain, leaving infertile lower soil layers that are unproductive.

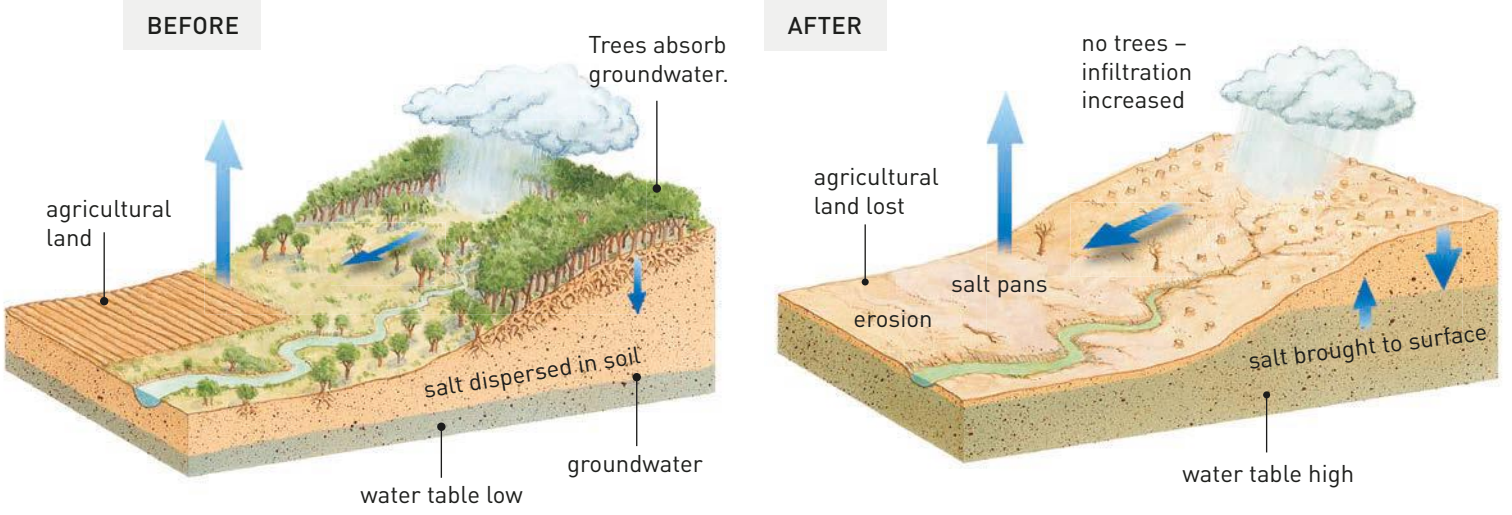
Source 1.45 Desertification



Salinity

Salinity refers to a high level of salt in the soil, which kills plants. Salt in the underground water is forced to rise when we remove trees with deep root systems that keep the water table low in the ground. This is known as dryland salinity. When extra water from irrigation enters the ground it also forces the water table to rise. This is known as irrigated salinity.

Source 1.46 Salinity



REVIEW 1.2.2

Remember and understand

1 Why is soil important?
2 Where does the soil that is eroded away end up? Describe how it got there.
3 What is desertification? Identify the three main human activities that can cause desertification.
4 What is salinity? Distinguish between dryland salinity and irrigated salinity.

Apply and analyse

5 Construct a pie chart to illustrate the causes of degradation.
6 Consider the processes that contribute to land degradation in farming, listed in the table below. Copy the table into your notebook and complete it by matching the following effects to the causes identified in the table. Remember: a cause is a reason or situation that leads to an outcome or result.
   - Waterlogged soils
   - Acidic and less productive soil
   - Loss of fertile topsoil
   - Smothering of native vegetation
   - Raised water table, bringing salts to the surface
   - Loss of productivity
   - Dried, cracked and hard soil surface
   - Barren and unproductive land
   - Very hard surface that water cannot infiltrate
   - Irreversible damage – abandoned land

Process	Cause	Effect
Acidification	Overuse of fertilisers	
Compaction	Driving over soil in heavy machinery Herds of hoofed animals	
Drought/Desertification	Global warming Lack of rainfall Overcultivation	
Erosion	Clearing of all vegetation, especially trees	
Nutrient depletion	Repeated cropping Overstocking on pasture	
Salinity	Excessive irrigation	
Weed invasion	Introduced species	

Investigate and create

7 You are a journalist trying to create greater awareness of the perils of land degradation. Consider the following statements and explain their meaning in your own words. Then propose another newspaper headline worthy of informing the reader of the importance of soils and the risks of land degradation.
   a 'We're treating soil like dirt. It's a fatal mistake, as our lives depend on it.'
   b 'Soil erosion threatens to leave the world hungry.'
   c 'From dust bowl to bread basket'



IMPACTS OF FARMING ON MOUNTAIN LANDSCAPES

Farming in mountainous areas has many advantages, such as reliable rainfall and fertile soils, but it also brings many challenges. These difficulties include accessing raw materials (such as grain for planting) and getting crops to market for sale. There are also many natural hazards to overcome, such as landslides and earthquakes. Despite all these obstacles, a lack of flat land is perhaps the greatest challenge for many mountain-dwelling farmers. Flat land allows farmers to irrigate their fields without the water draining away and also makes it easier to use animals or tractors for tasks such as ploughing.

Rice terraces

Throughout much of Asia, flat land has been carved out of steep mountains by creating steps on the hillsides known as terraces. These terraces have a dramatic impact on the natural landscape (see Source 1.47).

Terraces are built in three stages:

- Stage 1 – The farmer selects a good site with a reliable source of water, such as a stream or spring. A wall of large stones is then laid down across the slope of the hill.
- Stage 2 – Using the stream to carry material down the slope, the farmer fills the area behind the wall with gravel and then topsoil. The stone wall is built up as more gravel and soil are added.
- Stage 3 – Once the terrace is large enough, it is flooded with water so that rice can be grown. The flow of water down the terraced slope is controlled by removing and replacing stones from the wall.

Some terraces, including those shown in Source 1.47, are thousands of years old and farmers often spend many hours a day maintaining them. The crop most often grown in these terraces is rice, which is the staple food of half the world's population.

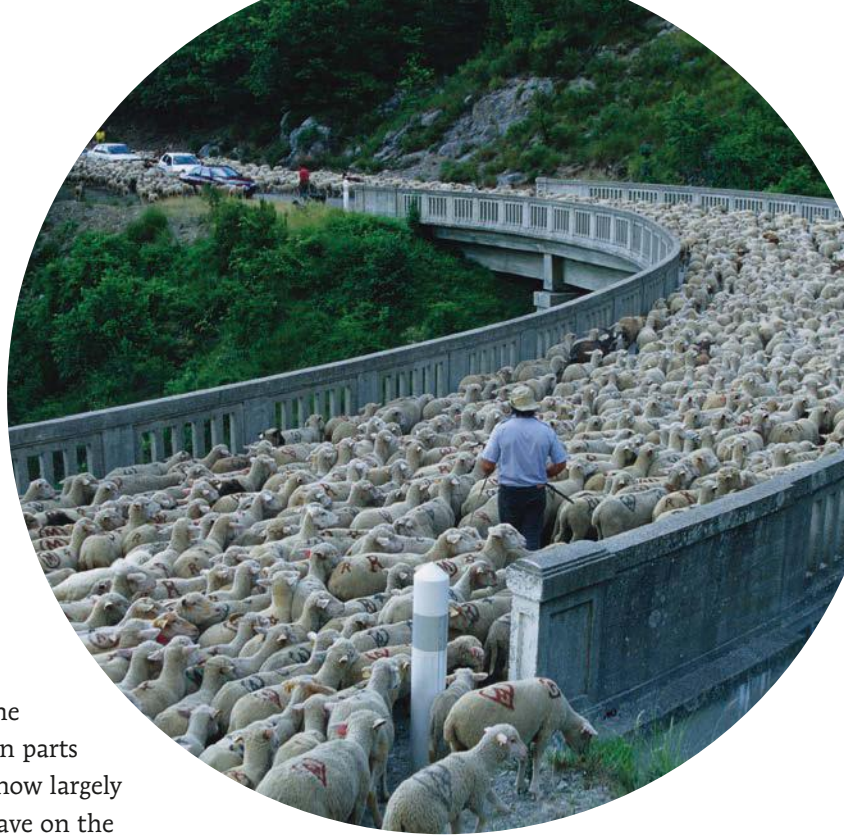


Source 1.47 These rice terraces on luzon Island in the Philippines are a Word Heritage Site and are more than 2000 years old.

Moving with the herd

In mountainous areas there can be dramatic differences between summer and winter. In winter, snow blankets the grass on the ground and animals (including farm animals, such as sheep, goats and cows) cannot feed. As temperatures rise in spring, the snow melts and the grass recovers. The warmer temperatures also allow moss, lichens (fungi) and wildflowers to flourish, providing food for grazing animals. Farmers respond to these seasonal changes by moving their herds between summer pastures in the mountains and winter pastures in mountain valleys and the plains below.

In some parts of Asia and Europe, including the French Alps (see Sources 1.48 and 1.49), this type of farming is centuries old. An Australian equivalent is the summer movement of cattle into the Australian Alps in parts of Victoria and New South Wales, a practice that has now largely been stopped because of the damaging effects it can have on the landscape.



Source 1.48 A shepherd takes his flock of sheep into the French Alps for summer.

Source 1.49 Climate data for the town of Mende in the French Alps

Month	J	F	M	A	M	J	J	A	S	O	N	D
Average low temperature (°C)	–3	–3	–2	0	5	8	10	11	7	4	–1	–3
Rainfall (mm)	164	100	84	125	127	72	42	52	153	232	225	167

REVIEW 1.2.3

Remember and understand

1 Why is rice often grown in terraces?
2 What is often the most challenging problem facing people farming in mountainous areas?
3 Why do many farmers in Europe live some of the year in the mountains and some of the year on the plains below?

Apply and analyse

4 Using the information provided, together with Source 1.47, complete the following tasks:
   - **a** Create a diagram illustrating the three stages required when constructing a rice terrace.
   - **b** Name two natural features that make the area shown in Source 1.47 suitable for farming.

Investigate and create

5 Compare the two methods of mountain farming described here. Complete a Venn diagram showing the features unique to each and the features they share.
6 Study the climate data for the town of Mende in the French Alps. This town is located near some of the summer pastures used by French farmers. Complete a climate graph for the town of Mende and answer the questions that follow.
   - **a** In which month do you think farmers bring their herds to the meadows near Mende?
   - **b** In which month do you think they leave?
   - **c** What would this mean for shop owners in Mende?

HUMAN IMPACTS ON COASTAL LANDSCAPES: GHOST NETS



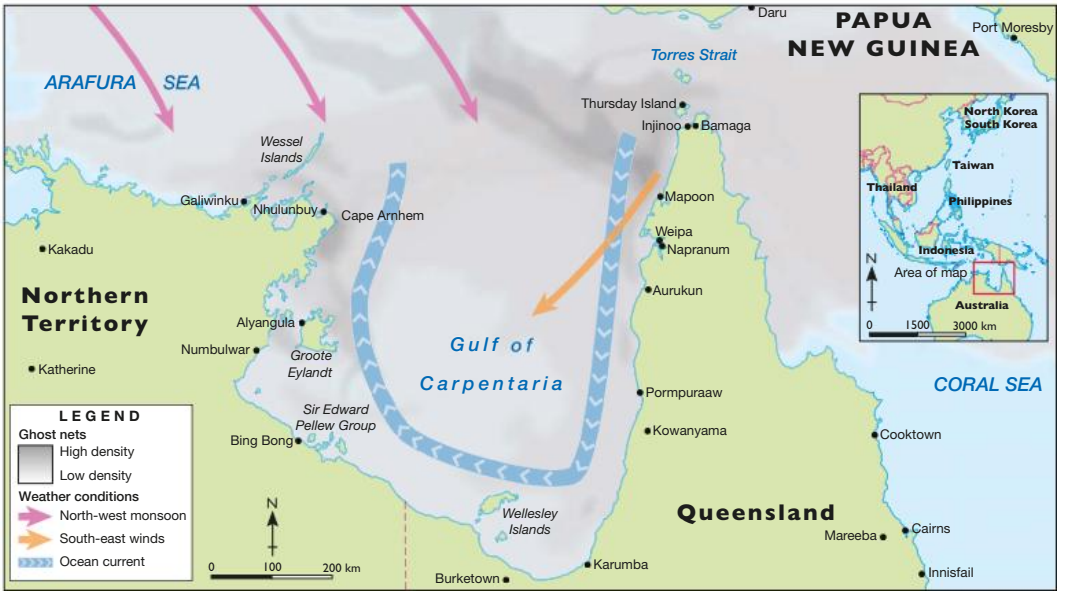
Source 1.50 Yirralka Laynlapuy rangers remove a ghost net from a beach in East Arnhem Land.

Every year, about 6.4 million tonnes of fishing gear (nets and tackle) is lost in the world's oceans. Most of this is made up of abandoned fishing nets that have drifted free from boats in extreme weather conditions or have been cut free because they became entangled. In many cases it is cheaper and easier for fishermen working in waters to the north of Australia to cut these tangled nets free than to haul them in and untangle them. The nets, still afloat because they are plastic, are carried south on ocean currents and continue to entangle fish and other marine species, such as turtles, dugongs and even crocodiles. They are referred to as **ghost nets** and at any one time there are thousands of them in the ocean.

About 100 000 marine mammals are killed by ghost nets every year. This includes endangered animals, such as whales, Australian sea lions and turtles. In northern Australia, ocean currents and winds carry ghost nets into the Gulf of Carpentaria where they can remain for years, trapped by circulating currents (see Source 1.51). Tides and storms wash them onto the shore and then drag them back to sea or bury them in the sand.

In response to this issue, GhostNets Australia, an organisation dedicated to removing ghost nets from the waters and beaches of northern Australia, was formed in 2004. It is an

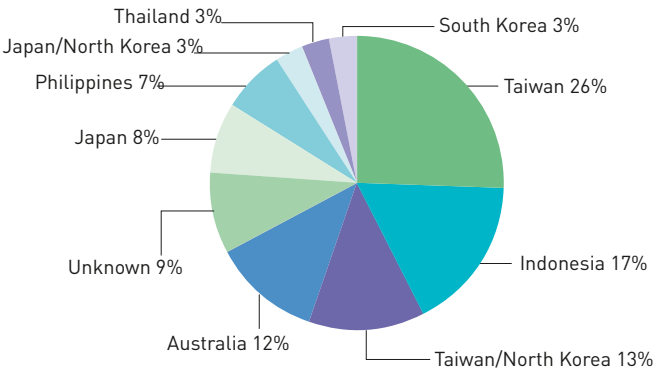
THE GULF OF CARPENTARIA: WEATHER PATTERNS AND DENSITY OF GHOST NETS



Source 1.51

Source: Oxford University Press

alliance of coastal Indigenous communities from Queensland, the Northern Territory and Western Australia. Since GhostNets Australia was formed, its rangers have retrieved more than 12 000 nets from Australian waters. This represents about 90 kilometres of netting. As well as removing the nets, these rangers also free trapped wildlife, map the location of the nets using global positioning systems (GPS), and try to identify the origin of the nets using resources supplied by the World Wildlife Fund.



Source 1.52 Origins of nets found at Cape Arnhem, Northern Territory

KEY CONCEPT: INTERCONNECTION

Where do the ghost nets come from?

Although some environments are unique, no environment exists in isolation from others. There are links between places, and by exploring these links we can develop a better understanding of the ways in which networks and systems work. This may help us to solve problems such as marine and coastal pollution. In the case of the ghost nets of the Gulf of Carpentaria, geographers examine the winds and currents of the area to help explain why nets collect in this region. By examining the data collected by the GhostNets Australia rangers and other researchers, we can also find out the origins of the nets (see Source 1.52).

For more information on the concept of interconnection, refer to section GT.1 of the 'The geographer's toolkit'.

REVIEW 1.2.4

Remember and understand

1 What are ghost nets?
2 Why do ghost nets create problems for the natural environment?
3 Describe the work done by the GhostNets Australia rangers.

Apply and analyse

4 Examine Source 1.51. How do ocean currents and winds affect the movement of ghost nets? Refer to specific winds and places in your answer.
5 Why do you think most GhostNets rangers are Indigenous Australians?

Investigate and create

6 On an outline map of the Asia–Pacific region, locate and label the countries of origin of fishing nets found at Cape Arnhem (see Source 1.52).
   a Colour in each of these countries using darker shades for countries that have contributed many nets and lighter colours for those with fewer nets. For example, you may use red for countries with more than 15 per cent, orange for those with 5 to 15 per cent, and yellow for those with less than 5 per cent.
   b Describe the pattern shown on your map.
   c Use arrows to show the paths that may have been taken by these nets to reach Cape Arnhem.
   d Use BOLTSS to finish your map.
   e How far have the Japanese nets travelled to reach the Gulf of Carpentaria? Why is this hard to estimate correctly?
   f Why are rangers and researchers interested in the origins of the nets?
7 What do you think should be done to reduce the number of ghost nets in the oceans? Why do you think this is such a difficult problem to solve?

1.2

WHAT ENVIRONMENTAL AND HUMAN PROCESSES FORM AND TRANSFORM LANDSCAPES AND LANDFORMS?

CHECKPOINT

- **Investigate the human causes and effects of landscape degradation**

1 Identify a landscape (for example, a coastal landscape or a mountain landscape) and explain one way that people use it:
   - **a** that improves it
   - **b** that degrades it
   - **c** that doesn't change it at all. [15 marks]

2 Describe the five main causes of land degradation. [5 marks]

3 Explain the consequences of desertification for world food production. [10 marks]

TOTAL MARKS [/30]

RICH TASK

Land degradation and food production

Land degradation is a major global issue. Its importance is critical because of its impact on both world food security and the quality of living environments. High population density is not necessarily the cause of land degradation; it is how people treat the land that will determine the extent of the degradation. People can be the main force in reversing a decrease in land quality. The challenge is for them to be healthy, skilled and motivated to care for the land, because dependence on subsistence agriculture, extreme poverty and illiteracy can be significant causes of land degradation.



Source 1.53 Soil degradation caused by poor farming practices has turned this once productive farm in Kenya into unusable land.

Processing geographical information

1 What benefit would there be in leaving the trees along the ridge?

2 Why does the likelihood of erosion increase when the land is ploughed?

3 What are the arguments for and against clearing the steeply sloping land?

4 Explain how terracing of the slopes can reduce soil erosion.

5 How can water erode sloping land?

6 Does it make a difference which direction the land has been ploughed?

7 Which area could be stocked with the most cattle?

8 How can overstocking an area cause erosion?

9 How could crop rotation reduce soil erosion?

Communicating geographical information

10 You have been employed as a consultant to provide advice to the farm owner. Propose an action plan of 10 points in order of importance.

11 Crop rotation is a practice designed to minimise pests and diseases, reduce chemical use, aid in building and maintaining healthy soil, and manage nutrient requirements – all of which aim to maximise production quantity and quality.
   - **a** Conduct research on crop rotation for a backyard vegetable garden. As you investigate, choose a variety of plants to demonstrate the principles of crop rotation (maximise yield, access available nutrients, avoid disease).
   - **b** Based on your findings, design a garden and make an annotated sketch of it.
   - **c** Perennial plants do not need to be rotated. Why is this so?
   - **d** What else can you do to improve the soil of your vegetable patch?

SKILL DRILL

Reading thematic maps

Thematic maps are used to represent a particular theme or topic; for example, the distribution of instances of desertification, deforestation or land degradation.

Step 1 Look carefully at the legend. Thematic maps use colours or symbols to represent different aspects of the topic on the map. For example in Source 1.54, areas of colour are used to show the different levels of vulnerability to desertification.

Step 2 Train your eyes to move from the legend to the map while you interpret the information. For example, look at the solid blocks of colour in Source 1.54 and work out what they tell you.

Step 3 Move to a different piece of information (in the case of Source 1.54, a different block of colour) and work out what that represents.

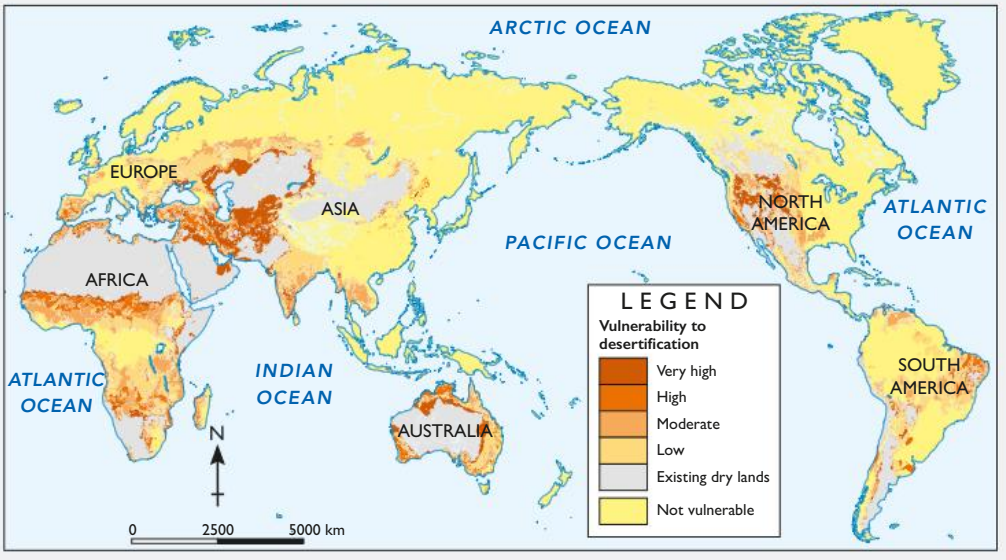
Step 4 Look for concentrations of the same symbol or colour in areas to see if patterns exist.

Apply the skill

Study Source 1.54.

1 What colour represents very low vulnerability to desertification?
2 What colour represents very high vulnerability to desertification?
3 What colour appears to dominate throughout Africa?
4 Which areas appear to have the lowest vulnerability?
5 Select one area that has low or very low vulnerability. Why do you think that is?
6 Select one area that has high or very high vulnerability. Why do you think that is?
7 Rank the continents in order of their vulnerability to desertification. The continent with the highest vulnerability will be number one.
8 What region has the highest concentration of areas that are not vulnerable?
9 Imagine if these non-vulnerable areas were as common in the rest of the world. What would need to change? What areas would you target first?

WORLD: DESERTIFICATION



Source 1.54

Source: Oxford University Press

CHECKPOINT

In this Checkpoint and Rich Task, you will be learning and applying the following geographical concepts, inquiry skills and tools:

» Concepts: Environment, Interconnection, Scale, Sustainability
» Inquiry skills: Processing geographical information, Communicating geographical information
» Tools: Visual representations, Maps

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHAPTER

2



Source 2.1 Machu Picchu in Peru is a UNESCO World Heritage site. Why do you think this site might be considered 'valuable'?

VALUING, MANAGING AND PROTECTING LANDSCAPES AND LANDFORMS

Landforms and landscapes around the world are valued by many different people for many different reasons. Some people may feel a deep personal connection to a particular landscape, while others are more interested in what it looks like or the money that can be earned from it. The value a person attaches to a particular landscape often depends on factors such as their age, occupation, education, cultural background and experiences.

Generally, if the population values a landscape, that landscape is more likely to be managed and protected. Management and protection both occur on a variable scale – from local, community-led initiatives to global, government-led strategies.



WHY DO PEOPLE VALUE LANDSCAPES AND LANDFORMS?

2.1 SECTION

In this section you will investigate:

- the aesthetic, cultural, spiritual and economic value of landscapes and landforms for people, including Aboriginal and Torres Strait Islander Peoples

CHECKPOINT 2.1

TO WHAT EXTENT ARE LANDSCAPES AND LANDFORMS SUSTAINABLY MANAGED AND PROTECTED?

2.2 SECTION

In this section you will investigate:

- ways people, including Aboriginal and Torres Strait Islander Peoples, manage and protect landscapes

CHECKPOINT 2.2

GEOGRAPHER'S TOOLKIT

Geographical concepts

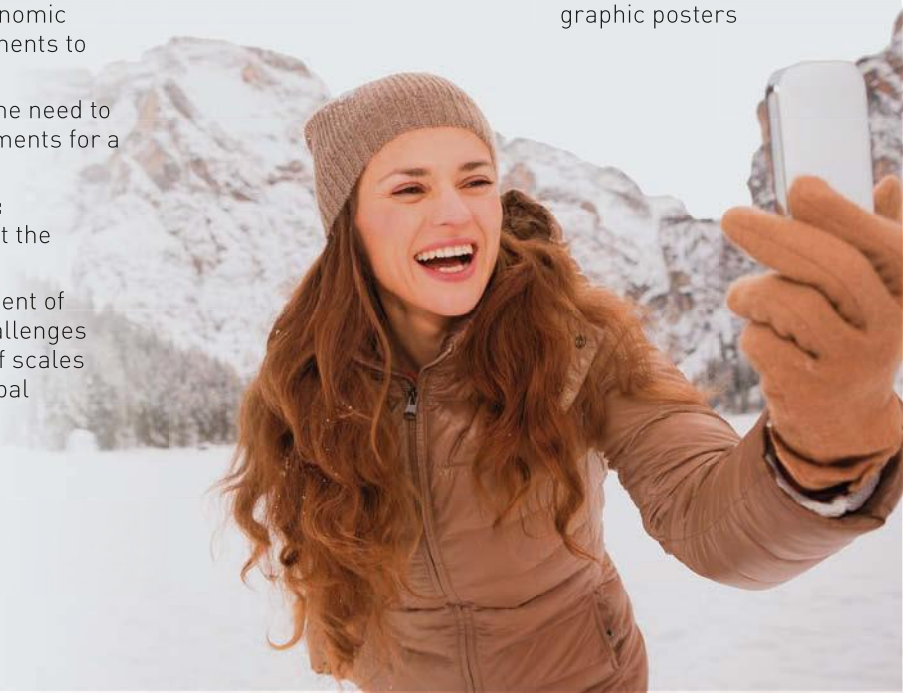
- **Place:** the special significance place has to some people
- **Space:** how location influences the ways people organise places
- **Environment:** the aesthetic, cultural, spiritual and economic value of environments to people
- **Sustainability:** the need to manage environments for a long-term future
- **Interconnection:** how people affect the environment
- **Scale:** management of geographical challenges across a range of scales from local to global

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** thematic maps, dot maps, flow maps
- **Graphs and statistics:** line graphs, data tables
- **Visual representations:** photographs, oblique aerial photographs, ground photographs, graphic posters



2.1 VALUING LANDSCAPES AND LANDFORMS



Source 2.2 Unique and beautiful landscapes in Kosciuszko National Park, such as the spectacular Blue Lake, are an example of the aesthetic value of places.

WHY DO PEOPLE VALUE LANDSCAPES AND LANDFORMS?

The *Australian Concise Oxford Dictionary* defines 'value' as 'the worth, desirability, or utility of a thing, or the qualities on which these depend'. In other words, 'value' can refer to many different things. It can also change over time. In general, geographers divide the ways in which people value landscapes and landforms into four categories:

- aesthetic value
- cultural value
- spiritual value
- economic value.

Aesthetic value

The aesthetic value of a landscape is closely linked to its beauty and uniqueness. The aesthetic value attached to a place is always subjective (personal). People are drawn to places for many reasons. Being surrounded by the beauty of the landscape may give someone a sense of freedom, stability and well being. An individual might be drawn to a particular landform because of its overwhelming majesty, creating a personal connection to that place.

The aesthetic value of the landscape to the community has been recognised through the creation of national parks, where land has been set aside for the public's use and enjoyment. National parks exist in all landscapes, including alps, deserts, forests and reefs. The first national park in Australia, the Royal National Park, south of Sydney, was established in 1879. It is also the world's second oldest national park, after Yellowstone National Park in the United States. There are now more than 500 national parks and marine parks across Australia.



Source 2.3 These Australian film posters reflect the colours of the Australian outback. They are examples of how the Australian landscape has cultural value.

Cultural value

Cultural value is linked to the importance of landscapes and landforms as expressed by people through creative means such as poetry, literature, art and films. How people value something is also linked through their cultural background. Australia's landscapes and landforms have shaped Australian culture and identity. Many Australian films are set in northern Australia and feature the vast, unforgiving landscapes of the outback, as well as the tropical landscape of the Far North. These unique landscapes often have a transformative effect on characters.

Indigenous Australians express the importance of the land to them through Dreamtime stories, song and dance, and their art. Nearly all Aboriginal art relates to the landscape, and maps the landscape and the landforms of importance to Indigenous communities.



Spiritual value

For Indigenous Australians the spiritual value of land is expressed through the concept of 'Country'. Indigenous peoples believe that the stories of their Dreamtime bind them to the land. They also believe that their ancestors live on through the land and ensure their continued connection with it. Landscapes contain many sacred sites of spiritual importance. Uluru, for example, is a sacred place to the Anangu people who live in the area. They believe that, in the Dreamtime, a great sand hill was transformed into this rock along with the Kunia people who lived there.



Source 2.4 Karlu Karlu (also known as the Devil's Marbles) is sacred to Indigenous Australians. This is an example of how landforms can have spiritual value.

Economic value

Economic value is a measurement of how financially important landscapes and landforms are. Economic value is particularly relevant to the tourism, agriculture and mining industries in Australia. Destination NSW (the leading government agency for New South Wales tourism), for example, wants regular visitors to the state because people who travel spend money on accommodation, transport, food, souvenirs and activities. This money provides income for the tourism and hospitality industries and the state. The Blue Mountains is a landscape in New South Wales with a high economic value because of its popularity with tourists.

Mining is the process of extracting natural resources from within the earth. These resources are sold, processed and used to manufacture a variety of goods – from jewellery to toys, construction materials and fuels. The mining industry attaches economic value to landscapes that contain sought-after metals and minerals such as coal and gold.



Source 2.5 Landscapes with high mineral and metal deposits are an example of economic value.

Competing values

The same landscape can be valued by different people for different reasons. To a mining corporation, the economic value of a landscape might be most important. To an Indigenous Australian community, however, the spiritual value may be most important. Then again, an artist might appreciate the aesthetic value of a landform. All these values are important to consider when deciding on how a landscape is best put to use.

In 2016, Australia had 19 World Heritage sites. These are places or areas that UNESCO, the United Nations Educational, Scientific and Cultural Organization, has agreed are worthy of special protection because they represent the best examples of the world's cultural and natural heritage.

REVIEW 2.1.1

Remember and understand

1 Describe the concept of 'value' as it applies to landscapes and landforms.

2 What does it mean for a landscape to have aesthetic value?

3 Explain the significance of a landscape that has cultural value.

Apply and analyse

4 Brainstorm the many different landscapes that you value around your school and local community.

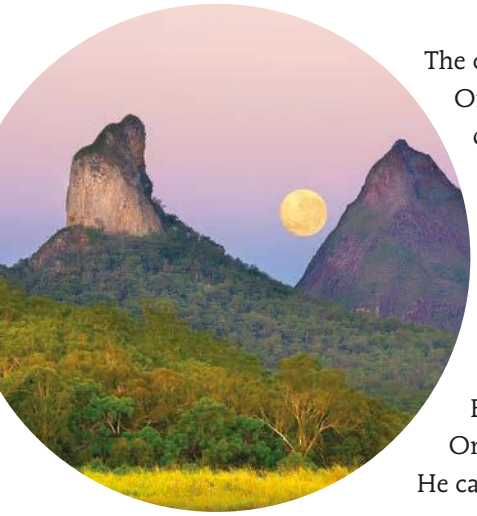
- **a** How do you value each landscape?
- **b** Justify your reason(s) for each landscape's value.
- **c** Share your ideas with a classmate.

Investigate and create

5 The first stage of a geographical inquiry is to identify an issue or problem. There are six World Heritage sites in New South Wales.

- **a** Use the Internet to find the names of these six sites.
- **b** Choose one site and then identify one issue or problem that could be used as the starting point for a geographical inquiry into competing values at this site.

CULTURAL AND SPIRITUAL VALUE OF LANDSCAPES AND LANDFORMS



Source 2.6 Mount Coonowrin sitting beside his pregnant mother, Mount Beerwah, Queensland

The cultural, spiritual and aesthetic values of landscapes and landforms are closely linked. On this page you will explore the legends of three different Indigenous peoples and discover the deep spiritual links that can exist between the landscape and the people who live in it.

The legend of the Glasshouse Mountains: a creation story from Australia

According to the Gubbi Gubbi people, Mount Tibrogargan, the father, and Mount Beerwah, the mother, had many children, the eldest of whom was Mount Coonowrin. One day, Mount Tibrogargan was looking out to sea and saw a great wave approaching. He called out to his eldest son, Coonowrin, to help his mother, Mount Beerwah, who was pregnant with child.

In the meantime, Tibrogargan gathered up his other children and began to run towards higher land. When Tibrogargan looked back to check that Coonowrin was helping his mother, he was angered to see him running off alone. He chased his son and, in a great rage, smashed him on the head with his club, dislocating his neck.

Later, when the floods had gone, Coonowrin begged his father for forgiveness, but all his father could do was weep in shame, creating the streams that still run in the region. He asked his son why he had not helped his mother. Coonowrin – not knowing his mother was pregnant – replied that Beerwah was the biggest of all of them and could look after herself. This angered Tibrogargan even more. He turned his back and vowed never to look at his son again.

Even today, Tibrogargan gazes out to sea and Coonowrin hangs his head and cries, his tears running off to the sea. His mother Beerwah is still pregnant as it takes a long time to give birth to a mountain.

STRANGE BUT TRUE

The UN estimates that there are more than 5000 distinct Indigenous peoples worldwide living in 72 countries.

The legend of Mount Tongariro: a creation story from New Zealand

According to the Maori people, the mountains of New Zealand were once warriors and gods who moved about the landscape. In the centre of the North Island stood seven great mountains. Six of the mountains were male; Mount Pihanga was the only female. Clothed in native trees and vegetation, she was a great beauty and all the other mountains loved her deeply. One night they decided to fight for her and a fierce battle erupted. The land shook. Smoke, fire and hot rocks filled the sky.

Eventually, Tongariro was proven to be the supreme warrior and won the right to stand beside Pihanga. The losers were given one night to move away or else they would be turned to stone. Taranaki, filled with anger and jealousy, fled to the coast, gouging out a mighty valley as he went. Reaching the sea, he slept. When the day broke he was trapped, and he still hides beneath a cloak of cloud.



Source 2.7 Mount Taranaki wearing a cloak of clouds

The legend of Mount St Helens: a creation story from North America

According to the Puyallup Tribe, long ago two tribes lived across the river from one another. They were friendly and peaceful tribes, and the Great Spirit built a bridge across the river for them. Then the tribes began to quarrel. The Great Spirit became angry. To punish the tribes he took away fire. The tribes prayed to the Great Spirit to return fire to them and eventually he agreed.

To restore fire, the Great Spirit had to go to an old woman named Loo-Wit who, because of her goodness, still had fire. She promised to share her fire with the tribes if the Great Spirit could make her young and beautiful forever. Fire was restored and the two tribes were peaceful for a short time. However, the chiefs both fell in love with Loo-Wit and went to war. In anger, the Great Spirit turned them into mountains: Mount Hood and Mount Adams. The Great Spirit made Loo-Wit into Mount St Helens, clothed in white and beautiful forever.



Source 2.8 Mount St Helens clothed in white with the Toutle River valley shown in the foreground

KEY CONCEPT: PLACE

Links between people and the natural landscape

Not all people think about and see the same place in the same way. These differences result from many factors, such as cultural background, education and life experiences. Scientists such as geologists and vulcanologists have studied mountains and revealed a great deal about their formation. Local Indigenous people, too, have their own stories about the creation of these landscapes. For many Indigenous people around the world, mountains are much more than lifeless rocks.

Many Indigenous people believe that the mountains were alive in the time before humans walked the Earth. They believe that the shapes and locations of mountains can tell us about ancient events. Learning these stories helps us to appreciate that we do not all see the same place in the same way.

For more information on the key concept of place, refer to section GT.1 of 'The geographer's toolkit'.

REVIEW 2.1.2

Remember and understand

1 Examine Source 2.6. Which of these mountains is Beerwah and which is Coonowrin? Give reasons for your answer.
2 According to the creation story from New Zealand, why did the mountains fight?
3 Why do you think many Indigenous people have legends to explain landscapes?

Apply and analyse

4 Compare the three legends.
  a What features do all three have in common?
  b What is unique about each legend?
5 As well as helping people to understand their natural environment, each of these legends contains advice about how to live and behave. What is this advice?
6 What did you learn about the Indigenous people of these three regions by reading their legends?

Investigate and create

7 Conduct an image search of the Three Sisters in the Blue Mountains. Imagine that you lived in Australia thousands of years ago, before there were scientific explanations for this landscape. Write and illustrate a legend that explains how this landscape was created.
8 The three legends refer to mountain landscapes. Go to the library or use the Internet to find a traditional Aboriginal or Torres Strait Islander story that is set in a coastal or riverine landscape. Be prepared to retell this story to your class. Take notes and draw sketches as your classmates retell their stories – this will help you practise collecting and recording information from secondary sources.



TRADITIONAL ABORIGINAL LAND USE

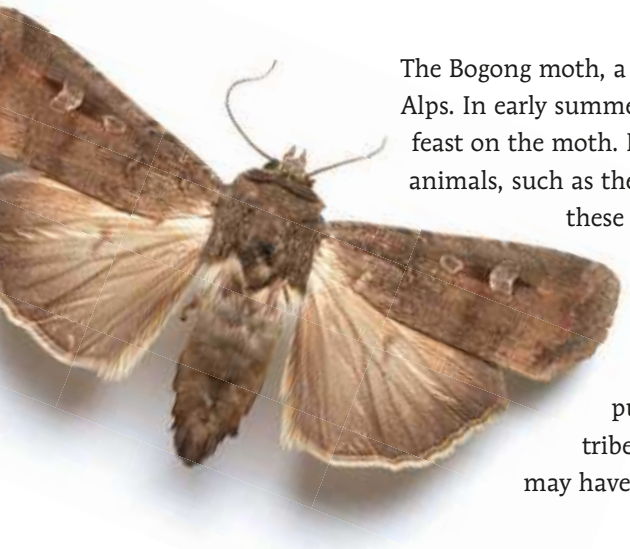
Aboriginal people have a special connection with the land. They see themselves as being responsible for looking after the stories, places, resources and culture of their land. In this way, they seek to live sustainably. This concept is sometimes called 'Caring for Country' and applies to all landscapes, including the forests, deserts, wetlands and mountains.



Source 2.9 Aboriginal rock art in the Kimberley region of Western Australia

Traditional Aboriginal land use in mountain regions

> The Mountains are very old and an ongoing life force that strengthens the ancestral link of our people. We have a living, spiritual connection with the mountains. We retain family stories and memories of the mountains, which makes them spiritually and culturally significant to us. Our traditional knowledge and cultural practices still exist and need to be maintained.
>
> Kosciuszko Aboriginal Working Group



Source 2.10 A Bogong moth

The Bogong moth, a prized food source, can be found in great abundance in the Australian Alps. In early summer, tribes would travel great distances into neighbouring tribal areas to feast on the moth. Rich in fat content, they also provide an important food source for alpine animals, such as the mountain pygmy possum, lizards, birds and fish. Each year millions of these brown moths migrate up to 1000 kilometres to the mountain tops of the Great Dividing Range. As the moths sleep in huge colonies during summer they are easy to catch. Thrown into the ashes of a fire to burn off their wings and legs, they were then roasted and eaten.

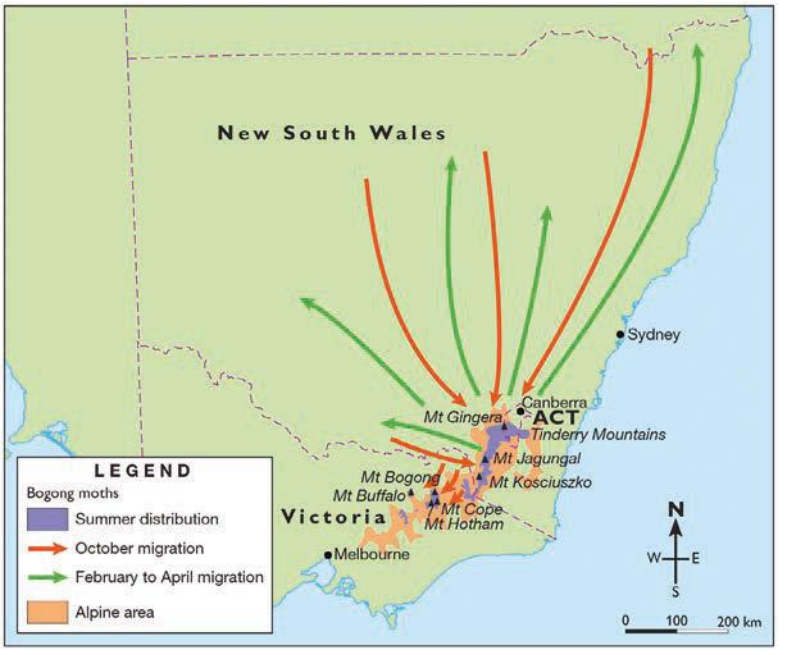
Important as food, the moths also served an important social purpose. As hundreds of people met at each nesting site, links between tribes and language groups were made and strengthened. Up to 1000 people may have converged at some sites, representing some of the largest gatherings

of Aboriginal people. These feasts were an opportunity for people to share or swap food and other resources from their own Country and to learn more about the customs and languages of other tribal groups.

As well as providing food, the mountains provided traditional Indigenous people with other resources. Some alpine plants, for example, were used in medicine and others were used in important ceremonies. The Bangalow palm, which grows in the rainforests of the eastern Australian coastal mountains, was used for thatching roofs and making water carriers.

The rocks of the mountains also had their uses, and Indigenous tribes would travel to particular stone quarries to collect rocks for tools such as axes and hatchets. Often they would trade other goods for these rocks and this strengthened the ties between and within tribal groups. One of the most important of these quarries was Mount William in central Victoria, which was the source of greatly prized greenstone hatchet heads.

BOGONG MOTH MIGRATION ROUTES



Source 2.11

Source: Oxford University Press



Source 2.12 A view of the Australian Alps in the Great Dividing Range. This region attracts millions of Bogong moths during summer.

REVIEW 2.1.3

Remember and understand

1 Why was the Bogong moth an important resource for Indigenous Australians?

2 Why did people travel to Mount William?

Apply and analyse

3 Examine Source 2.11.
   - **a** Describe the migration patterns of the Bogong moth. Include compass directions, distances and times of the year.
   - **b** How did these migration patterns influence the movement of some Indigenous people?

4 Imagine that you are an Indigenous Australian and have travelled hundreds of kilometres to reach the nesting site of the Bogong moths. When you arrive, the harvest is well under way.
   - **a** Describe what you see, smell and hear as you arrive.
   - **b** What would you bring with you?
   - **c** Explain why your trip is an important annual event for you and your tribe.

Investigate and create

5 Was the harvesting of the Bogong moth a sustainable use of this resource?

6 What questions could you ask to help you decide if the quarrying of stone at Mount William was a sustainable use of this resource?

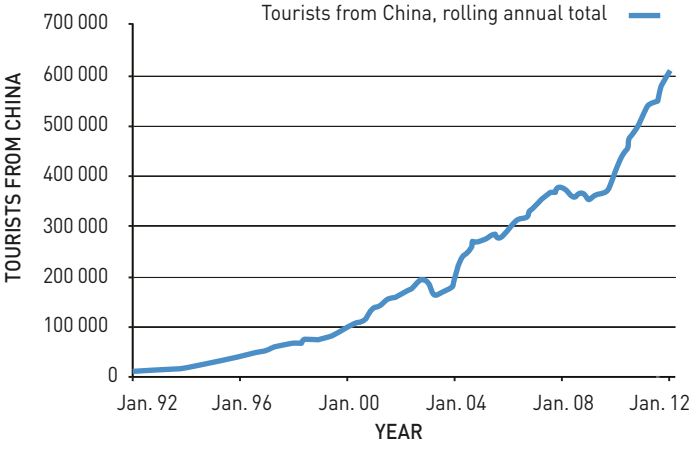
ECONOMIC VALUE OF LANDSCAPES AND LANDFORMS

The unique landscapes and landforms in Australia attract tourists from around the world. Landscapes and landforms such as Sydney Harbour, the Blue Mountains, Uluru, the Great Ocean Road and Kakadu National Park not only have cultural, spiritual and aesthetic value, they also have an economic value to Australia because of tourism.



Source 2.13 Chinese tourists in Australia enjoying the aesthetic value of the Twelve Apostles on the Great Ocean Road

AUSTRALIA: GROWTH IN NUMBERS OF CHINESE TOURISTS



Source 2.14

The Chinese tourism boom in Australia

In recent years, there has been a significant increase in the number of tourists coming to Australia from China. In 2012, China became Australia's second-largest tourism market, after New Zealand. Many of these tourists come because they want to see landscapes and landforms that are different from those they see at home.

In terms of economic value, Chinese tourists are the biggest spenders in Australia, contributing $4.7 billion a year to the Australian economy. Tourism researchers are predicting that the number of Chinese visitors coming to Australia will continue to increase, and that by 2020 this number will exceed 850 000 a year.

Purpose of visit	Percentage of Chinese visitors
Holiday	53
Family or friend connections	19
Education	15
Business	7
Employment	2
Other	4

Source: Tourism Australia, *China Market Portfolio* (2014)

Source 2.15 Chinese visitor arrivals by purpose of trip, 2013

SKILL DRILL

Analysing statistics

Many organisations collect information that geographers can use to describe and explain human activities. Sometimes this information is in the form of numbers, known as statistics. By learning a few simple techniques you can use this information to better understand changes and trends. Follow the steps below to learn how to identify maximum and minimum in order to rank entries as well as calculate averages.

Source 2.16 Tourist arrivals in Australia from the top five countries, 2013

Country of origin	Economic value to Australia ($ million)	Number of tourists ('000)	Change in visitor numbers 2012–13 (%)
China	3457	715	+14.2
United Kingdom	1807	634	+6.8
New Zealand	1615	1212	+0.9
United States	1308	509	+6.2
Japan	737	329	–7.1

Source: ABS and Tourism Research Australia

Step 1 Look carefully at the title of the statistics so you understand exactly what has been measured. Note the date in particular.

Step 2 Consider the source of the information. Statistics collected by government agencies such as the Australian Bureau of Statistics (ABS) are generally more reliable than those collected by individuals and companies.

Step 3 To identify the maximum and minimum, list the statistics in order from the largest to the smallest. This list is known as the rank, and the position of each country within it is a ranking or rank score.

Step 4 To calculate the average, add up all the numbers and divide this total by the number of countries in the table. Take note of the title of each column in the table as this will inform you of the quantities being counted – for example, it may be in thousands ('000) or millions of dollars ($ million).

Step 5 You can calculate averages of each row as well as each column. For example, by dividing the economic value of each country by the number of visitors from that country you will find out the average value to Australia of each person.

Step 6 Use the numbers you have calculated – average, rank, maximum and minimum – to make some statements about the statistics. Focus on trends or changes that you can identify as these can be used to make predictions about future changes.

Apply the skill

1 The statistics in Source 2.16 are for which year?
2 What is the source of these statistics? How do you think they were collected?
3 Rank the five countries in Source 2.16 from most tourists to Australia in 2013 to least tourists.
   a What is the rank score of China?
   b Which country contributed the most tourists?
   c Which one contributed the least tourists?
4 Calculate the average economic value to Australia of these five countries.
5 Which country's visitors contribute the highest economic value per person?
6 What are the two fastest growing tourism markets?

REVIEW 2.1.4

Remember and understand

1 Identify what are in your opinion Australia's five best tourist sites.
2 In 2015, almost 2.3 million New Zealanders visited Australia. Why do you think this is the case?

Apply and analyse

3 Use Source 2.14 to describe the growth in the number of Chinese tourists to Australia from 1992 to 2012.
4 Brainstorm possible reasons for this growth.

Evaluate and create

5 Tourist researchers classify international tourists into groups so that people who work in the tourism industry, such as hotel owners and tour operators, can better understand their clients. Source 2.15 lists six groups of Chinese tourists, according to the purpose of their visit.
   a Which of these six groups do you believe are the biggest spenders in Australia? Why?
   b Which do you believe are the lowest spenders? Give some reasons for your answer.
   c Tourism Australia is keen to attract more Chinese visitors to Australia. On which of these six groups do you think they should focus?
   d Create a poster, brochure or web page that is designed to attract this group to Australia.

2.1

WHY DO PEOPLE VALUE LANDSCAPES AND LANDFORMS?

- **Investigate the aesthetic, cultural, spiritual and economic value of landscapes and landforms for people, including Aboriginal and Torres Strait Islander Peoples**

CHECKPOINT

Look carefully at Source 2.17.

1. Which value is being attached to this source? [5 marks]
2. What groups of people are most likely to have a different opinion about the value of this landscape? [5 marks]
3. Create a table to outline the groups and their possible opinions. [10 marks]
4. What reasons might you give to account for these differences of opinion? [10 marks]

TOTAL MARKS [/30]



Source 2.17 A tiered open-cut mine within Kakadu National Park

RICH TASK

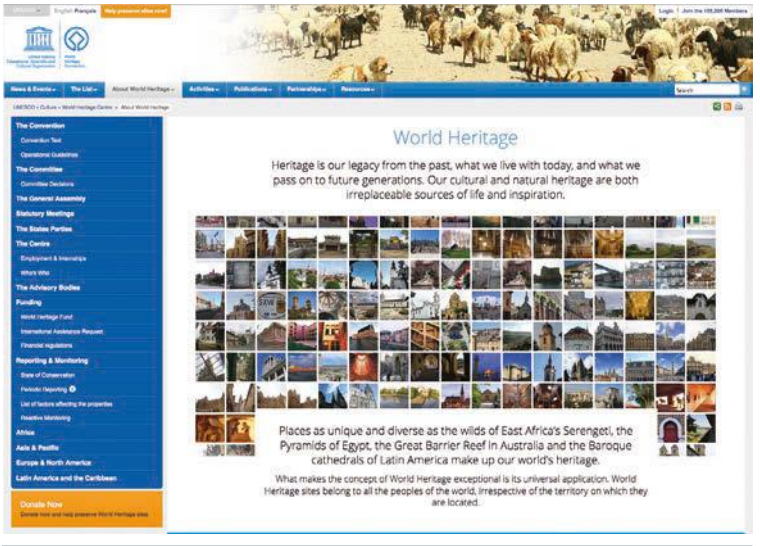
The worldwide value of landscapes

The goal of the United Nations Educational, Scientific and Cultural Organization (UNESCO) is to identify, protect and preserve sites of 'outstanding value to humanity'. These sites can be cultural or natural heritage areas and are found worldwide. UNESCO works under an international treaty called the Convention Concerning the Protection of the World Cultural and Natural Heritage (or the World Heritage Convention), which was adopted in 1972.

World Heritage sites belong to all peoples of the world, regardless of which country or territory they reside in. UNESCO's World Heritage mission is to:

- Encourage countries to sign the World Heritage Convention and to ensure the protection of their natural and cultural heritage;
- Encourage countries to the Convention to nominate sites within their national territory for inclusion on the World Heritage List;
- Encourage countries to establish management plans and set up reporting systems on the state of conservation of their World Heritage sites;
- Help countries safeguard World Heritage properties by providing technical assistance and professional training;
- Provide emergency assistance for World Heritage sites in immediate danger;
- Support countries' public awareness-building activities for World Heritage conservation;
- Encourage participation of the local population in the preservation of their cultural and natural heritage;
- Encourage international cooperation in the conservation of our world's cultural and natural heritage.

(Source: UNESCO World Heritage Centre)



Source 2.18 The UNESCO World Heritage home page

Acquiring geographical information

1 Which three of the UNESCO mission statements listed on the previous page do you value most? Why?

2 Compare your list with that of a classmate.

3 Why do you think your answers are similar or different?

4 Research UNESCO's World Heritage List online and explore the interactive world map on UNESCO's website.

Processing geographical information

5 Look carefully at Source 2.19.

- **a** Is there any pattern around the world between cultural and natural sites?
- **b** Explain the significance of the round black symbols on the map.

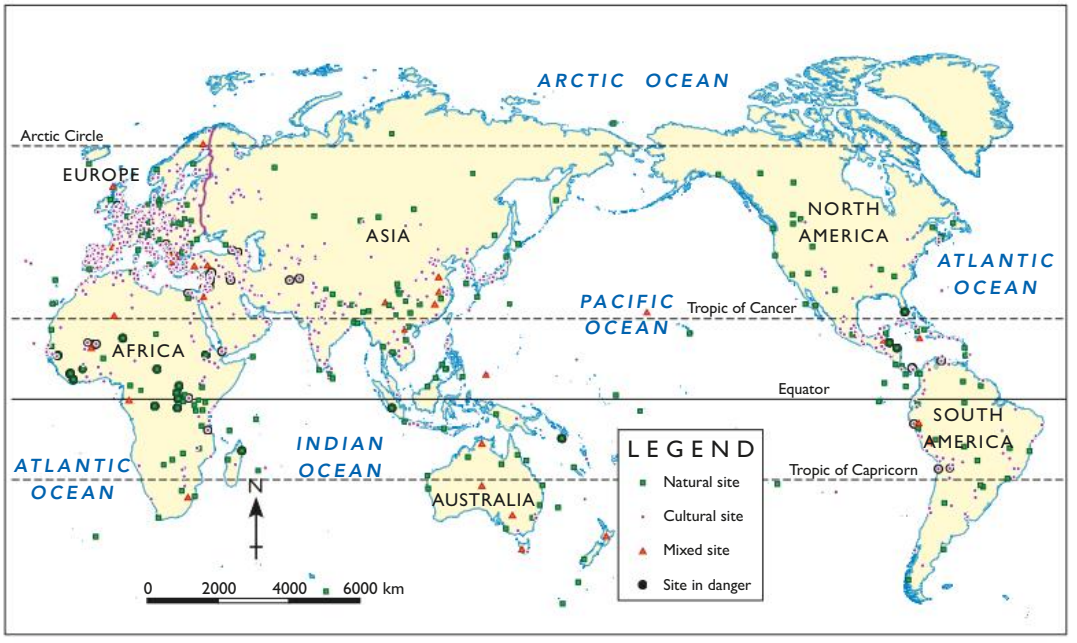
Communicating geographical information

6 Select and research an Australian site (cultural or natural), and outline the reasons for its protection.

7 Mission statements are sentences that help to show others what organisations aim to do and value most. For example, the Nike company aims 'to bring inspiration and innovation to every athlete'. Write your own set of three mission statements about valuing and protecting the site you have chosen.

8 Research a book, poem, movie or website that has cultural value for Australia, or a country or place that you feel connected to. Present your findings in a multimodal format; for example, create a digital poster on Glogster or use another design program. Include the title of the work, the author, a blurb about it and an image to represent it. Most importantly, provide three reasons why you feel it has particular cultural significance.

WORLD: UNESCO WORLD HERITAGE SITES



Source 2.19

Source: Oxford University Press

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Space, Environment, Sustainability
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHECKPOINT

2.2 LANDSCAPE MANAGEMENT STRATEGIES

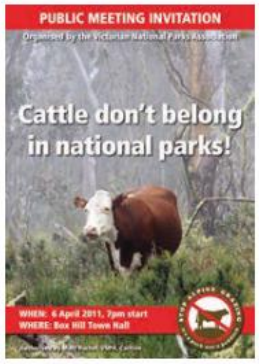
TO WHAT EXTENT ARE LANDSCAPES AND LANDFORMS SUSTAINABLY MANAGED AND PROTECTED?

Landscapes can be managed at a variety of **scales** – local, regional, national or global. Your local bush track, for example, might be managed by a local voluntary Landcare group. The Great Barrier Reef, on the other hand, is managed at a regional and national scale by governments, and monitored internationally by UNESCO's World Heritage List.

Whether or not a landscape is managed usually depends on the value placed on the landscape, and the landforms and resources within it. Management should always be thought of in terms of **sustainability**. Having a plan or strategy is essential for the successful and sustainable management of a landscape. Below is an overview of four different landscape management strategies.



Source 2.20 Conservation management in Uluru–Kata Tjuta National Park



Source 2.21 The Victorian National Park Association organises opposition to stop the high-country grazing.

Preservation

Preservation is a management strategy that aims to keep an environment in its existing form. It prevents all human activities in the area and a places a complete ban on using its resources. The preservation management plan may be indefinite or may change once the landscape has recovered. Landscapes may be preserved because they are of noted cultural, aesthetic, spiritual or economic value. An example of a preserved landscape is some areas of the Great Barrier Reef that are accessible for research only.

Conservation

Conservation is a management strategy that involves the careful control of resources and planned activities in an area to minimise environmental impacts. Human activities in the area are allowed, but limited. An example of a conservation landscape is Uluru–Kata Tjuta National Park.

Utilisation

Utilisation is a management strategy that allows productive human activity in an area, such as farming. This approach can cause damage to landscapes. For example, people have argued for many years over the use of mountain landscapes in Australia's alpine region for grazing cattle in summer. Cattle graziers claim that it causes little or no environmental damage and may actually reduce the risk of serious bushfires. There are many opponents of high-country grazing, claiming that scientific studies have shown that cattle cause great environmental damage to the region.

Source 2.22 Cattle grazing in the high country

Exploitation

Exploitation is the complete and unregulated use of natural resources in a landscape without any regard for sustainability. This approach can have disastrous consequences. An example of exploitation can be seen in Source 2.23. This landscape in Sierra Leone has been completely degraded through deforestation, loss of vegetation, soil erosion and contamination of water sources because of the unregulated mining of diamonds.



Source 2.23
A diamond mine in Sierra Leone

Other landscape management strategies

Stewardship

Aboriginal and Torres Strait Islander Peoples see themselves as custodians or stewards (protectors) of their lands. Their ideas, beliefs and practices towards the land are shaped by the fact that the land has provided them with food, shelter and a spiritual connection for up to 60 000 years. Their **stewardship** of the landscape involves the ethical planning and management of resources.

Ecotourism

Ecotourism promotes the enjoyment of landscapes by tourists in a responsible, sustainable way. Ecotourism operators understand that they need to respect the environment that provides them with their source of income. They take much pride in their workplace, and want to educate visitors about its wonderful and often unique features. Ecotourism operations must be certified (see Source 2.24) and there are different levels of certification. In some ways, ecotourism embodies the traditional stewardship approach.

Source 2.24
An ecotourism certification logo

REVIEW 2.2.1

Remember and understand

1 Describe the four landscape management strategies (preservation, conservation, utilisation and exploitation) in your own words.
2 Explain how exploitation is a management strategy.

Apply and analyse

3 The landscape management strategies discussed on these pages can be thought of as a scale of landscape management. At one end of the scale is the viewpoint that all things in nature should be exploited by humans for profit. At the opposite end is the viewpoint that the natural environment must be preserved regardless of human needs.
   a Draw a horizontal line to represent a scale of landscape management. Use a scale of 1 to 10 where 1 = complete landscape degradation and 10 = untouched natural landscape.
   b Place all landscape management strategies (including stewardship and ecotourism) where you think they sit on this scale.
   c Annotate your scale to explain your decisions.
4 Use examples to justify the importance of stewardship to Aboriginal and Torres Strait Islander Peoples.

Investigate and create

5 Research an ecotourism business on the Ecotourism Australia website.
   a Why do you think your chosen company has decided to be registered?
   b Choose two very different ecotourism operators (for example, a 4WD tour and a wildlife experience). Account for the type of ecotourism certification that each company has been given.

CASE STUDY

MANAGING COASTAL LANDSCAPES

As you discovered in Chapter 1, the forces of nature are constantly changing coastal landscapes around the world. The shapes of beaches are changed; spits are formed; harbours fill with sand; and waves erode the coast, causing houses, roads and other structures to collapse into the sea. Cities and towns built in coastal areas are often affected by these natural processes.

The residents of coastal cities and towns around the world have responded by trying to manage the natural processes. Their responses differ in scale depending on the types of forces being dealt with. For example, along depositional coastlines responses are designed to combat the presence of too much sand, while along erosional coastlines the responses are designed to combat the wearing away of the land.



Source 2.25 These groynes near Brighton Beach in Adelaide were built to protect the millions of cubic metres of sand pumped onto this beach in the 1990s.

Coastal management for depositional coasts

The main issue confronting communities along depositional coasts is sand movement. For example, the sand that makes up Adelaide's beaches is gradually moving northwards under the influence of longshore drift. This is causing the beaches in some areas to become narrower, leading to waves eroding land close to roads and houses. In other areas, sand is being deposited in river mouths, blocking boat access to the sea.

Constructing sea walls from large rocks, concrete blocks or sandbags can slow or even stop the movement of sand along the coast. **Groynes** – walls that jut out from a beach into the sea – prevent erosion of a beach by stopping waves from pounding onto the shore, and by directing them away from specific areas of the beach (see Source 2.25). **Training walls** – walls on either side of the mouth of a river – are built to prevent sand from blocking a harbour or river mouth (see Source 2.26).

Another method to prevent the erosion of beaches is to move sand from one place to another. This method, known as beach nourishment (or beach replenishment), may involve moving thousands of truckloads of sand every year to reverse the effects of longshore drift. In Adelaide, millions of cubic metres of sand have been dredged from the sea floor or taken from dunes in other places and trucked onto the eroding beaches.



Source 2.26 Two training walls and a breakwater have helped to trap sand at the mouth of Glenelg Harbour in Adelaide.

Coastal management for erosional coasts

In places where destructive waves are eroding the coast, communities have responded by building barriers, parallel to the coast, to prevent waves from reaching the coastline. These barriers are usually made of concrete or piles of rocks or rubble. Walls that are built out in the sea are called **breakwaters**. Walls that are built close to the coast are called **seawalls**. These barriers are designed to direct the water's force at the solid walls made of hard materials rather than the soft and easily moved sands and dunes.

While these walls may help in the short term, they can often create new problems. The energy of the wave may be deflected downwards, for example, eroding the front of the wall, weakening it until it eventually collapses into the sea. The shoreline is then left unprotected.

STRANGE BUT TRUE

Approximately 85 per cent of Australians live within 50 kilometres of the coast.





Source 2.27 Lakes Entrance on Victoria's east coast

REVIEW 2.2.2

Remember and understand

1 What are groynes and why have they been built in Adelaide?

2 Have the structures built at Glenelg Harbour (see Source 2.26) been successful in controlling the movement of sand? Give some evidence for your answer.

Apply and analyse

3 Examine Source 2.27 carefully.
- **a** Is this an erosional or depositional coast? What is your evidence for your answer?
- **b** What is the groyne designed to do? Is it working?
- **c** What is the training wall designed to do? Is it working?

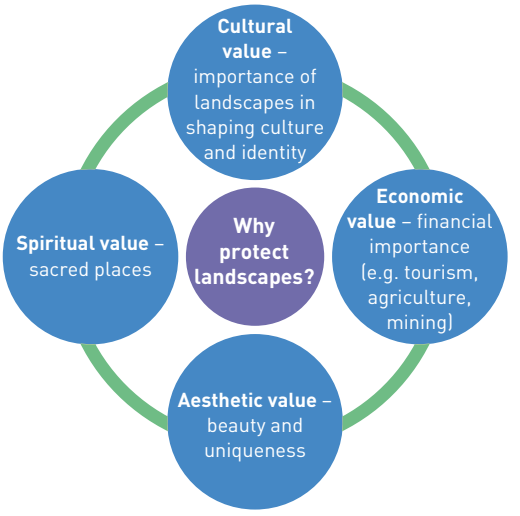
Investigate and create

4 There is a large build-up of sand in the river channel at site A in Source 2.27. Over time it may build up further and become a danger to small boats using the river.
- **a** What does this build-up of sand tell you about the river?
- **b** What would you do to try to control this sand build-up? You may like to sketch your solution onto a copy of the photograph.

5 Draw a sketch map of a coastline that includes a groyne, training walls, seawalls and a breakwater. Show these features in your map legend.

LANDSCAPE PROTECTION ACROSS A RANGE OF SCALES

Landscapes are protected in different ways and for a variety of reasons across a range of scales. Landscape protection can be as simple as a sign to educate the public about what they should and should not do within an area. Another landscape might be protected by a fence and be taken care of by a volunteer group. Critically endangered or valuable landscapes are more tightly protected. This may include constant monitoring by authorities such as the NSW National Parks and Wildlife Service. Some landscapes are protected by law, and people who do the wrong thing may be fined.



Source 2.28 The reasons why we protect landscapes



Source 2.29 A local park sign in England



Source 2.30 A sign at Batemans Marine Park, southern New South Wales



Source 2.31 A sign in Kosciuszko National Park, southern New South Wales

Why do we protect landscapes?

Source 2.28 shows four reasons why we should protect and manage landscapes. One landscape may need a management strategy for just one of these reasons; another may need attention for multiple reasons. Ultimately, the strategy used must be in line with the principle of ecological sustainable development (ESD).

The Australian National Strategy for Ecologically Sustainable Development (1992) defines ecologically sustainable development as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'. ESD combines economic, environmental, social and equity considerations in decision-making processes. ESD also aims to provide for the needs of present generations without risking the ability of future generations to meet their own needs.

How do we protect landscapes?

Sources 2.29 to 2.31 show a range of protection measures at varying scales – from a local park to a state forest and a national park. There is even an international 'Red List' (see Source 2.32), which highlights species at risk of extinction and their habitat. In all cases the identification and study of such sites are the most important measures of management and subsequent protection.

When landscapes are not protected correctly there can be catastrophic consequences (see Source 2.33). There may be reasons to allow what seems to be the complete destruction of a natural landscape. An example of this may be a mining site where a valuable resource is being extracted, or a state forest used for plantation timber. Keeping in mind the ESD principle, such sites must be even more tightly controlled so they can be returned as near to their 'natural state' as possible after the resource has been exhausted. This restoration involves long-term management, environmental impact studies, flora and fauna surveys, seed collection and species relocation.

Source 2.32 The IUCN (International Union for Conservation of Nature) Red List is updated constantly to show which species have become extinct, are endangered, threatened or vulnerable. The main threats are habitat and landscape destruction.





Source 2.33 The Jarrahdale Mine in Western Australia shows how sites can be reclaimed.

REVIEW 2.2.3

Remember and understand

1. Define the term 'scale' in the context of the topic discussed on these pages.
2. Why are signs so important to manage and protect landscapes?
3. Construct a table showing why we should manage and protect landscapes.

Apply and analyse

4. What does the principle of ecological sustainable development (ESD) mean to you?
5. Using Source 2.33 as an example, explain what ESD might look like in a landscape in your local area.

Investigate and create

6. Imagine you are in charge of a landscape that needs better management in order to protect the species that live there and the people who use it. Design a poster or sign to educate the general public about the landscape. Include rules about what to do and what not to do. You may like to take examples from the section 'How do we protect landscapes?' or conduct some research of your own.



Source 2.34 The Gulf of Mexico oil spill, 2010

2.2

TO WHAT EXTENT ARE LANDSCAPES AND LANDFORMS SUSTAINABLY MANAGED AND PROTECTED?

CHECKPOINT

• Investigate ways people, including Aboriginal and Torres Strait Islander Peoples, manage and protect landscapes

1 Describe the difference between valuing, managing and protecting landscapes. [10 marks]

2 Explain how you would protect a landscape you value in your local area. [10 marks]

TOTAL MARKS [/20]

RICH TASK



Source 2.35 A typical LNG ship is 300 metres long, 45 metres wide and needs a channel at least 12 metres deep.



Source 2.36 An oblique view of one of the three massive LNG plants on Curtis Island

Case study: The impacts of gas exploration on a coastal landscape

Step 1: Understand the situation

In many coastal areas, human activities impact on the environment. An example of this is the development of three liquefied natural gas (LNG) plants on Curtis Island off the coast of Queensland near the town of Gladstone. The plants allow natural gas to be liquefied, stored and loaded onto ships for transportation. LNG is methane (natural gas) that has been cooled into liquid form to make it easier to transport and store. The gas is extracted from onshore coal seams before being piped to the island. Ships then transport the LNG to ports around the world, particularly in Asia.

The projects involved construction of hundreds of kilometres of gas transmission pipelines to bring the gas to the port to be liquefied and exported. The construction of the gas fields, pipeline and plants created tens of thousands of jobs and boosted the economy of the region.

Gladstone is the largest port in central Queensland with over 1500 large ships using the port facilities every year. Large quantities of coal (fourth largest in the world), petroleum and cement are already moved through the port. When the LNG plants are fully operational, each week two to three specially designed ships will carry LNG from Curtis Island to export markets.

Gladstone port and Curtis Island are located beside the Great Barrier Reef. The reef is the largest in the world and is included on the UN World Heritage List. Curtis Island sits within this World Heritage area, so the companies building the plant have had to ensure that they follow strict guidelines about changes to the environment. Indigenous communities in this region include the Gureng Gureng People of Gladstone mainland and the Bayali People of Curtis Island.

Despite government approval and constant monitoring, some people remain concerned that the new LNG facilities will endanger the natural environment, including the reef. In particular, they are worried about the following:

- To allow large LNG ships to reach the gas plant, 8 million cubic metres of sand and mud needed to be dredged from the channel. This environment is home to marine life, such as turtles and dugongs.
- Dredged material was dumped near the reef.
- The LNG plant requires a reliable supply of fresh water so a desalination plant is being built as part of the facility. This takes water from the sea, removes the salt and pumps the salt back into the sea.
- The movement of ships through the reef means there is the potential for a shipping accident that may damage the reef.

Step 2: Who are the stakeholders?

Stakeholders are groups of people with a special interest in a particular issue or project, such as businesses, governments, local Indigenous landholders, tourist bodies and residents. For this gas plant project, you will need to investigate who are the groups involved in the local area and in the wider regional community.

Step 3: Assess and make a decision

Now that you have reached an informed and balanced point of view, you need to make

a decision. Is there enough environmental protection in place around the port facility? Have the interests of all involved been taken into consideration? Is the current plan in the best interests of the greater community?

Processing geographical information

1 Describe the changes that are taking place on and around Curtis Island. Why are these changes taking place?
2 Outline the stakeholders involved.
3 Construct a table with two columns: 'Arguments *for* the new LNG plant' and 'Arguments *against* the new LNG plant'.

Communicating geographical information

4 Carefully examine the map (and the legend) showing the natural environments (Source 2.37).
   a Describe in detail the natural environment in which the LNG plant is being developed. In your description include details about vegetation as well as birds and animals.
   b Research what management and protection measures have been put in place.
   c Analyse the reasons why we might protect this particular landscape (see Source 2.28).
   d Dugongs are protected marine mammals that feed on seagrass, which grows on the sea floor. Evaluate how dredging might affect these animals.

NATURAL GAS PLANT DEVELOPMENT AREA



Source 2.37

Source: Oxford University Press

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

» Concepts: Place, Space, Environment, Interconnection, Scale
» Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
» Tools: Maps, Statistics

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHECKPOINT

CHAPTER

3



Source 3.1 A truck flees from the pyroclastic flows spewing from Mount Pinatubo in the Philippines, on 17 June 1991. This was the second largest volcanic eruption of the twentieth century.

LANDSCAPE HAZARDS

Landscape hazards – also known as geomorphic hazards – originate in the Earth's crust. They can have a disastrous impact on the surrounding area and the people living there. Landscape hazards include volcanic eruptions, earthquakes, tsunamis, landslides, avalanches and subsidence. A landscape hazard becomes a disaster when the change is so great that it causes not just damage to the land, but also to animals and plants, to property, to people – to everything in the landscape. The effects can be environmental, economic or social. A natural disaster can profoundly affect people's lives. Services such as power, transport and communication are often disrupted.



WHAT IMPACTS CAN LANDSCAPE HAZARDS HAVE ON COMMUNITIES AND ENVIRONMENTS?

3.1 SECTION

In this section you will investigate:

- one contemporary geomorphic hazard including causes, impacts and responses

CHECKPOINT 3.1



GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Scale:** management of geographical challenges across a range of scales from local to global
- **Environment:** processes that form and transform landscapes and landforms across the world
- **Space:** spatial distribution of natural hazards
- **Interconnection:** how people are affected by the environment with regards to natural hazards

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** topographic maps, political maps
- **Graphs and statistics:** climate graphs
- **Spatial technologies:** satellite images
- **Visual representations:** oblique aerial photographs, annotated sketches, topographic cross-sections, graphic organisers

3.1 NATURAL PHENOMENA, NATURAL HAZARDS AND NATURAL DISASTERS

WHAT IMPACTS CAN LANDSCAPE HAZARDS HAVE ON COMMUNITIES AND ENVIRONMENTS?

A natural phenomenon, such as an earthquake, becomes a hazard when it affects communities, infrastructure and agricultural lands. When the hazard results in fatalities and extensive property damage, it is classified as a disaster. The effects of disasters can be mitigated (reduced in severity) in some circumstances by taking measures in advance. These measures are aimed at decreasing or eliminating the impact of a hazardous event. This can occur by:

- lessening the hazard – for example, maintaining trees on slopes to prevent landslides
- reducing the vulnerability of the community – for example, monitoring and early warning systems
- changing the exposure by zoning the environment in which the hazard and the community interact – for example, land-use zoning and building regulations.

Source 3.4 shows the **distribution** of landscape hazards around the world.





Source 3.2 The Nepal earthquake in April 2015 killed more than 9000 people and injured more than 23000.

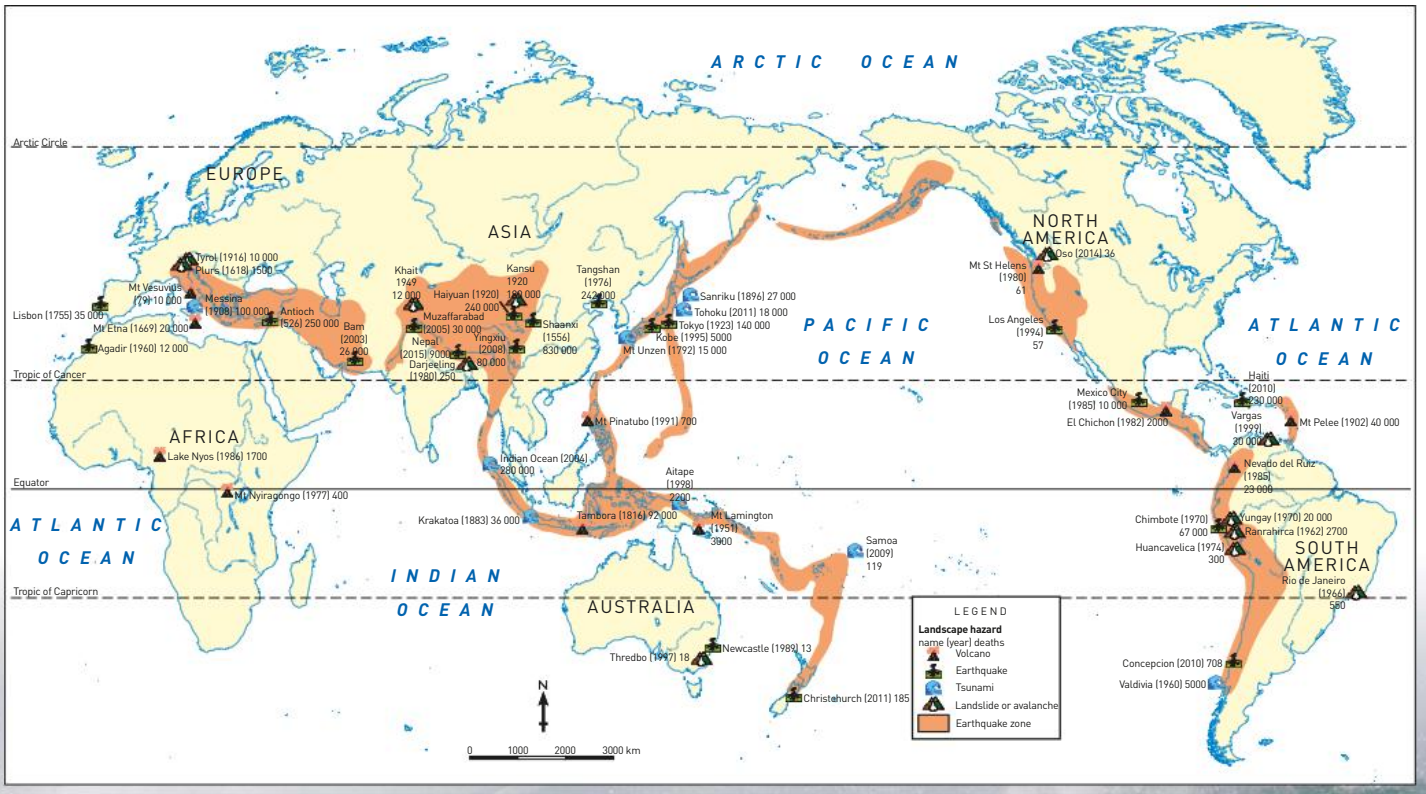
Source 3.3 The 2011 Tohoku tsunami in Japan

Landscape hazards

The most common landscape hazards:

Volcanic eruption	A volcano is a vent or chimney that transfers molten rock, known as magma, from a great depth to the Earth's surface. Magma erupting from a volcano is called lava.
Earthquake	An earthquake is the shaking of the Earth's crust caused by plate movements or volcanic activity. The shaking is a result of the breaking of rocks under stress.
Tsunami	A tsunami is a giant sea wave, often resulting from an undersea earthquake or landslide.
Landslide	A landslide is the movement of rock, debris or earth down a slope. Speed varies from abrupt collapses to slow, gradual slides.
Avalanche	An avalanche is the fast downhill movement of soil and rock or snow.
Subsidence	Subsidence is the displacement or sinking of land. An extreme case is the formation of a sinkhole.

WORLD: LANDSCAPE HAZARDS AND DISASTERS



Source 3.4

Source: Oxford University Press

REVIEW 3.1.1

Remember and understand

1 Explain what is meant by the term 'landscape hazard'.

2 Explain the difference between a hazard and a disaster.

3 Identify the most common landscape hazards.

Apply and analyse

4 Use Source 3.4 to describe the areas of the world most seriously affected by the following landscape hazards:
- **a** volcanic eruptions
- **b** earthquakes
- **c** tsunamis
- **d** landslides or avalanches.

Investigate and create

5 Select one earthquake disaster from Source 3.4 and research it to complete a fact sheet that includes:
- **a** the location and time of year
- **b** the cause(s) of the disaster
- **c** a brief description
- **d** the impacts of the disaster
- **e** an explanation of how the community recovered from the disaster.

VOLCANIC ERUPTIONS

Volcanoes are dangerous natural features and can erupt without warning, devastating local communities and environments. Lava can flow like a molten river or rain down like bombs many kilometres from the eruption site. Ash can cover the sky and blanket the landscape in a cloud that can kill people and animals alike. Humans are generally powerless in the face of such force. Hazards caused by eruptions such as ash clouds, lava flows, mudslides, floods and tsunamis have resulted in countless human casualties over the history of Earth.

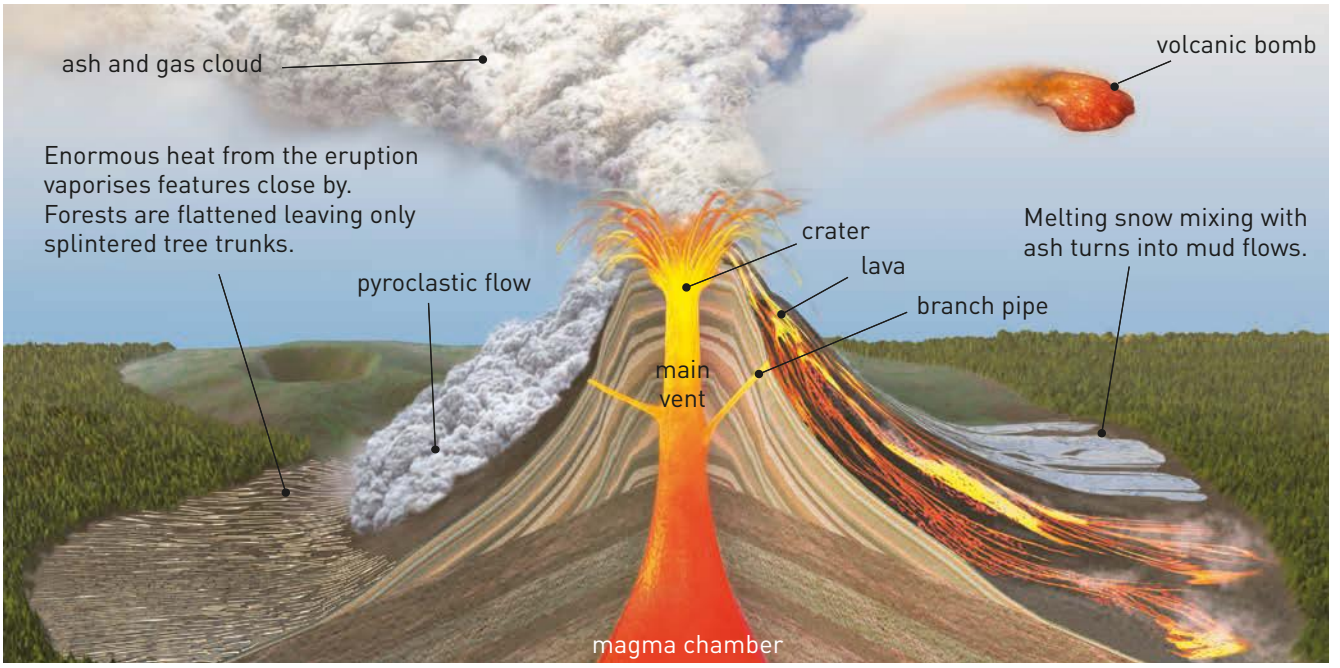
Perhaps the biggest danger in an eruption is the huge clouds of volcanic ash that can be produced. These clouds result from the sudden release of enormous pressure from within the Earth's mantle and crust. The Eyjafjallajökull volcano in Iceland halted international air travel for several weeks in 2010 when it spewed tonnes of ash into the atmosphere. This eruption cost airlines billions of dollars in lost revenue but resulted in no deaths. When Italy's Mount Vesuvius erupted in 79 CE it covered the nearby town of Pompeii in a thick layer of ash, killing 2000 people. The town lay forgotten beneath the ash for almost 1600 years before being discovered by workmen digging a canal.

The ash produced in an eruption can travel straight up (vertically) and then fall on the surrounding landscape, as in the case of Mount Vesuvius, or it can travel sideways (horizontally). Horizontal eruptions are perhaps the most dangerous because the ash – along with rocks, boulders and gases – can travel at speeds of 700 kilometres per hour and carry material heated to 1000 degrees Celsius. These are called **pyroclastic flows** and are responsible for many of the most devastating volcanic eruptions.

Another danger can be the sudden melting of the snow and ice on the sides of the volcano or the release of water from a crater lake in an eruption. These events can



Source 3.5 Dried lava flows at Hawaii's Kilauea volcano



Source 3.6 Features of a volcano and the hazards caused by eruptions

cause huge mudslides called **lahars** up to 50 metres thick to sweep down the sides of mountains. The eruption of Colombia's Nevado del Ruiz volcano in 1985 covered whole villages with thick mud and ash, killing 23 000 people. This makes it the deadliest volcanic eruption of the last 100 years.

Tambora: the world's deadliest eruption

The deadliest volcanic eruption in history took place in 1815 in Indonesia, when Mount Tambora erupted. About 92 000 people were killed by the pyroclastic flows and the tsunami that was triggered by the eruption. More than 50 square kilometres of new material (ash and lava) was produced by the eruption and deposited on the Earth's surface.

Located where the Indo-Australian tectonic plate subducts (moves down) below the Eurasian plate, Indonesia has been home to more active volcanoes over time than any other nation. **Vulcanologists** estimate that Indonesia's 76 active volcanoes have produced more than 1000 eruptions in recorded history.

REVIEW 3.1.2

Remember and understand

1 Make a list of the dangers faced by communities living close to volcanic eruptions.
2 Why is a sideways eruption more dangerous than a vertical one?
3 Study Source 3.6. What is a volcanic bomb?
4 Name two countries close to Australia that experience many tectonic disasters.

Apply and analyse

5 Use Source 3.6 to explain how volcanic eruptions take place.
6 Almost every resident of Tambora died in the eruption of Mount Tambora. Why do you think that was the case?

Investigate and create

7 Conduct some research on the Internet to find out what people who live near Mount Tambora today could do to protect themselves from the effects of another eruption.

LANDSLIDES



Landslides are one of the most common types of hazard affecting mountain landscapes. The term 'landslide' is used to describe any type of large-scale movement of soil, mud, rocks or snow carried downhill by the force of gravity. The movement can be as slow as a few centimetres a year or very rapid. Large, rapid landslides have the potential to destroy towns, roads and bridges, block rivers and take human lives. They are among the most dangerous of all hazards in mountain landscapes.

Landslides are often caused by a combination of natural processes and human factors. Natural factors include heavy rain, unstable slopes, an earthquake or volcanic eruption, and erosion by rivers or waves. The likelihood of a landslide happening is often increased by human activities, such as vegetation clearing, road or mine construction that requires cutting into a slope, leaking pipes and vibrations caused by rock blasting or heavy traffic.

Types of landslides

There are four main types of landslides that can affect different mountain landscapes:

Soil creep

Soil creep is the gradual movement of soil, rocks and earth down a gentle slope. This is the slowest moving type of landslide and can take place over many years. As a result, it is often unnoticeable to people living in the area. Areas affected by soil creep can be identified by features such as leaning telegraph poles and fences, cracked walls and bowed trees.

Slumping

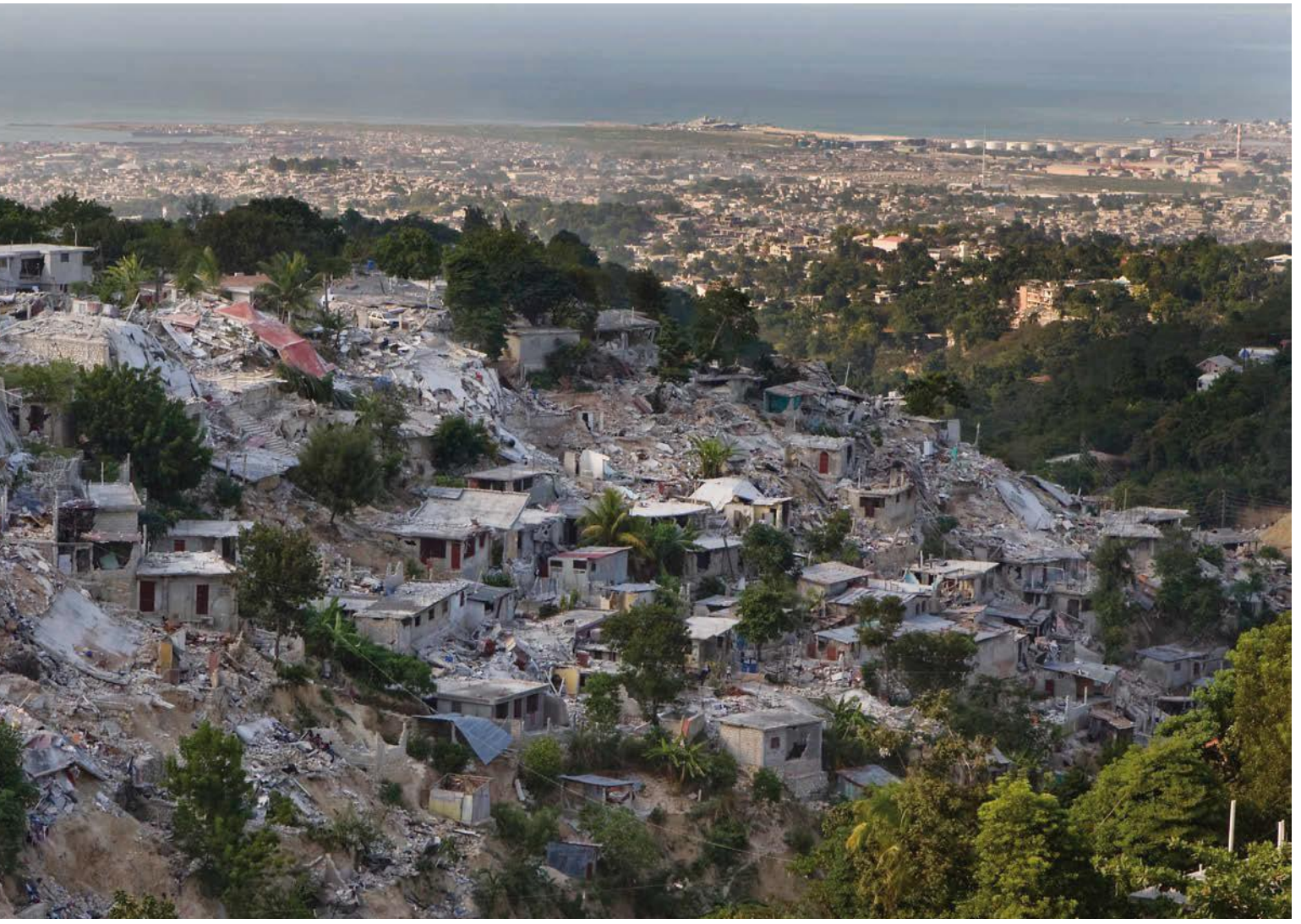
Slumping is the movement of larger sections of soil and rocks down a steep, curved slope. These sections slip down the surface of the slope to different degrees, often creating a number of different levels (called scarps). Slumping is usually triggered by earthquakes, excessive rain, or freezing or thawing of the land.

Mudslides

Mudslides (also known as lahars) are often triggered by heavy rain, quick thawing earth, earthquakes or volcanic activity. For example, snow on the sides of active volcanoes is caused to melt quickly and combine with soil and rocks to create mud slurry that travels downhill. The mud can be up to 50 metres thick and travel at speeds of up to 80 kilometres an hour, burying entire villages and killing many people.

Avalanches

Avalanches are the rapid movement of snow down steep mountain slopes. They are the fastest moving type of landslide. Avalanches are triggered by natural movements of the Earth (such as earthquakes and weather events) and human movements (such as skiers and snowboarders).



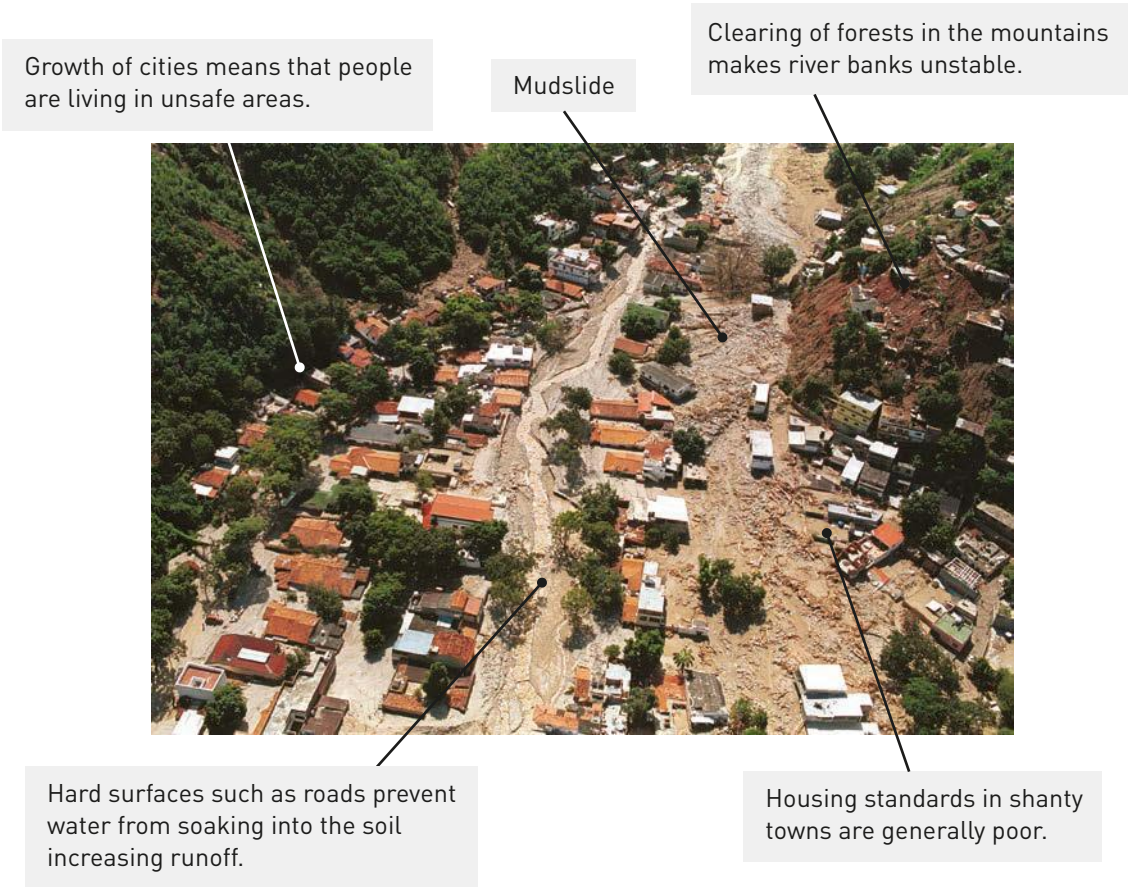
Source 3.7 A landslide in Haiti, triggered by an earthquake, killed thousands in 2010.

When landslides strike

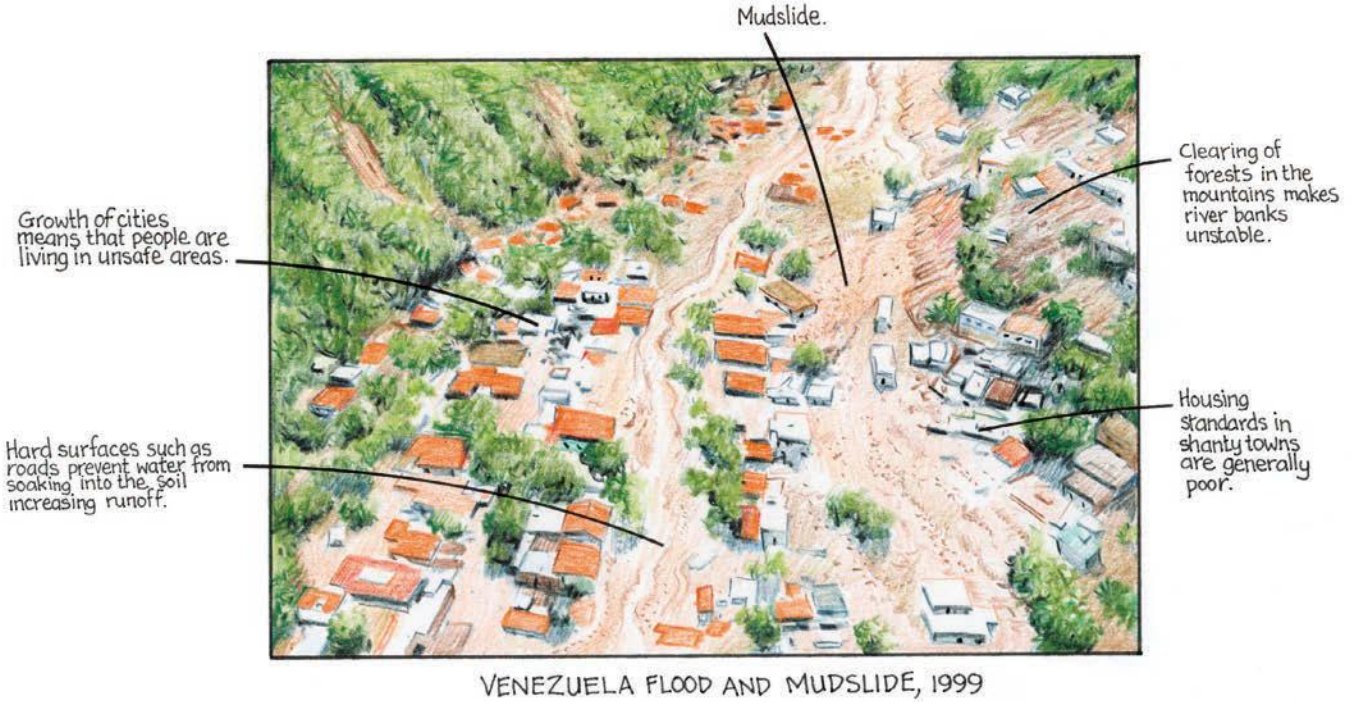
As with many natural disasters, people in poorer countries are more at risk. There, homes and other buildings are often poorly made and hillsides are often cleared of trees as timber is needed for fuel and building. With few planning restrictions in place people often live in landslide danger zones, with devastating results (see Source 3.7).

When heavy rains hit the South American country of Venezuela in late December 1999, they triggered the world's deadliest landslide (see Sources 3.8 and 3.9). The rains were heaviest in the mountainous area in the north of the country. As the swollen rivers swept down from the mountains, they eroded their banks, turning the rivers into raging torrents of mud. Charging towards the coast, the rivers swept through towns and cities perched between the mountains and the ocean, covering them in a sea of mud. Hardest hit were the poorer residents of the country who had built their homes in shanty towns on cheap land on the steep mountain slopes. The mud quickly engulfed the streets and homes of these shanty towns, sweeping them away or burying them.

To try to avoid the danger of disease, the dead were quickly buried and so the scale of the disaster will never be fully known. It is believed that more than 30 000 people lost their lives in these floods, but some estimates have placed the final figure closer to 50 000.



Source 3.8 An oblique aerial image of a mudslide in Vargas, Venezuela, 1999



Source 3.9 An annotated sketch of Source 3.8

Managing landslide risk



Although landslides can strike with great speed and little warning, there are some measures that communities can take to prepare for them and reduce their effects. Perhaps, most importantly, they can recognise that some human activities make landslides more likely. Careful planning is needed before cutting a road into the side of a hill, for example, because it makes the slope less stable.

KEY CONCEPT: SCALE

Landslide prediction

There are landslides in many mountainous areas around the world, but the reasons for them differ from place to place. Geographers who try to predict where there will be a landslide need to study factors at a range of scales:

- At the local scale they need to consider steepness of the slope, soil type and changes made by people.
- At the regional scale they need to consider rainfall patterns and the likelihood of storms.
- At the global scale they need to consider the location of plate boundaries and tectonic movement.

For more information on the key concept of scale, refer to section GT.1 of 'The geographer's toolkit'.

REVIEW 3.1.3

Remember and understand

1 What is a landslide?
2 Why are landslides more of a hazard in mountainous areas than in flatter places?
3 What can people do to reduce the likelihood of landslides?

Apply and analyse

4 Some landslides are so slow, they are known as soil creep. How might a very slow landslide affect human activities and structures?
5 Which natural processes contributed to the landslides in Haiti? Which human activities contributed?
6 Use a series of sketches to explain why digging into a hillside for mining or road building can lead to a landslide.

Investigate and create

7 Use Source 3.9 as a guide to create a geographical sketch of Source 3.7. Label your sketch with those factors that contributed to the landslide.
8 Do you think that natural factors or human factors were most responsible for the Venezuelan landslides? Give some reasons for your answer.

CASE STUDY

TUMBI LANDSLIDE, PAPUA NEW GUINEA

On the night of 24 January 2012 there was a massive landslide in the Southern Highlands of Papua New Guinea. The landslide buried whole villages and killed dozens of people. It was triggered by the collapse of a 150-metre wide section of hillside, and carved a 560-metre-long path of destruction through the forests and villages below. More than 3 million cubic metres of rubble thundered downhill in the disaster. The Highland Highway, which runs through the area, was destroyed. Quarry workers and machinery were buried in debris up to 15 metres thick. Rescue efforts were hampered by heavy rain in the hours and days following the landslide. Landslides are a hazard in Papua New Guinea, particularly during the wet season from December to May.

KEY CONCEPT: ENVIRONMENT

Possible causes of the Tumbi Landslide

The ways in which humans use and change the natural world is an important part of the key concept of environment. By examining the possible causes of this landslide you will learn how environments are changed by a complex series of human activities and natural processes. As with many disasters such as this, the exact causes are unclear. Initial newspaper reports focused on a nearby natural gas plant under construction and some associated quarrying near the slip site, but the gas company denied any connection. Here are some of the possibilities and some of the evidence.

Was it heavy rainfall?

PNG is experiencing one of the worst wet seasons, which traditionally runs from December to May, ever, local authorities say.

United Nations report

The ground water level rose significantly above its historical levels ... This caused the two minor, and one major, streams to combine, forcing water levels to rise beneath the limestone substructure of the hillside.

Papua New Guinea Government report

Was it the Tumbi quarry?

Local people have blamed blasting from nearby quarries, which sent hundreds of tonnes of earth crashing down on the village of Tumbi.

Newspaper report, *Mail Online*, 26 January 2012

Was it the shape of the land?

[The land where the slip occurred is] characterised by high terrain and precipitous [steep] slopes.

United Nations report on the disaster

Was it an earthquake?

The Geophysical Observatory (PMGO) reported no seismic activity within the area in the past two weeks.

Papua New Guinea Government report

Was it the farmers?

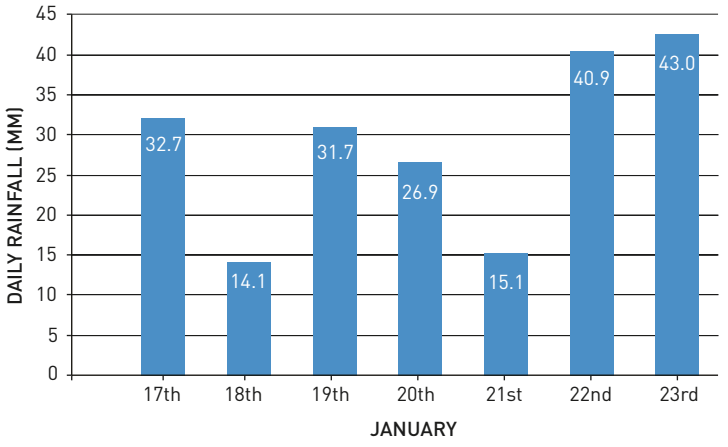
Intensive cultivation of the surrounding land may have also been a contributing factor by denying the ground of its natural vegetation.

Papua New Guinea Government report

For more information on the key concept of environment, refer to section GT.1 of 'The geographer's toolkit'.

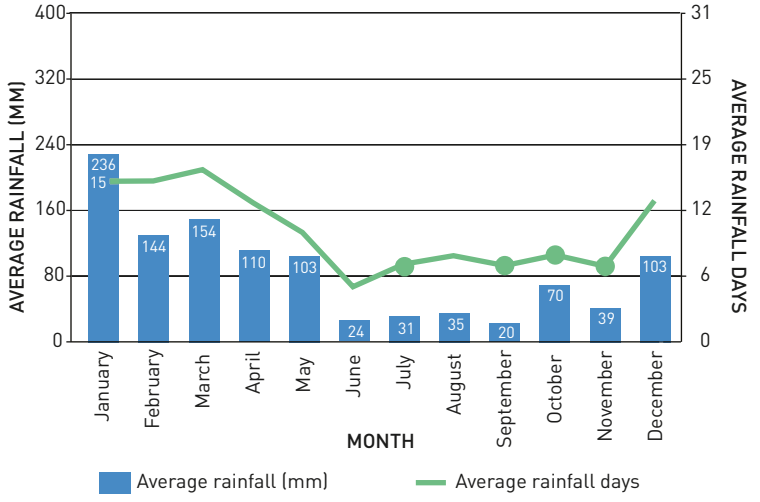


KOMO, PNG: DAILY RAINFALL



Source 3.10 Daily rainfall totals from 17 to 23 January 2012 in Komo, a town near the Tumbi Landslide site

KOMO, PNG: AVERAGE RAINFALL



Source 3.11



Source 3.12 The landslide that engulfed the village of Tumbi in Papua New Guinea

REVIEW 3.1.4

Remember and understand

1 Describe the scene in Source 3.12.

2 On what date was there a landslide? Is this during the wet season?

3 Describe the shape of the land at the site of the landslide.

Apply and analyse

4 Study Source 3.10. How much rainfall was recorded in Komo in the seven days before the landslide? Compare this with the weekly average in January of 53.2 millimetres.

5 How does a quarry change the shape of a hillside? How might this contribute to a landslide?

6 Divide the possible causes of this landslide into two lists: natural processes and human activities.

Investigate and create

7 Rank the possible causes from those that you consider most responsible for the landslide to those that you consider had no influence. Write a few sentences explaining your choice of the top contributor.

8 Compare your ranked list with those of your classmates. Is there some general agreement about the leading cause? Why or why not?

9 What further questions could you ask to help you work out the causes of this disaster?

AVALANCHES



Source 3.13 A skier in the path of an avalanche

More than 150 people a year, mostly skiers and snowboarders, are killed by avalanches in Europe and North America. Avalanches are a type of landslide. They involve the rapid movement of snow down mountain slopes. Some slopes are more likely to produce an avalanche than others, mainly due to their steepness. Snow resting on a layer of slippery ice on a steep slope can easily collapse. The resulting avalanche can reach speeds of up to 130 kilometres per hour. In 2010, a lone snowboarder was killed by an avalanche in Glacier National Park in Montana in the United States. The site of the avalanche is shown in Source 3.14.

The shape and angle of a slope are the important factors when predicting an avalanche. Slopes over 60 degrees are usually too steep for snow to rest on, and slopes under 25 degrees are too gentle to cause a slide. The danger zone comes between 30 and 45 degrees, which is just where people want to ski and snowboard. Constructing a cross-section of a mountain allows us to see both the shape and angle of the slope.

GLACIER NATIONAL PARK, UNITED STATES: SITE OF AVALANCHE IN 2010



Source 3.14

Source: Oxford University Press

SKILL DRILL

Constructing a cross-section

Step 1 *Identify the cross-section.* Find the two points on the map that form the outer edges of your cross-section. In this case, these points are labelled A and B.

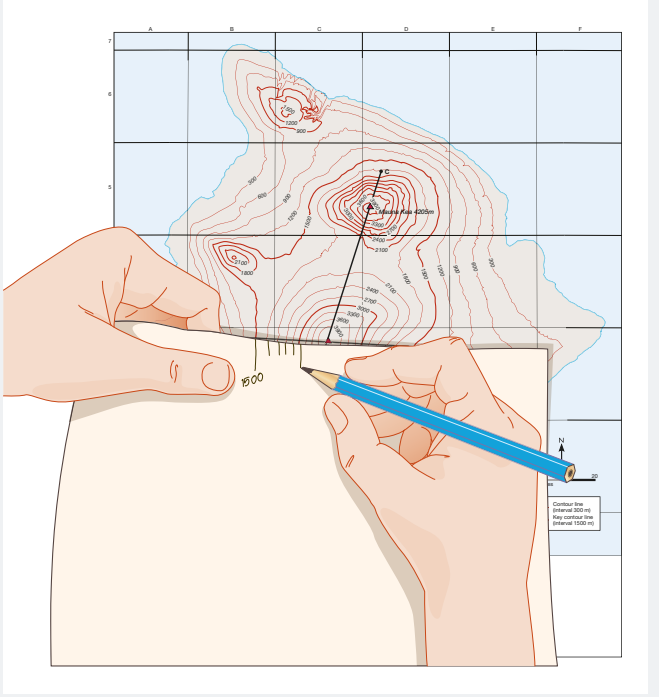
Step 2 *Mark the outer edges.* Place a straight-edged piece of paper across the map so that it crosses both points A and B. Mark these two points on your piece of paper. Be careful not to draw on the map.

Step 3 *Mark the contour lines.* Working from left to right, put a small mark on your piece of paper at every point that it crosses a contour line. You need to know the height of each of these lines so jot this down on the piece of paper as well.

Step 4 *Draw the axes.* On another piece of paper draw a set of axes for your cross-section. The horizontal axis is the same width as the distance between points A and B on the map. The vertical scale must begin below the lowest height on your cross-section and extend above your highest point. Put a vertical scale on both the left-hand side and right-hand side of your cross-section.

Step 5 *Transfer the contour line heights.* Lay your straight-edged piece of paper along your horizontal axis. For each contour height shown on your piece of paper, you must place a dot on your cross-section at the correct height according to your vertical scale.

Step 6 *Join the dots.* Join the points with a smooth line. Use a pencil and take care to make your sketched line as 'natural' as possible. It should not be a series of short, straight lines but one long, smooth line.



Source 3.15 Marking contour lines

Step 7 *Add the finishing touches.* Lightly shade the area below your line to show that this is solid land. Label both axes with their correct scales and give your cross-section a title.

Apply the skill

1 Construct a cross-section of the avalanche site along the line A–B marked on Source 3.14.

REVIEW 3.1.5

Remember and understand

1 Study Source 3.14.
- **a** In which direction did the avalanche travel?
- **b** How far was the snowboarder carried?
- **c** Using your cross-section as a guide, describe the steepness of the slope at this place.
- **d** Did the avalanche travel down a gully or a ridge?

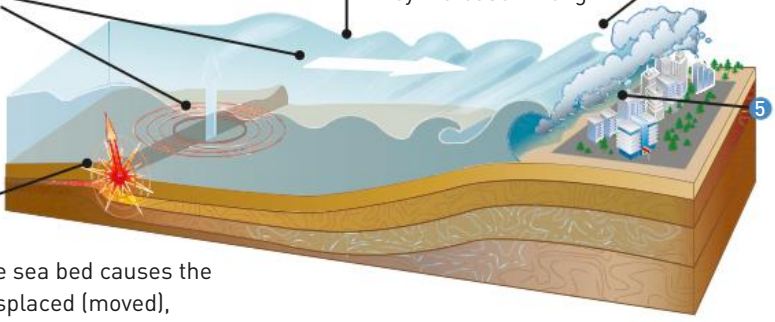
2 Rangers at Glacier National Park monitor snow conditions carefully and sometimes close dangerous areas such as this to skiers and snowboarders. What do you think they look for when they examine the snow conditions?

3 Study Source 3.14. On this map the beginning of the avalanche is labelled as A and the point at which it stopped is B.
- **a** How do you think the snowboarder accessed this slope?
- **b** What could the snowboarder have done to minimise the risks of an avalanche?
- **c** What could he have done to increase his chances of surviving an avalanche?

TSUNAMIS

Giant waves called **tsunamis** (a Japanese word meaning 'harbour wave') are perhaps the most terrifying coastal hazard. A tsunami is created when natural events move a huge amount of water in a short period of time. The largest and most common tsunamis are created when the sea floor moves upwards during an earthquake. This causes a series of high, very broad waves to be generated. Other events that can cause tsunamis include underwater volcanic eruptions and landslides. Smaller tsunamis can be created when a large landslide reaches the sea or when large sheets of ice break off glaciers.

Source 3.16 The life cycle of a tsunami



2 Build
The energy from the movement of the sea floor causes ripples in the ocean to move outwards at speeds of up to 800 kilometres per hour.

3 Travel
As the waves travel across the ocean, they increase in length.

4 Approach
As the waves approach the coast, they slow dramatically but they grow in height. Waves that were barely noticeable at sea may suddenly become 5 or 10 metres high.

5 Impact
The giant waves collide with the shore, causing massive damage. In low-lying areas and river estuaries, they may run several kilometres inland. As the water flows back to the sea the destruction continues as people and properties are washed away.

1 Origin
The movement of the sea bed causes the water above to be displaced (moved), generating massive amounts of energy.

2004 Indian Ocean earthquake and tsunami

On Boxing Day 2004, a natural disaster of epic scale and force struck many of the countries surrounding the Indian Ocean. A huge earthquake near the southern coast of the Indonesian island of Sumatra triggered massive, broad waves of water that slammed into nearby coastal towns and cities, such as Banda Aceh in Indonesia. The tsunami then travelled across the Indian Ocean, sending huge amounts of water inland with tremendous force wherever it encountered low-lying coastal areas. Indonesia, Sri Lanka, India and Thailand were most affected, but deaths (230 000 in total) were recorded as far away as Somalia, Tanzania and even South Africa. By the time the tsunami had run its course, much of coastal Asia lay in ruins.

Source 3.17 Banda Aceh, Indonesia, before and after the tsunami struck – 23 June 2004 (left) and 28 December 2004 (right)



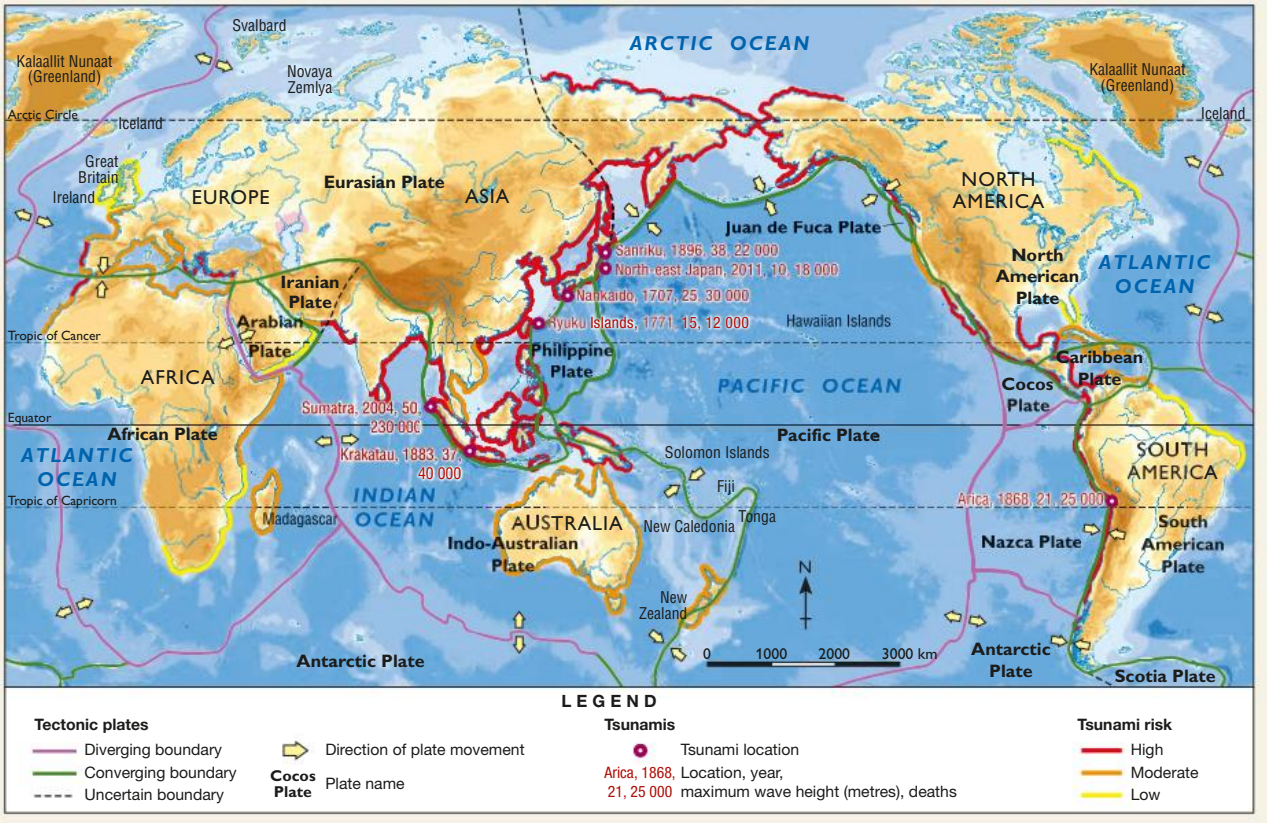
KEY CONCEPT: SPACE

Where do tsunamis occur?

Geographers have noticed that some coastal areas are much more at risk from tsunamis than others. By comparing the distribution of tectonic plate boundaries, earthquakes and tsunamis, they found that coastal areas facing a region where undersea earthquakes occur are most at risk from tsunamis. Japan is the world's most earthquake-prone country, as its east coast lies within 100 kilometres of a very active plate boundary.

For more information on the key concept of space, refer to section GT.1 of 'The geographer's toolkit'.

WORLD: TSUNAMI THREAT AND OCCURRENCE



Source 3.18

Source: Oxford University Press

REVIEW 3.1.6

Remember and understand

1 What are some of the causes of tsunamis?
2 In 2004, which countries were worst hit by the Indian Ocean earthquake and tsunami?
3 Describe how a tsunami wave changes as it approaches the coast. How do these changes make it more dangerous?

Apply and analyse

4 Study Source 3.18. Describe the distribution of the most tsunami-prone regions of the world.
5 Describe the relationship between plate boundaries and the level of tsunami threat as shown on the map. Give the names of specific places and plates.
6 Hawaii lies thousands of kilometres from a plate boundary and yet it is one of the world's most tsunami-prone places. Why?

Investigate and create

7 Sketch the outline of the Banda Aceh coast in June 2004 (Source 3.17). On your sketch, label five changes caused by the 2004 tsunami.
8 While the 2004 tsunami caused immediate damage to Banda Aceh, some of its effects will be felt for years. In a small group, discuss how tsunamis affect people and places, and classify the effects as either short term or long term.

CASE STUDY

2011 JAPANESE EARTHQUAKE AND TSUNAMI

STRANGE BUT TRUE

An entire city in Chile (Concepcion) moved 3 metres to the west in a massive 8.8-magnitude earthquake on 27 February 2010. The quake is also thought to have changed the planet's rotation slightly and shortened Earth's day.



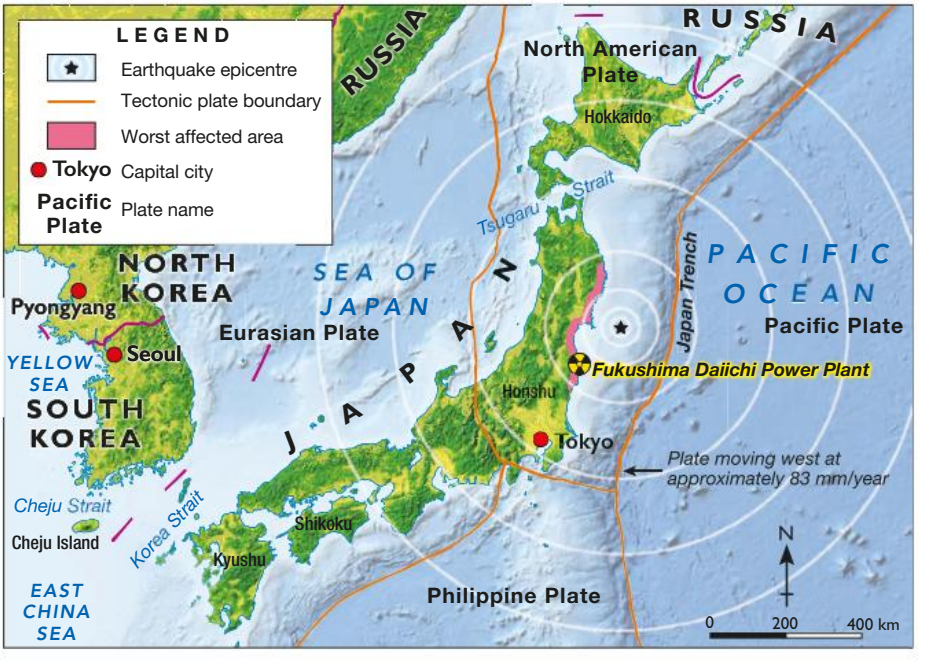
The world's largest **tectonic plate**, the Pacific Plate, is moving slowly westwards towards Japan at the rate of about 80 millimetres a year (see Source 3.19). This movement causes many earthquakes and makes Japan the tsunami capital of the world. Because of the danger, many Japanese towns and cities are protected from tsunamis by high sea walls. There are also many tsunami evacuation centres built on higher ground across Japan. Japanese people, aware of the threat, are educated about ways to prepare for a tsunami event.

On 11 March 2011, all these preparations were put to the test when one of the largest earthquakes ever recorded sent massive tsunami waves racing towards Japan and eastwards across the Pacific Ocean. Within an hour, tsunami waves up to 7 metres high reached Japan's east coast and caused immediate devastation.

The waves in some places pushed several kilometres inland. The water cascaded over the sea walls and washed away buildings, cars, roads and people. The damage was worst in areas close to the epicentre of the earthquake; in these areas entire towns were destroyed or entirely washed away. The movement of the tsunami waves was strongly influenced by the shape of the land, as the water tended to be funnelled into estuaries and bays. In one location, researchers found fishing equipment that had been carried 30 metres up a cliff face, making these waves among the highest ever recorded in Japan.

In some places, the earthquake caused land to sink (subside) and this allowed the waves to travel even further inland. Almost 300 000 buildings were completely destroyed and more than one million were damaged. Four large shipping ports were destroyed and a further 300 fishing ports were damaged. Damage to power stations and electricity lines left more than four million homes without electricity. An estimated 25 million tonnes of debris was created in the earthquake and tsunami, 5 million tonnes of which was washed into the Pacific Ocean. Items

JAPAN: 2011 EARTHQUAKE AND TSUNAMI



Source 3.19

Source: Oxford University Press



Source 3.20 The 2011 Japanese tsunami destroyed everything in its path as it moved inland (from left to right).

STRANGE BUT TRUE

Tsunamis can travel at 950 kilometres per hour in deep water, which is similar to the speed of a passenger jet. Earthquake vibrations can travel even faster – up to 14 kilometres per second. The fastest seismic waves take less than 20 minutes to reach the other side of the Earth, a distance of almost 13000 kilometres.

such as boats and soccer balls began washing onto the west coast of North America about a year after the disaster.

Eleven nuclear reactors that supplied electricity in Japan were immediately shut down after the initial earthquake, but the safety systems of several of these plants were destroyed in the tsunami that followed. This caused three of the nuclear reactors at the Fukushima Daiichi Power Plant to overheat and go into meltdown, releasing high levels of radiation into the atmosphere. In response to the disaster, all people living within 20 kilometres of the damaged power plant were ordered to evacuate their homes.

The final death toll may never be known but authorities estimate that nearly 16000 people were killed by the earthquake and tsunami and more than 6000 were seriously injured. More than 12 months after the disaster, more than 3000 people were still listed as missing.



REVIEW 3.1.7

Remember and understand

1 What event triggered the Japanese tsunami in March 2011?

2 What were some of the effects of the tsunami on people within an hour of the waves striking the coast? What were some of the effects that would still be felt a year later?

Apply and analyse

3 Examine Source 3.19. Describe the location of Japan relative to tectonic plate boundaries. How does this location make the country the 'tsunami capital of the world'?

4 The centre of the earthquake was about 70 kilometres from the coast of Japan. How soon did the tsunami waves reach Japan's east coast? How fast were they travelling? At this speed, how long would they take to reach California, 7800 kilometres away?

Investigate and create

5 In the photograph (Source 3.20), the first tsunami wave can be seen as it moves from left to right. Describe what you think happened in this place in the 15 minutes after this photograph was taken.

6 Japanese children are taught what to do if a tsunami wave is approaching. What do you think they are told to do?

3.1

WHAT IMPACTS CAN LANDSCAPE HAZARDS HAVE ON COMMUNITIES AND ENVIRONMENTS?

CHECKPOINT

- **Investigate one contemporary geomorphic hazard including causes, impacts and responses**

1 Identify and distinguish between five different types of landscape hazard. [15 marks]
2 Name and geographically locate a recent example of each hazard. [10 marks]
3 Outline two major impacts of each of the hazards identified in question 2. [10 marks]
4 Using one example, describe a response that could have improved the outcome of the disaster if it had been implemented:

a before the event **b** during the event **c** after the event. [15 marks]

TOTAL MARKS [/50]



Source 3.21 The Nepal earthquake tops the list of natural disasters in 2015.

RICH TASK

Nepal earthquake, 2015

Nations around the world rushed to offer help immediately after a devastating earthquake struck Nepal around midday on 25 April 2015. More than 9000 people were killed and 23000 injured. This was the worst natural disaster in Nepal since the 1934 earthquake (8.0 on the Richter scale). With a magnitude of 7.8 on the Richter scale and an intensity of IX (violent) on the Mercalli scale, the impacts of this disaster were widespread and long term. Hundreds of thousands of people were made homeless as entire villages were destroyed.

Acquiring geographical information

1 Find a blank outline map of Asia on the Internet and print it out, or trace a map outline from your atlas. Then, using your atlas for reference, label this map with the correct locations for Nepal, China, India, Pakistan, Bangladesh, Bhutan, Myanmar, Plateau of Tibet, Afghanistan, Bay of Bengal, Mount Everest, Kathmandu.
2 Look up on the Internet the USGS (United States Geological Survey) poster titled 'M7.8 Nepal Earthquake of 25 April 2015'. Examine the information on the poster and complete the questions below.
   a Describe the location of the earthquake epicentre, using distance, direction and place names.
   b Which crustal plates were responsible for this earthquake?
   c Refer to the table in the top right-hand corner of the poster, which shows population exposed to shaking. Calculate how many people were affected by level VIII and above on the Mercalli scale.
   d How many people were estimated to have been exposed to at least 'strong' shaking?

Processing geographical information

3 Despite the generous donation of millions of dollars of aid and supplies from around the world, much of the aid and assistance offered was slow to reach the people who really needed it.
   a Read the 11 information points. Rank them by showing what you consider to be the most important factor in influencing aid delivery in Nepal after the earthquake disaster in 2015.
   b Copy the diamond ranking diagram (see left) into your notebook. Organise the information points into the diagram, where the most important point goes at the top of the diamond, two points of lesser but equal importance go below, and points of moderate importance go beneath both of those. (You will have two points left over.)

Communicating geographical information

4 Referring to your completed diamond ranking diagram, justify your top three rankings and also the two that you left out. (Why were they not important?)

SKILL DRILL

Nepal earthquake: information points

1 Communication

After the earthquake, most lines of communication were down. This affected both the people needing the relief and the groups trying to provide it. If help were to come it would have to involve helicopters, and, until they arrived, people had to survive any way they could.

2 Cooperation

Initially it was very difficult to organise relief, yet by the first three months of the response, aid workers had reached more than 2.2 million people with money and support. Agencies all aimed to provide shelter kits and water, and set up temporary schools. These were delivered quickly, often in partnership with local people and community organisations.

3 Damage to roads

The earthquake and avalanche destroyed roads and footpaths, effectively shutting down access in and out of the disaster zone. Helicopters were the only option.

4 Responsible aid

How do you ensure that aid reaches the people who need it most? The first helicopters to arrive were privately contracted to pick up people who had insurance policies – primarily NGO (non-government organisation) workers and foreigners. This angered many locals and uninsured tourists, who wanted to evacuate the most seriously injured.

5 Local conditions

The sheer scale of the disaster area, treacherous terrain and monsoon rains made roads impassable, causing more landslides and building collapses.

6 Medical

International aid agencies were able to start medically evacuating the critically wounded by helicopter from outlying areas, initially cut off from the capital city, Kathmandu. They treated others in mobile and makeshift facilities. There was concern about epidemics because of the shortage of clean water, the basic nature of living conditions and the lack of toilets.

7 Population

An estimated 2.4 million people had their homes destroyed by the earthquake and aftershocks. Aid agencies moved fast to provide emergency shelter to protect people from the treacherous monsoon rains and provided materials or cash to help families rebuild their own homes.

8 Earthquake refugees

Internally displaced people from rural areas are still living in camps made of basic shelters. They have moved several times since the earthquake and need somewhere they can relocate to permanently. The women walk more than half an hour to get fresh water and they barter with local villagers for vegetables. They have become dependent on aid, and therefore, have no way of saving up to rebuild their homes or move somewhere else.

9 Aftershocks

A series of aftershocks began immediately after the main shock, with one aftershock reaching a magnitude of 6.6 within 34 minutes of the initial quake. A major aftershock of magnitude 6.9 occurred the next day. The aftershocks caused fresh avalanches on Mount Everest and landslides across the region.

10 Safety issues

Many buildings, roads and bridges that were damaged were unsafe to use and there was a lack of skilled engineers to inspect and repair them. People were panicking – fighting among themselves for water, food and other supplies.

11 Missing persons

With more than 450 000 displaced people, and many injured and missing, friends and relations were desperate for information.

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Space, Environment, Interconnection, Scale, Change
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.



2 PLACE AND LIVEABILITY



THE PLACES WE LIVE

4 CHAPTER

LIVEABLE PLACES

5 CHAPTER

The Netherlands: modern dykes, highways and wind turbines. Located in north-western Europe, this small country has 450 kilometres of coastline along the North Sea. Three major rivers – the Rhine, Schelde and Meuse – end in the Netherlands. This makes the country particularly vulnerable to flooding. It is also one of the most densely populated places on Earth – and rated one of the most liveable. Dykes, dams and floodgates are used to control the constant risk of flooding from storm surges in the sea. Wind power is used as a renewable energy source.

CHAPTER

4



Source 4.1 An aerial photograph looking south towards Bondi Beach and surrounding suburbs in Sydney

THE PLACES WE LIVE

Both Indigenous Australians and early European settlers to Australia made decisions about where to live based on the available resources needed to survive – water, food and shelter. The factors that influence the liveability of places today are more varied and include access to services, environmental quality and safety. Connections to family, friends and places also influence where we live. Where we live can also change over time due to a range of factors, such as work and property prices. In retirement, many people opt for a sea change or tree change to enjoy a more relaxed lifestyle.



WHY DO PEOPLE'S PERCEPTIONS OF THE LIVEABILITY OF PLACES VARY?

4.1 SECTION

In this section you will investigate:

- factors influencing perceptions of the liveability of places

CHECKPOINT 4.1

WHAT EFFECT DOES ENVIRONMENTAL QUALITY AND ACCESS TO SERVICES HAVE ON PEOPLE'S WELLBEING?

4.2 SECTION

In this section you will investigate:

- the impact of environmental quality on the liveability of places
- the influence of accessibility to services and facilities on the liveability of places

CHECKPOINT 4.2

GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Place:** factors affecting people's perceptions of places; the special significance place has to some people; the effect of global trade, transport, information and communication technologies on places across the world
- **Environment:** the effect of human activities on natural and human environments
- **Sustainability:** the need to manage environments for a long-term future

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** topographic maps, road maps, thematic maps, resource maps, sketch maps, choropleth maps, complex maps
- **Fieldwork:** local area surveys
- **Graphs and statistics:** line graphs, bar graphs, climate graphs, population pyramids
- **Spatial technologies:** satellite images
- **Visual representations:** oblique aerial photographs, graphic organisers, annotated photographs, infographics



4.1 WHY WE LIVE WHERE WE DO

WHY DO PEOPLE'S PERCEPTIONS OF THE LIVEABILITY OF PLACES VARY?

The **liveability** of any place is closely linked to how suitable and enjoyable you think that place is to live in. How liveable you find a place to be depends on your own wants and needs, and whether they are met. What we like about places can depend on our age, income, cultural background, lifestyle, values and beliefs. The following questions will help you to determine the features of places that make them most liveable to you.



Source 4.2 Some activities, such as horse riding, require lots of space.

What do you like to do?

Access to services and facilities that allow us to do the things we enjoy has an effect on what we think of the place we live. This, in turn, increases how highly we rate its liveability.

Sport and recreation play an important part in our lives. Team sports (such as netball, football and soccer) can be played in most places. Community facilities (such as sports stadiums and sporting parks) are provided in most communities. If your passion is surfing, you might consider a coastal town more liveable than an inland town. Horse riders might prefer to live in a rural area or on the edge of a city, close to open spaces where they can keep their horses.



Source 4.3 A peak-hour traffic snarl on Parramatta Road, Concord. Busy streets in cities can make moving around difficult.

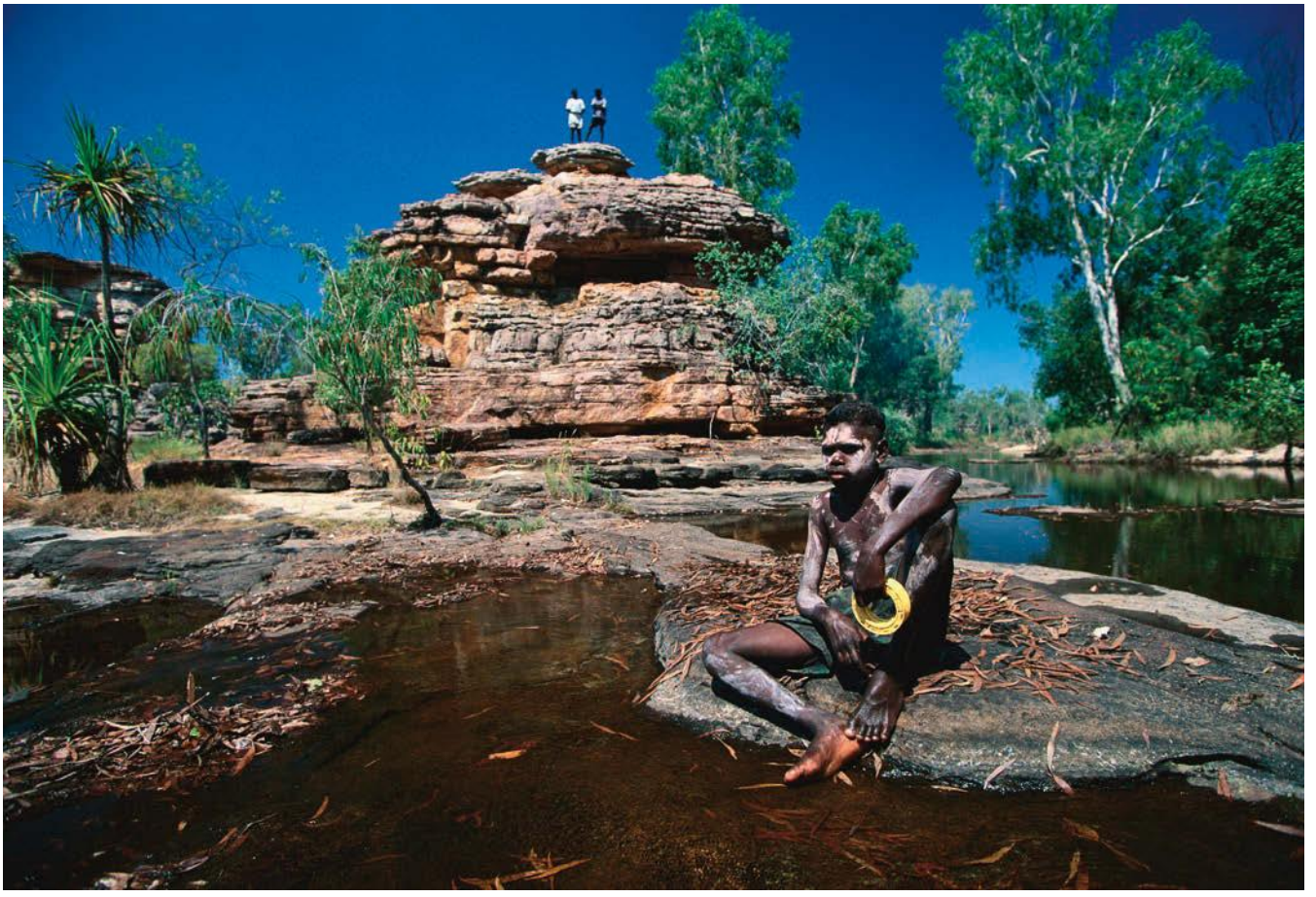
Where do you like to go?

The places we like to go to, and how easy they are to get to, also affect the liveability of a place.

Where do you spend most of your time? Do you like to catch up with friends, go to the movies, or shop at the local shopping centre? How do you get there? Do you walk, ride a bike, or catch a bus, train or car? Think about how easy it is for you to travel from your home to where you like to go. Is it difficult? This could make you feel negatively about where you live, decreasing its liveability. Is there another place you could live that might make it easier for you to travel to where you like to go? If so, this would increase the liveability of that place for you.

What are your favourite places?

We all have places that are special to us. There are many different reasons for this. Some places appeal because of the way they look. This is known as aesthetic value. Others appeal to us because they are familiar or are attached to memories of things we have done. This is known as sentimental or spiritual value. Aboriginal and Torres Strait Islander Peoples have developed very strong connections with their places. Places are a dominant feature of their stories and their lives. These spiritual connections can also increase the liveability of one place over another.



Source 4.4 An Aboriginal boy fishing in Manbalbirrlarri billabong at Djukalajarrang, Arnhem Land. This is a very special place for the Ganalbingu clan because of important rock art, burial caves, and secret and sacred sites. The Ganalbingu clan feel spiritually connected to this place.

Every year about 5000 Australians are asked to take part in a survey about the factors that they believe make a place liveable. Their replies are often similar to the replies of people from all around the world when asked the same question. Most people agree that a liveable place:

- offers a temperate (mild) climate
- is easy to get around
- is able to offer good health care, work and education opportunities
- is safe
- is affordable
- is diverse
- is sustainable
- is attractive.

REVIEW 4.1.1

Remember and understand

1 What is meant by 'liveability'?
2 What characteristics of a place attract us?
3 What do you like to do? Where would be a good place to live to enable you to do this?
4 Where do you like to go? Where would be a good place to live to enable you to do this?

Apply and analyse

5 Imagine that you could live anywhere. Where would you live and why?
6 What are the important aspects of liveability that don't need a lot of money?
7 Give an example of how a person of your age and a much older person might have different ideas about the liveability of a place.

Investigate and create

8 What is your most special place? Why do you have a special connection to this place?

WHERE EARLY INDIGENOUS AUSTRALIANS LIVED



It is impossible to work out exactly when the first people arrived in Australia, but many historians estimate it was between 40 000 and 50 000 years ago. At that time, sea levels were lower than they are today. The islands of Indonesia were part of the Asian mainland, and over time people walked and undertook short sea voyages to reach what is now northern Australia. Over thousands of years these people gradually moved south, eventually reaching the south-western and south-eastern corners of Australia. As sea levels rose, Australia became an island and the cultures and traditions of Indigenous Australians developed in isolation.



Factors that influenced where Indigenous Australians lived

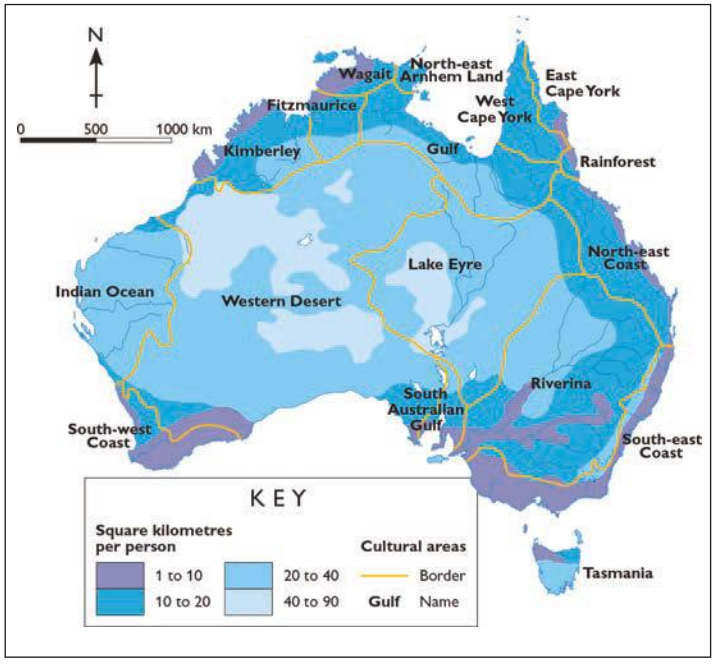
On reaching the Australian continent, early Indigenous Australians looked for the most liveable places – those that supplied the resources they needed to survive and prosper. Many Aboriginal peoples settled along the northern, eastern and southern coasts as well as along what we now know as the Murray River. In these places they found the resources they needed to survive, particularly fresh water and abundant food.

Indigenous Australians developed a way of life that took advantage of the natural resources available. Trees provided many important resources, including bark to make shelters, canoes and shields, and wood to make fires and spears.

They fished the rivers, in some places building elaborate stone traps to catch eels and fish, and hunted larger game such as kangaroo and wallaby. Birds and lizards living in the trees also supplied much of their food. Early tribes used virtually every part of the natural environment to support their way of life – shells, stones, plant fibres, coloured clay and bones all had their uses; however, a reliable supply of fresh water, usually a river or stream, was perhaps the most important resource.

Further inland, resources were much scarcer. Aboriginal communities living here developed a different way of life suited to the limited resources. Throughout much of Australia, fresh water is hard to find and there are few large animals to supply food. In these desert regions, Aboriginal people lived a more nomadic way of life than the coastal and river peoples. Liveable places changed according to the season, so for most of the year they kept on the move, following natural cycles of monsoonal rains, the movement of animals or the fruiting of plants. They became superb trackers and hunters and were able to survive in some of the harshest environments on Earth. They found water in the most unlikely places, even in the roots of desert plants and the bodies of dormant (hibernating) frogs. Much of their food came from animals such as insects, grubs and reptiles, as well as from plants such as the bush tomato.

AUSTRALIA: LOCATION AND DISTRIBUTION OF INDIGENOUS AUSTRALIANS IN 1788



Source 4.5

Source: Oxford University Press





Source 4.6 Aboriginal men in northern Queensland demonstrating traditional fishing techniques using a spear



Source 4.7 In the Western Desert, Aborigines use fire to expose the hiding places of goanna.

A spiritual connection to the land

Aboriginal and Torres Strait Islander Peoples developed a deep connection with the land that supported them. The land form the core of their beliefs and spirituality and an integral part of their view of themselves. They do not see themselves as separate from the natural environment but as part of it. Rather than owning land or living off the land, they believe that they live *with* the land and are responsible for looking after it. Their perception of liveability is based on the principle that the land is much more than just a resource to be used. Aboriginal people refer to their land, and their connection to it, as 'Country'.

Part of the reason that Country is such an important concept to Indigenous Australians is because their Dreaming stories, their way of life and their ancestors are all part of their homelands. When an Indigenous Australian is in their Country, their spirits and their ancestors keep living through them. In fact, they see the Country as a living individual. Many Indigenous Australians choose to live in their traditional homelands or dream of doing so. Like other Australians might long to see a favourite relative or return to a family home, Indigenous Australians get their sense of belonging from their Country.



Source 4.8 Many modern Aborigines are moving back to their traditional homelands to reconnect with their ancestors and their beliefs.

REVIEW 4.1.2

Remember and understand

1 How did Aboriginal people first reach Australia?

2 Compare the ways of life of inland desert Aborigines and those who lived near rivers in south-eastern Australia. What were some of the similarities and some of the differences?

Apply and analyse

3 Why did most Aboriginal people live near the coast or along rivers?

4 Examine Source 4.6. What resources from the natural environment are these Indigenous hunters using?

5 What factors influenced the liveability of places for early Indigenous Australians? Are these factors the same as those that influence your ideas on what makes a place liveable? Why or why not?

Investigate and create

6 What do you think Aboriginal people may have used each of these resources for: shells, stones, plant fibres, coloured clay and bones?

7 When Europeans arrived in Australia they had a different view of landownership and land use than Aboriginal people. Why did these differences cause tensions and conflicts between these two groups of people?





WHERE MODERN AUSTRALIANS LIVE

In much the same way as the early Indigenous Australians did, modern Australians also make choices about where they live based on how liveable they perceive a place to be. Today, however, many things have changed. In the distant past, people chose where to live based on whether the place gave them access to the basics necessary for survival, such as water and food. Today, modern technology and **infrastructure** make food and water available right across Australia, even in parts of the country, such as the desert, that would have previously been uninhabitable. As a result, the factors that influence where modern Australians live have changed. Today, many Australians make decisions about where to live based on a series of lifestyle factors.

Factors that influence where modern Australians live

A person's perceptions of liveability often depend on his or her needs, wants or preferences. These needs and wants are changing all the time and are often dependent on what stage of life a person is at. Age has a big influence on what a person wants from where they live. Young adults, for example, often want access to educational opportunities and jobs, while retired people will not be so concerned about these things. The type of household a person is a part of is also significant, as families have different needs from single people.

Despite these differences, many of the factors that people take into consideration when deciding where to live remain constant. A range of these are discussed below.

Access to services and facilities

Housing

Suitable housing is a key consideration for people. On a basic level, people make decisions about where they live depending on what they can afford, and the size of house they need.

Personal choice also has a big influence, whether, for example, someone wants a modern home or a traditional home, a large garden or a low-maintenance apartment.



Source 4.9 A visible community police presence is a reassuring feature to many people.

Services

People generally like to live within easy reach of the services they need. Public transport and well-maintained roads help people to get around with ease. Access to health care is also important, but even more so for people who need specialist care. Families with children often want access to good schools, child care and playgrounds. Local shopping centres providing access to shops, banking and other professional services, as well as cafes and restaurants, play an important role in where people settle. Feeling safe and secure in a community will also influence where people choose to live.

Employment

People often move to a place because it offers them the best opportunities for employment, and generally the bigger the place, the more jobs there are. Many young people who have grown up in small country towns end up moving to cities to find employment. Big cities, however, are not the only places to find employment. In recent years, isolated mining towns with very few facilities and services have grown rapidly because of the high-paying jobs on offer there.



Source 4.10 Large entertainment events such as Groovin the Moo attract big crowds of young people and play a role in where they choose to live.

Entertainment

People also make choices about where they live based on their leisure activities; for example, whether they want easy access to the outdoors or to museums and theatres found in city centres. People of different ages often want different entertainment options. Many younger people are drawn to the variety of entertainment offered in big cities such as music venues, nightclubs, concerts, theatres, shops and big sporting arenas, whereas these facilities may be of little use to older people.



Source 4.11 A mild climate and attractive natural features such as beaches can be a key factor in determining where people live

Environmental quality

Most people in Australia live along the east coast, where the climate is more moderate than other parts of the country. Personal preferences, especially when it comes to climate, are a key factor in determining where people settle. For example, many older people follow the sun, sea and a warmer climate in their retirement by moving to the Gold Coast. Coastal places are very popular with young and old people alike, but on the other hand, someone who enjoys snow-skiing might prefer to live near the mountains.

KEY CONCEPT: PLACE

Comparing different perceptions of place

How you perceive and use a place can be influenced by various factors. The same place can be perceived in different ways by different people – a historian might perceive a museum as a fascinating place to visit, for example, while another person might think it is quite boring. The same place can be used in very different ways, too. The steps outside the museum could be used as a place to go skateboarding, or at other times as a backdrop for wedding photos. A park that is filled with families on a bright sunny day might seem like a safe, enjoyable place to go with a friend, but the same park might seem very different to you if you found yourself there in the middle of the night alone. Factors that influence how you perceive places include:

- your age
- your ethnic origin
- your gender
- the time of day or night you are visiting the place
- whether you are travelling to the place alone or in a group
- whether you have a disability or are able-bodied.

For more information on the key concept of place refer to section GT.1 of 'The geographer's toolkit'.



Source 4.12 There are many factors that might influence the way someone perceives a place.

Community connections

Many people choose to live near their family and friends, and for this reason may stay in the same town or city **suburb** for the whole of their lives. Those moving to a new place, particularly from another country, may be attracted to a neighbourhood where others from the same cultural and language backgrounds live. This can offer a sense of security and familiarity, with local shops selling products from home, and local services offered in their native language.

SKILL DRILL

Fieldwork: the liveability of your local area

Liveability applies not only to countries and cities but also to smaller local areas. Some areas are more liveable than others because of the infrastructure that is available or because of their culture and environment.

Completing a map survey

There are several pieces of information that you can collect to assess the liveability of your local area. The first of these is a map survey.

To complete a map survey of your local area, follow these steps:

Step 1 Locate a map of your local area. This could be from a street directory or from a website, such as Google Maps. Decide on the limits of your local area. This could be a suburb if you live in a large city or the whole town if you live in a smaller rural town. In this example, the student lives in inner Brisbane and has chosen an area 1.5 kilometres from where she lives.

Step 2 Mark the limit of your local area on your map.

Step 3 Examine this area closely and count each of the following pieces of infrastructure within it:

- police stations
- hospitals
- chemists
- doctors
- churches
- sporting grounds
- parks
- post offices
- schools.

Completing a street survey

Another useful way to collect information about the liveability of your local area is to undertake a street survey as part of some fieldwork. In a street survey you are assessing the quality of the housing and other features of a street or several streets.

To complete a street survey in your local area, follow these steps:

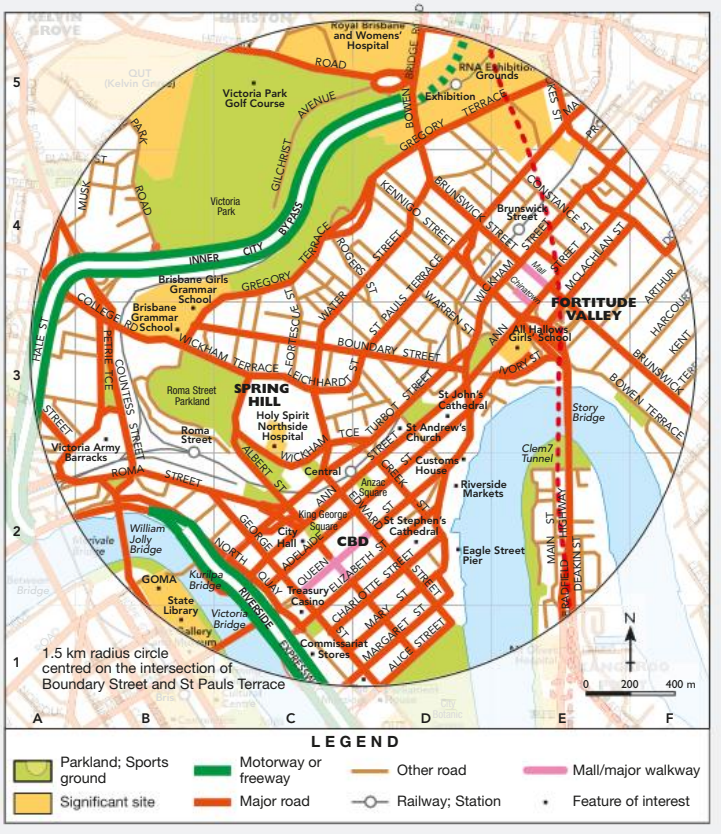
Step 1 Choose a street with at least 30 properties and a length of at least 100 metres.

Step 2 Use a street survey form like the one shown in Source 4.14 to score your chosen street on a scale of 0 to 3 in a range of categories.

Apply the skill

1. Using the three steps outlined left, complete a map survey of your local area.
2. Describe the infrastructure of this area in a carefully worded paragraph.
3. Using the two steps outlined above, complete a street survey in your local area.

BRISBANE: CBD AND INNER SUBURBS



Source 4.13

Source: Oxford University Press

4 In what parts of the survey did the street score well? In what areas did it score poorly?
5 What could be done to improve this street?

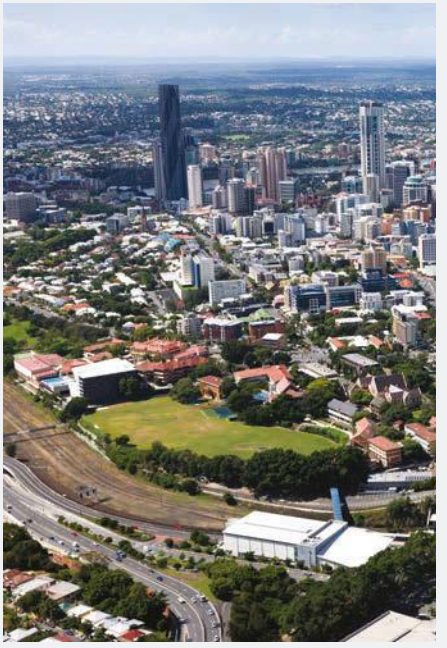
Extend your understanding

1 What health-care facilities are available to residents of Spring Hill?
2 What education facilities are available to residents of Spring Hill?
3 As an inner-city area, Spring Hill is well served with public transport. What evidence can you find for this?
4 Comment on the availability of roads in this area.
5 Brisbane did not score as highly as Melbourne or Sydney in a recent survey of liveable cities. In what measures of liveability do you think it scored lower than these other cities?

Street name: _____ **Suburb:** _____

		SCALE				
Traffic	Free of parked vehicles Low volume of traffic Safe for children	3	2	1	0	Cluttered with parked vehicles High volume of traffic Dangerous for children
Gardens	Variety of plants Neatly maintained					No plants Overgrown
Houses	Well maintained Variety of housing styles Variety of building styles					Run down All houses the same style All houses built from the same material
Vegetation	Trees shade half of road					No trees
Street furniture (signs, electricity poles, seats etc.)	Inconspicuous Improve the area					Conspicuous Detract from the area
Street lighting	Well lit					Poorly lit
Litter, vandalism and graffiti	No litter, vandalism or graffiti					Much litter, vandalism and graffiti
Access to facilities	Shops within walking distance Parks within walking distance Primary school within walking distance					Shops not within walking distance Parks not within walking distance Primary school not within walking distance
Footpaths, roads and kerbing	Clearly defined Good condition Maintained nature strips					Undefined Poor condition No nature strips
Other land uses	No offensive land uses					Offensive land uses
Column score						
Total score						

Source 4.14 A street survey



Source 4.15 Spring Hill is an inner-city suburb of Brisbane. It contains a mix of residential and commercial land uses.

REVIEW 4.1.3

Remember and understand

1 What are some of the factors that modern Australians take into consideration when deciding where to live?
2 How important are climate and environment in influencing where people in Australia live?

Apply and analyse

3 For each of the following groups, identify some of the liveability factors that would be most likely to influence where they want to live:
   a a family with school-age children
   b a retired couple
   c a surfer in his 20s.
4 Consider the local area in which you live.
   a What are its key liveability factors?
   b What types or groups of people commonly live in your local area?

Investigate and create

5 Examine Source 4.12. How do you think the people in the photographs feel about the places they are in? How might a different person feel about each of these places?

CASE STUDY

MOVING TO NOOSANGATTA

The warmer climate and stunning natural features of the south-east Queensland coastline mean this region has many high-rating liveability factors. The region, in fact, has attracted many Australians, particularly older people from New South Wales and Victoria, to make the move north. Just 50 years ago, the Gold Coast and Sunshine Coast were small holiday towns. Today, the area has seen such extensive growth and development that the towns and cities along this section of coastline may join together to form a continuous urban area known as a megalopolis. Some geographers predict that Noosa in the north and Coolangatta in the south will one day also join to form one vast urban area that some people have already nicknamed 'Noosangatta'.

The high population growth in south-east Queensland over the last few decades has led to an increasing demand for housing. As the suburban areas have spread, there has been a loss of 7500 hectares (75 square kilometres) of bushland and farms each year. The stunning natural features and easygoing lifestyle that attracted people to move to the area in the first place are coming under threat. A victim of its own success, the area is in danger of becoming less liveable.



Source 4.16 An oblique aerial photograph of coastal development between Noosa and Brisbane

REVIEW 4.1.4

Remember and understand

1 Why are many older Australians moving north to settle in south-east Queensland?

2 Explain what is meant by the expression 'a victim of its own success'.

Apply and analyse

3 Describe the importance of natural features such as rivers, mountains and coasts in affecting the location and shape of cities. Use evidence from the map (Source 4.17) for your description.

4 Is it likely that the city of Toowoomba will join the Noosangatta megalopolis? Give reasons for your answer.

Investigate and create

5 Explore the region shown in Source 4.17 on Google Earth. Use the 'Historical Imagery' tool to find examples of places that have undergone great changes in the last 10 years.

SKILL DRILL

Reading a complex map

A map is a plan of an area of the Earth's surface drawn directly from above. Complex maps, such as the one shown in Source 4.17, can appear a little confusing at first because they show a wide range of features. As with all maps, however, it is important that you read the legend, title, source and scale carefully, so that you can learn more about the region being shown.

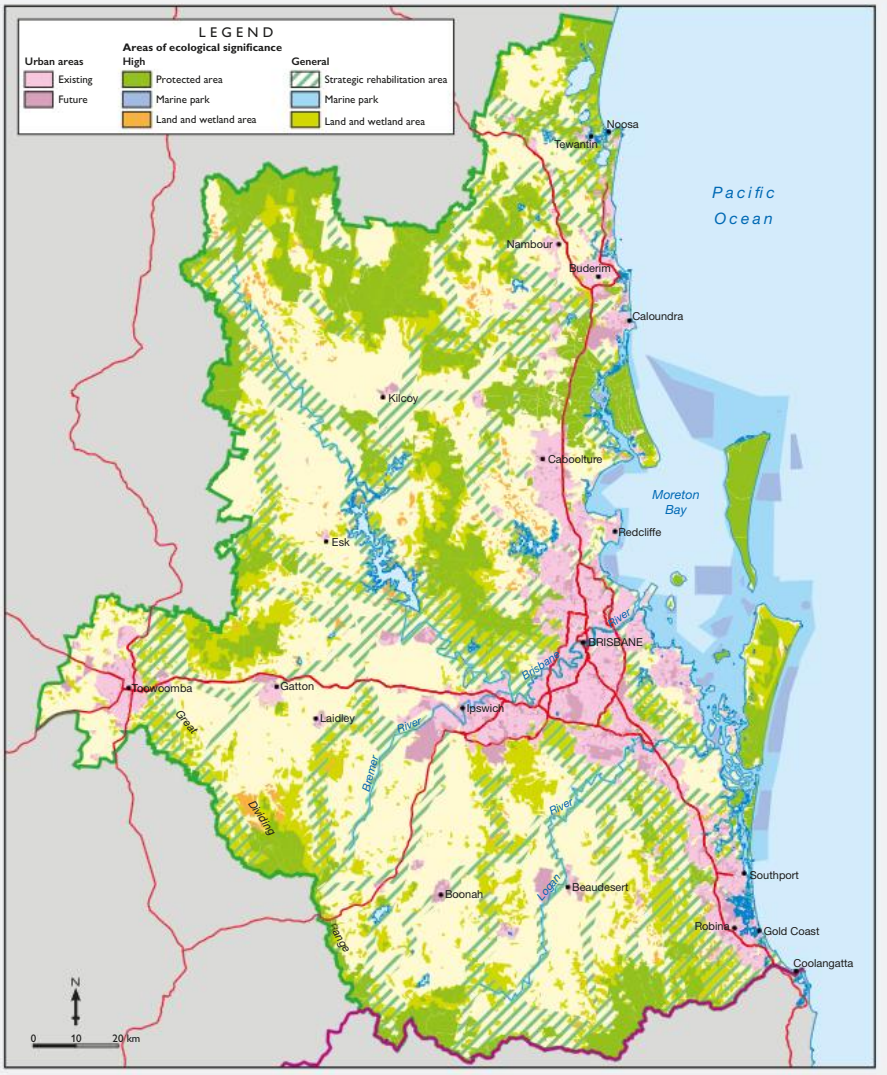
Follow these steps to help you read and understand a complex map:

Step 1 Read the title carefully. Make sure that you understand what the map shows and the region that is shown in the map. If you are unsure of the location of the region, locate it in your atlas to see where it sits in relation to other regions or countries.

Step 2 Check the source of the map so that you can assess the reliability of the information. Maps drawn by government departments and professional publishers are generally more reliable than those drawn by individuals and businesses.

Step 3 Look carefully at the symbols and colours used in the legend and find an example of each of these on the map. Look for relationships between these symbols such as roads and urban areas.

SOUTH-EAST QUEENSLAND: ECOLOGICAL AND URBAN AREAS



Source 4.17

Source: South-East Queensland Regional Plan 2009–2031, Queensland Department of Infrastructure and Planning.

Apply the skill

1 What is the source of the map shown in Source 4.17?

2 Is this a reliable source of information?

3 Use the line scale to estimate the straight line distance from:
- Brisbane to Robina
- Brisbane to Noosa
- Brisbane to Toowoomba.

For a guide on estimating distance, refer to section GT.3 of 'The geographer's toolkit' (Skill drill: Using line scale to measure distances).

4 Describe the distribution of existing and future urban areas. Use the names of towns and cities as well as compass directions and geographic features such as the coast and rivers in your description.

5 Describe the distribution of protected areas and the land and wetlands areas of high ecological significance.

6 Which areas of high ecological significance are likely to be impacted most by the continued growth of urban areas in this region?

MEASURING LIVEABILITY



Source 4.18 A young boy sits in front of a destroyed building in Homs, Syria. Syria has been in civil war his entire life. Feeling safe is a key factor that affects the liveability of places.

Liveability is a measure of what a place is like to live in according to particular criteria such as access to schools and health care, climate, safety and infrastructure. Each year, a number of different companies review the liveability of cities around the world, ranking them from most liveable to least liveable. For example, the Economist Intelligence Unit (EIU) publishes an annual list of rankings. The EIU gives each city a score based on:

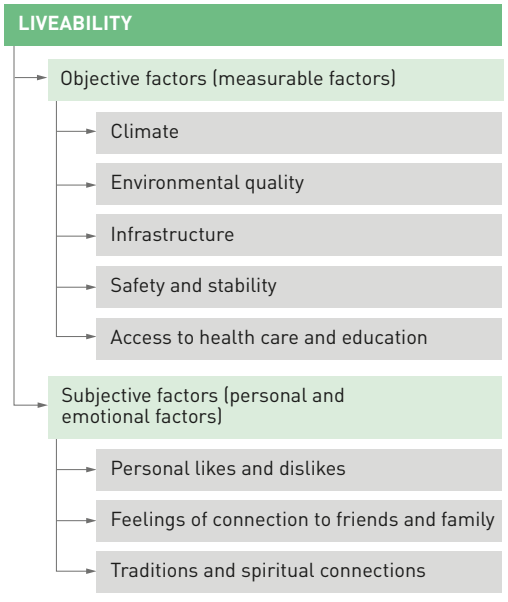
- stability (such as crime and terrorist threats)
- health care
- environment and culture (such as climate, shopping and religious freedom)
- education
- infrastructure (such as public transport, roads, water and electricity).

Melbourne has been rated the world's most liveable city since 2011. It ranked equal first in health care, education and infrastructure. Damascus in Syria was rated the world's least liveable city in 2015 with health care, education and stability rankings the worst in the world.

What makes a city liveable?

The liveability of a place is generally measured by a number of different factors relating to quality of life. People's views about the liveability of a place can vary depending on their age, income, cultural background, lifestyle choices, values and beliefs.

The factors that influence people's ideas on liveability can be measured in two ways: by objective factors and subjective factors. Objective factors are things that can be measured and expressed as numbers, such as the cost of housing, the climate, the number of hospitals and schools, the availability of public transport, and the level of crime. Subjective factors are things that are personal, emotional and spiritual, and that cannot be easily measured or expressed as numbers. Examples of these factors are people's spiritual connections and sentimental attachments to a place (see Source 4.19).



Source 4.19 Liveability can be measured by objective and subjective factors.

Objective factors

There are many different objective factors that affect liveability.

Environmental quality

The environment is a key factor that determines how liveable a place is. Environmental quality can refer to a number of characteristics relating to the natural or built environment, such as clean water and clean air. It can also be a measure of other things such as the level of pollution, rubbish or noise in an environment.

Climate

Climate is one of the most important factors affecting the liveability of a place. Although different people like different types of weather, most people agree that a mild climate without extremes of heat or cold is ideal. Places with mild (temperate) climates often score highly in terms of liveability. The amount of rainfall is also important when it comes to climate. Too little or too much rain has a negative effect on the liveability of a place.

Infrastructure

The availability of services and facilities (such as roads, public transport, emergency services, post offices, water, sewerage treatment plants, airports, housing, sporting and entertainment facilities, electricity and communications) helps make a place more or less liveable. Together these services and facilities are referred to as infrastructure.

Safety and stability

Safety and stability are two of the most important factors linked to the liveability of a place. More than most other things, people value feeling safe and stable in their homes. Australian cities are regarded as some of the most liveable places in the world for this reason. Safety and stability are measured by taking into account crime statistics and other information collected by the government. Many of the world's least liveable cities are found in war-torn countries such as Iraq and Afghanistan, where crime rates are very high and there are very few police to enforce the law. For this reason, many **refugees** flee to countries such as Australia in search of safety and stability.

Access to health care and education



In general, people living in the world's most liveable cities have access to good health care services, including doctors, public and private hospitals, specialist clinics and over-the-counter medication. They also have access to schools and education facilities such as training centres and universities. In many of these cities, including in Australia, a school education is not only compulsory but also free. Cities in Canada, the United States, Australia and Western Europe generally rank highly in both health care and education. African cities are the lowest ranked for these services.

Subjective factors

Unlike objective factors, subjective factors cannot be easily measured and compared. They are linked to personal likes and dislikes, and feelings of connection to family, friends and cultural groups. They are also linked to beliefs, traditions and spiritual connections to places. Organisations such as the OECD are now conducting life-satisfaction or **wellbeing** surveys to take some of these subjective factors into account when rating the liveability of different places. These surveys try to take into account how happy or sad people feel, and look for the factors in their lives and environments that cause these feelings. This information is then placed alongside more objective measures in order to give a more complete picture of liveability.

REVIEW 4.1.5

Remember and understand

1. How do companies measure the liveability of places around the world?
2. What are the objective measures of liveability for countries? Why are these important?
3. What are subjective measures of liveability and how are they measured?

Apply and analyse

4. Safety is a key liveability measure in all communities.
   - **a** What do you think are the most important safety issues for people living in large Australian cities?
   - **b** What are the most important safety issues for people living in Syria?
   - **c** What safety issues are similar and which are different?

Investigate and create

5. Can you really measure wellbeing and happiness? Consider your responses to the following:
   - **a** How satisfied are you with your life?
   - **b** How happy did you feel yesterday?
   - **c** How anxious did you feel yesterday?
   - **d** To what extent do you feel the things you do in your life are worthwhile?
6. Identify factors that influence people's answers (e.g. age and gender).

4.1

CHECKPOINT

WHY DO PEOPLE'S PERCEPTIONS OF THE LIVEABILITY OF PLACES VARY?

- **Investigate factors influencing perceptions of the liveability of places**

1 Why is the concept of place important in geography? What does it help geographers do? [10 marks]
2 Explain the term 'liveability'. [5 marks]
3 Identify and describe two environmental features of a liveable place. [4 marks]
4 Identify and rank three human factors that influence the liveability of a place. [6 marks]
5 What features shown in Source 4.1 tell you that many people live in the suburb of Bondi Beach? [5 marks]
6 Why do you think people choose to live in Bondi Beach? [5 marks]
7 Explain how the EIU determines its ranking of the liveability of cities around the world. [5 marks]
8 Account for the differences in liveability of cities across Australia. [10 marks]

TOTAL MARKS [/50]

RICH TASK



Source 4.20 Your school's recreation areas

Local area fieldwork

You can find out a lot about your local area through investigations that involve fieldwork.

During any geographical inquiry, geographers will ask questions, collect a range of data and information, record their findings, and represent them so they can be interpreted more easily. By following a process of geographical inquiry like this, geographers can be sure that the conclusions they reach will be accurate, useful and reliable.

Your key inquiry question: How well do you know the area around your school?

Acquiring geographical information

1 In small groups take a series of 8 to 12 digital photographs, with your mobile phone or camera, in the local area around your school. If possible, also make a sound recording at each location.

Processing geographical information

2 Sort the photos so that the places you like the best are displayed first and the ones you like the least come last. (This can be done in hard copy or digitally, as a slide show.)
3 Are there any patterns evident in your chosen photo order? Describe them.
4 What features in each photo would you change to make you like the place more?
5 Place a coloured sticker (red, yellow, green) onto each photo depending on how it makes you feel. Red = unhappy, yellow = neutral, green = happy.

Communicating geographical information

6 Create a class map of the area around your school. If this is a digital map, also add the sound recording at each location.
7 Each group marks the location of each of their photographs on the map, with the same coloured dot they have chosen for the photograph.
8 To what extent do you agree or disagree with the following statement? 'I feel that my neighbourhood is a safe place to live.'



Source 4.21 How do you get to school?

SKILL DRILL

Drawing sketch maps

One of the most useful skills a geographer can master is drawing sketch maps. Sketch maps show the main features of the landscape that you are studying, but do not contain the details you would be expected to include on a formal map. Source 4.22 is an example of a sketch map.

Step 1 While conducting fieldwork you will probably start with a basic outline map of the main features of the location you are studying.

Step 2 Concentrate on the issue or problem that you are investigating. If you are studying the area around your school, for example, you might mark on your map features such as parks and bus stops.

Step 3 Label the features that you recognise. Keep your writing neat and level across the page.

Step 4 Look around the area you are studying in your fieldwork and find other examples that support your inquiry question. Locate and label these on your sketch map. You may find it best to shade large areas, such as sporting fields, and to add a legend to show the shading and any other symbols you use.

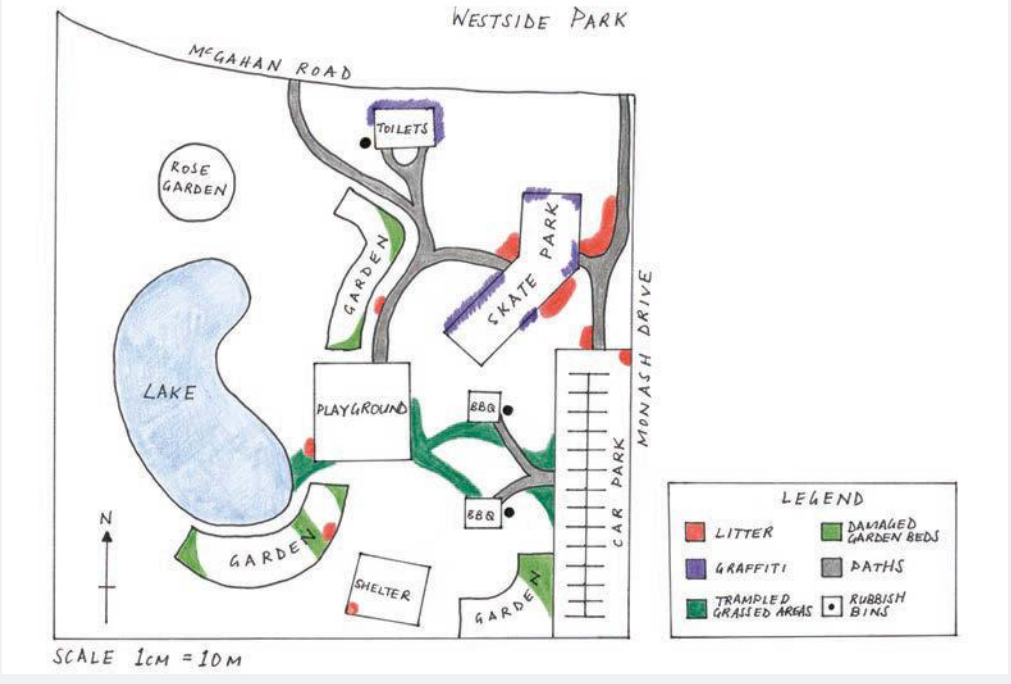
Step 5 Add carefully labelled arrows to show examples of movement. For example, in the sketch of your local area, an arrow might show the direction of cars in a one-way street. Other examples may include the movement of people, water or transport.

Step 6 Add any examples you can find of change over time; for example, new buildings or outdoor seating areas, landscaping, pathways and fences.

Step 7 Add a title that includes the date, and a north arrow. (You may need to use a compass.)

Apply the skill

1 Create a sketch map of the area around your school. Remember that all maps show a view from directly above. On your sketch map, show how people have managed this area.



Source 4.22 A sketch map of a local park identifying the locations of a range of environmental issues.

Source: 8B Gumtree College

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Change
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Fieldwork, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

4.2 WHY ARE SOME PLACES MORE LIVEABLE THAN OTHERS?

WHAT EFFECT DOES ENVIRONMENTAL QUALITY AND ACCESS TO SERVICES HAVE ON PEOPLE'S WELLBEING?

The importance of place

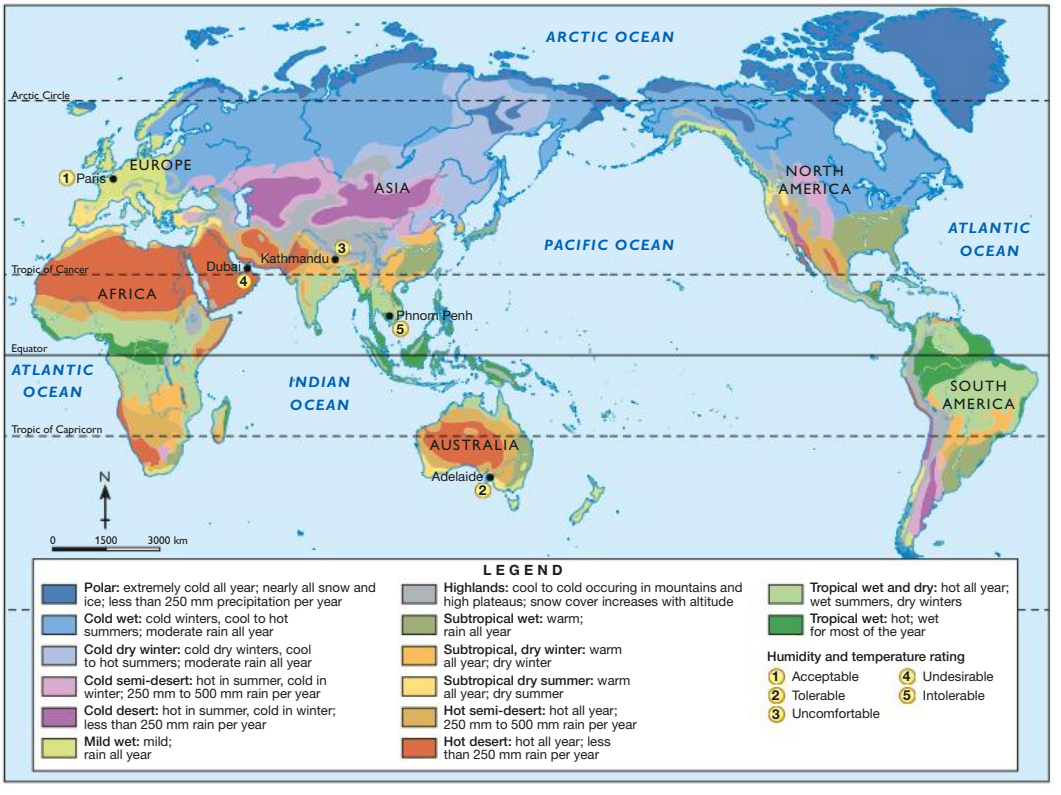
Where we live influences many aspects in our lives – the hobbies we pursue, the friends we make, the skills we learn, the jobs we do, the teams we join. It is almost impossible to find a place to live that meets all our desires. So we compromise, trading one factor for another.

Liveability and wellbeing

People's basic requirements for life are the same wherever they live – in **urban, rural** or **remote** places. These basic needs include fresh water, a secure food supply, shelter, clothing and safety. Once these primary requirements are met, other needs become important to secure our wellbeing. Wellbeing is the ability of people to access the things they need in order to live happy, healthy and contented lives. These secondary needs include:

- environmental quality – climate conditions, levels of pollution, **sustainability** of lifestyle, **vulnerability** to hazards, safety and stability
- access to services and facilities – infrastructure, health care and education.

WORLD: CLIMATE ZONES



Source 4.23

Source: Oxford University Press

SKILL DRILL

Comparing climate graphs

Climate graphs show the maximum and minimum temperatures as **line graphs** using the scale on the left-hand vertical axis, and rainfall as a **bar graph** using the scale on the right-hand vertical axis. The months are shown on the horizontal axis. By comparing climate graphs, geographers can better understand the differences between climates and the reasons for them.

Step 1 Select climate graphs for two locations for comparison.

Step 2 Describe the climate of one of these locations. Include the following elements of climate.

- The rainfall pattern: Mention whether rainfall is consistent during the year or if there are clear wet and dry seasons. Mention the highest rainfall month and any periods with little or no rainfall.
- The temperature pattern: Mention periods of warmer and colder temperatures, if these occur. State whether there is a more even temperature throughout the year state. Use temperature figures in your description.

Step 3 Describe the climate of the other location, using the same method.

Step 4 Point out the obvious differences in the climates of the two locations.

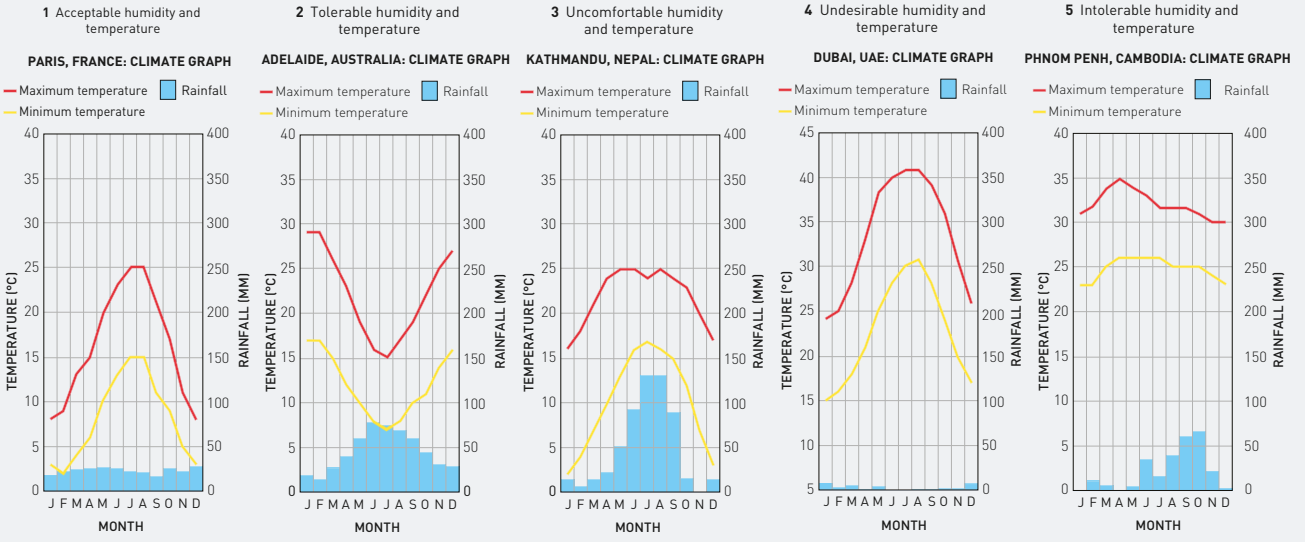
Step 5 Try to explain these differences. For example:

- Places nearer to the Equator are warmer than places closer to the poles. They also tend to be wetter with rainfall occurring throughout the year.
- Places near or beside oceans have milder climates with fewer extremes than places in the centre of large land masses.
- Places at high altitude are colder than places at sea level. They are often wetter as well.

Step 6 Point out any similarities between the two locations.

Apply the skill

1 Using the steps outlined above, compare the climate of two cities shown in Source 4.24.



Source 4.24

REVIEW 4.2.1

Remember and understand

1 Which city has acceptable temperature and humidity?

2 What is the connection between climate and liveability?

Apply and analyse

3 Why do you think Kathmandu's climate has been described as uncomfortable?

4 Look carefully at Sources 4.23 and 4.24.

a Which city has intolerable humidity and temperature?

b What type of climate does this city experience?

c What types of climate are experienced by the cities that have acceptable levels of humidity and temperature?

Investigate and create

5 How do people adapt to living in places with undesirable climates?

6 What features of the natural environment other than climate may affect a city's liveability?

LIVING IN URBAN PLACES

Most Australians choose to live in large capital cities where access to services is easiest. The greatest growth in capital cities usually takes place around the outer edges of metropolitan areas. New suburbs appear on what was once farmland along the **rural–urban fringe**. As new housing estates are built on the farmland or bushland adjoining the suburbs, other services are attracted to these new suburbs to service the growing population. Schools, shopping centres, medical centres and sporting facilities become established to meet the needs of the residents. Industries are also attracted to the cheaper land and rents of the outer suburbs.

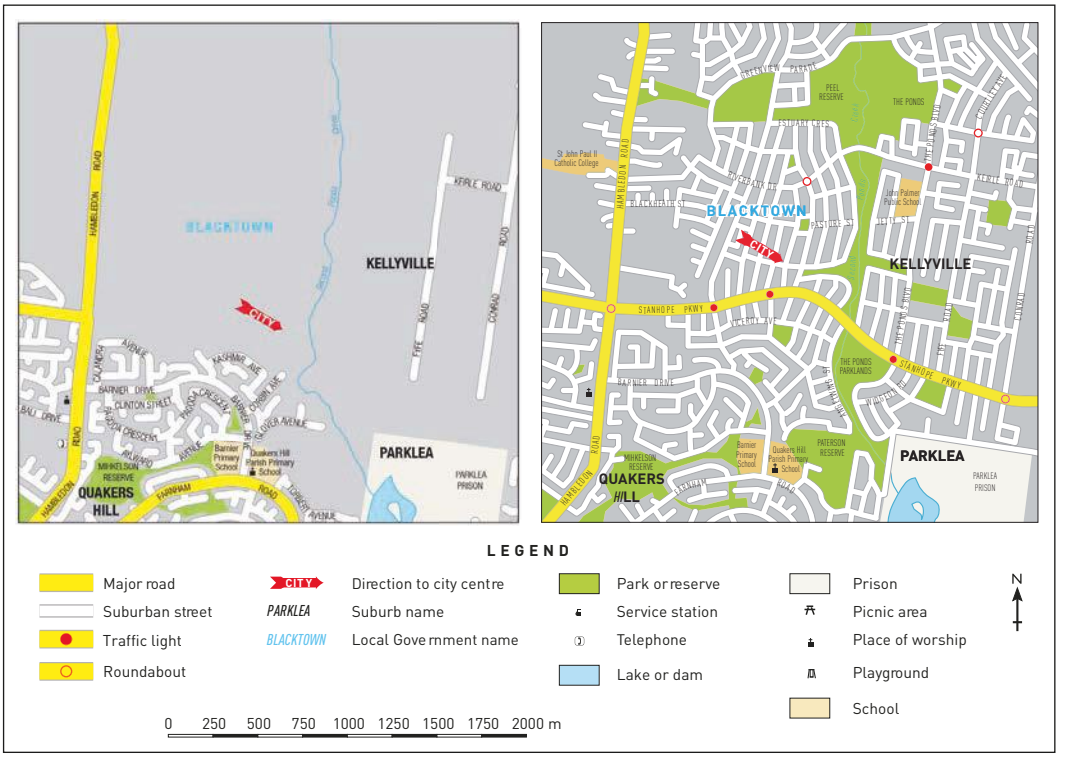
CASE STUDY

Blacktown City, New South Wales

A modern, bustling city of 48 residential suburbs, Blacktown City is home to over 330 000 people, making it the largest city by population in New South Wales. Parklea and Kellyville Ridge are two of its fastest growing suburbs. Located on the fringe of the metropolitan area in western Sydney, Parklea – Kellyville Ridge has grown by 9.4 per cent in 2013–14. It is one of the fastest-growing areas in Australia, having increased by 2700 people over the same period to reach 31 800. This remarkable growth has been sustained with expanding land releases (see Source 4.25). At the 2011 **census**, the area had a population of 22 404. This population is growing rapidly. This is due to a range of factors, including the overall growth of Sydney, the relatively cheap land and the building of major roads, such as the Westlink M7 linking the M2, M4 and M5 motorways, and other services.

There are a number of schools in the region along with other **amenities**, such as public pools, libraries and a university. Blacktown City also has numerous shopping areas, including large shopping centres, shopping strips along major roads and its own central business district (CBD). Blacktown City is linked to other parts of Sydney, including its CBD, by a road and rail network. In common with other regions of Australia with a rapidly growing population, Blacktown City struggles at times to meet the demands of all its

PARKLEA – KELLYVILLE RIDGE: 1997 (LEFT) AND 2015 (RIGHT)



Source 4.25
Source: Oxford University Press

residents. It can be very difficult to find rental accommodation, and some public facilities, such as hospitals, have experienced problems in dealing with a large, growing and diverse population.

Many residents of the western suburbs work closer to the centre of the city and use private vehicles to travel to and from work. This puts hundreds of thousands of cars on the road during the morning and afternoon peak periods, causing traffic jams and long delays. The road system struggles to cope with this heavy demand; at peak hour, the average speed on the freeways and tollways slows from 100 kilometres per hour to less than 30 kilometres per hour. These problems are only set to become worse in the next few decades when the population of western Sydney is expected to reach four million.



Source 4.26 An oblique aerial photograph of Blacktown looking towards the Sydney CBD





Source 4.27 Blacktown has a large population of refugees and migrants. (Left) These girls are being introduced to AFL football at Blacktown Olympic Park. (Right) There is extraordinary community support for the Western Sydney Wanderers A-League football team, the first Australian team to win the AFC Champions League.

REVIEW 4.2.2

Remember and understand

1 Where does the greatest growth in capital cities generally occur?
2 What change takes place as suburbs spread to the rural–urban fringe?
3 Why are some industries attracted to the outer suburban areas?

Apply and analyse

4 What problems do town planners in Blacktown face?

Investigate and create

5 Refer to Source 4.25.
a Construct a sketch map of Blacktown in 1997. Show the main roads and label the schools and prison. Shade in green the area of the map used for housing. These are the areas with the short, curving streets.
b On your sketch map add the changes that had occurred by 2015. Shade in red the new housing areas and label any new schools and main roads.
c Describe the changes that occurred in this area between 1997 and 2015.
d How do you think this area will change in the next 15 years?

LIVING IN RURAL PLACES



Many parts of Australia are used to raise animals and grow crops for food. The type of farming carried out in different areas is generally determined by climate and the availability of water. Farms vary from small properties used to grow crops, such as grapes or vegetables, to huge stations the size of European countries where cattle are raised.

Living on a farm can be very different from living in a city. It can be more difficult to access services, such as schools, shops and doctors. The population of many rural areas is declining because people move to cities for better job opportunities and a wider range of education options. There are also many advantages to living on a farm. Farms are often family-run businesses and this gives farmers the opportunity to be their own boss. There is also less air pollution, noise and traffic in rural areas. In recent years, advances in information and communication technology have reduced the disadvantages of living in a rural place.

CASE STUDY

Western District dairy region Victoria

The largest industry in rural Victoria is dairy farming. There are more than one million dairy cows in the state and they produce more than 6 billion litres of milk a year. There are three main dairy farming regions in Victoria – in the north near Echuca; south-east of Melbourne; and in the Western District, centred on the city of Warrnambool.

Source 4.28 is a map of the Western District dairy farming region. On the map each town is shown in the centre of a green circle. The size of each circle is determined by the number of people living in the town. The bigger the population, the bigger the circle. This makes it easy to see where the larger towns and cities are located in this region and allows us to see a pattern in this distribution. These circles are called proportional circles.

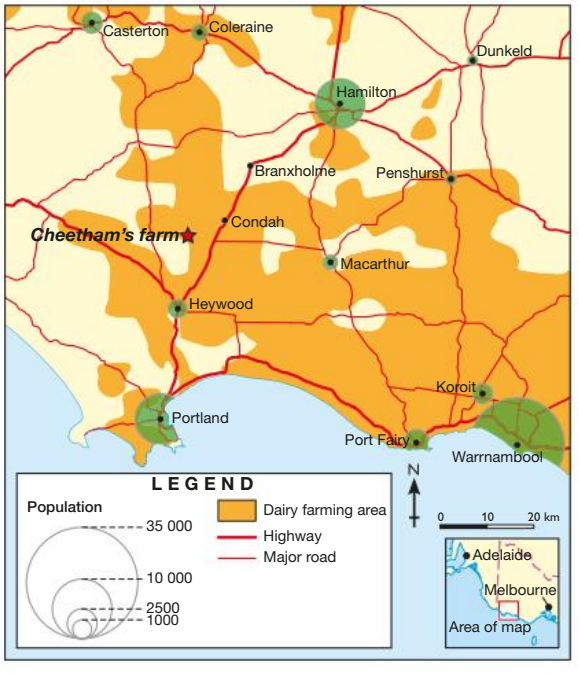
Near the small town of Condah, in the Western District of Victoria, lies the dairy farm of Sam and Kristy Cheetham. In common with many farms in Australia, this dairy farm is a family-run business.

The farm has grown over the years as the family has bought more land. Several workers are employed to help milk the cows twice a day and carry out other farm jobs, such as mending fences and looking after the grazing paddocks. These workers and their families also live on the Cheetham's farm.

The Cheetham's farm is located close to several small towns and some distance from larger towns and cities. The small towns of Condah and Branxholme have very few shops and the Cheethams only visit these places for basic items, such as bread. The closest supermarket is in Heywood, 24 kilometres away, as is the closest bank. Heywood has a population of 1300, which is large enough to support a wider range of retail shops and other services than the smaller towns. These include a doctor, vet and several schools.

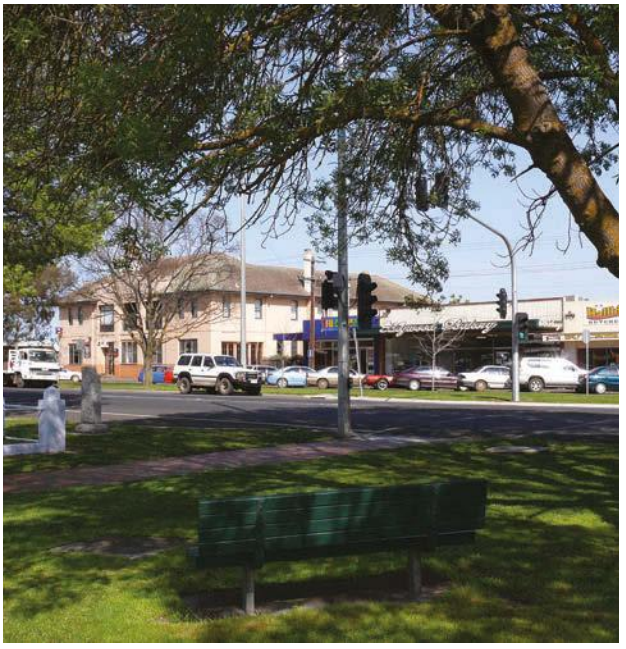
Larger towns include Hamilton and Portland, and Warrnambool is the closest regional city. These places have a wide range of shops and other services, such as large hospitals and secondary schools. They need only visit Victoria's capital city a few times a year for major services, such as an international airport or specialised health care. They also travel to Melbourne for sport and entertainment as most large events of this type are not held in regional areas.

VICTORIA: WESTERN DAIRY REGION



Source 4.28

Source: Oxford University Press



Source 4.29 Heywood's main shopping street



Source 4.30 Warrnambool's main shopping street

Towns and cities in rural areas tend to be located a certain distance apart. This is determined by the size of the population and the services available in that town or city. Large towns (such as Warrnambool, Portland and Hamilton) offer a large range of goods and services and are spaced well apart. They need to draw in people from a bigger distance to support services they offer. Small towns, such as Condah, only have a few shops and services to support the local community.



Source 4.31 Branxholme's main shopping street

REVIEW 4.2.3

Remember and understand

1. How does living in a rural area differ from living in a city?
2. What are Victoria's three main dairy farming regions?
3. What different jobs are done on the Cheetham farm?
4. Where would the Cheetham family go to buy each of the following?
   - **a** a loaf of bread
   - **b** a packet of breakfast cereal
   - **c** a pair of jeans
   - **d** a new television
5. Look at Source 4.31. What services and supplies do you think might be available in Branxholme?

Apply and analyse

6. Look carefully at Source 4.28.
   - **a** List the three largest towns in the region.
   - **b** What is the approximate population of the largest town?
   - **c** Why do you think there are a lot of of small towns and only a few large towns?
   - **d** Why are proportional circles useful on a map?

Investigate and create

7. List one product and one service that you think would only be available in the very largest towns in the region.
8. List one product and one service that people in the region might need to travel to Geelong or Melbourne to purchase.

LIVING IN COASTAL PLACES

Eighty-five per cent of all Australians live within 50 kilometres of the coast. As a result, nine of our 10 largest cities sit on the coast. As well as huge cities such as Sydney and Melbourne, there are hundreds of smaller communities dotted along our coastline. Outside the capital cities, these coastal communities tend to be the fastest growing regions in each state. In Queensland, it's the Gold Coast and the Sunshine Coast, in Victoria, it's the Surf Coast, and in New South Wales almost the entire coastline is dotted with seaside towns such as Byron Bay, Coffs Harbour, Port Macquarie in the north, and Shellharbour, Batemans Bay and Merimbula in the south.

Coastal towns and cities are growing in size and population across Australia due to a range of factors. Many people decide to move to the coast because they want a more relaxed lifestyle near natural features such as beaches, bays and other landforms. Geographers refer to this trend as a 'sea change'.

CASE STUDY

Shellharbour, New South Wales



Shellharbour is located on the New South Wales coast, about 100 kilometres south of Sydney. It has long been a popular holiday destination, particularly during the warmer summer months. On summer weekends, the population of the town can double, as people travel from Sydney and Canberra to take advantage of the beaches and relaxed lifestyle of this coastal town. The number of permanent residents is also growing. In 2015, the town's population was approximately 68 000. By 2035, the population of Shellharbour is expected to grow by an additional 25 per cent. As with any change, there are both benefits and costs to this population increase.

Coastal towns close to large cities attract sea changers, because they offer the option of living in the coastal town and commuting to work in the city. Shellharbour's proximity to Sydney makes it a popular choice for this reason, and a fast train service and new station facility at Shellharbour Junction have reduced the journey to the Sydney CBD to about 90 minutes.

Shellharbour also attracts many retirees. In some cases, after retirement, people are moving permanently into holiday homes they already own and in other cases they are building new homes to live in. As more Australians reach retirement age, it is expected that the demand for new homes and services such as health care, education and roads will increase dramatically in the sea-change towns like Shellharbour.

NEW SOUTH WALES: SOUTH COAST (SHELLHARBOUR)



Source 4.32

Source: Oxford University Press

While real estate agents and builders welcome the new residents, not everyone feels the same way. Some people are concerned that the once small town of Shellharbour will become exactly the type of suburban development the sea changers are trying to escape. Farmland, sand dunes and older residential areas are being redeveloped as retirement villages and housing estates. New businesses such as Stockland Shellharbour are threatening the survival of smaller, well-established local businesses. Changes like this often cause conflict in the local community. In some cases the small seaside village that attracted the 'sea changers' in the first place becomes more city-like over time as more people move in – almost as hectic as the urban environments they left.



Source 4.33 Killalea Beach or 'The Farm' as locals call it



Source 4.34 New homes have replaced dairy farms in Shellharbour.

REVIEW 4.2.4

Remember and understand

1 How does living in a coastal area differ from living in a city?
2 What has made it possible for residents in Shellharbour to enjoy both coastal and city life?
3 What is a sea change?
4 What is Shellharbour's population expected to be in 2035?

Apply and analyse

5 Examine Source 4.32.
   a What are the largest towns on the south coast?
   b Where do you think people on the south coast would go to shop at department stores or purchase expensive items such as cars?
   c How far is Shellharbour from Wollongong?
6 Explain the following statement: 'Some people are concerned that the once small town of Shellharbour will become exactly the type of suburban development the sea changers are trying to escape.' Why might some people feel this way?

Investigate and create

7 Research an 'intentional community', such as:
   - an ecovillage (e.g. Lammas in Pembrokeshire, UK, or Crystal Waters in Queensland)
   - a commune (e.g. Nimbin, NSW)
   - a kibbutz (e.g. Israel)
   - an ashram (e.g. Mangrove Mountain, NSW)
   - a housing cooperative (e.g. Jindibah in Byron Bay, NSW).

   a Describe its location.
   b What type of intentional community is it? What is its purpose?
   c Identify the advantages and disadvantages of living there.

LIVING IN REMOTE PLACES

Most Australians live in large cities on the coast, with very few people living in the centre of the continent. Much of the interior of Australia is **desert** or semi-desert, with large distances between towns and settlements. Geographers refer to these areas as remote because people living in these areas have difficulty accessing some goods and services. Providing basic services (such as roads, food, water, telephone and Internet access) to remote communities can be difficult and expensive.

A high proportion of Indigenous Australians live in regional and remote areas – almost half of the population compared with just 13 per cent of the total population. For many Indigenous Australians this decision is based on a deep connection to the land that began thousands of years ago.



Living in the desert

Australia is the second-driest continent in the world, after Antarctica. Seventy per cent of our continent receives less than 500 millimetres of rainfall each year. This low rainfall has produced large deserts across much of inland Australia. Deserts are some of the harshest places on Earth. The people who live in desert communities must overcome many challenges.

CASE STUDY

Yuendumu

One desert community is based in the town of Yuendumu, located 290 kilometres from Alice Springs in the Northern Territory. Not only is it located in the Tanami Desert, it is also one of the most remote places in the world. It is so remote that few locals have ever seen the sea.

The Warlpiri people

The Warlpiri people of Yuendumu do not see land as something to be owned. Instead, they believe that they belong to the land. This deep sense of connection to a particular place can be very difficult for non-Indigenous Australians to understand. In the same way, Warlpiri people find a system of landownership difficult to understand.

The Warlpiri system of family and relationships is complex. A crucial part of any Warlpiri child's education is to learn about this system. It helps them to understand the natural and social world and a person's place within it. This system binds the Warlpiri people to each other and to the land.



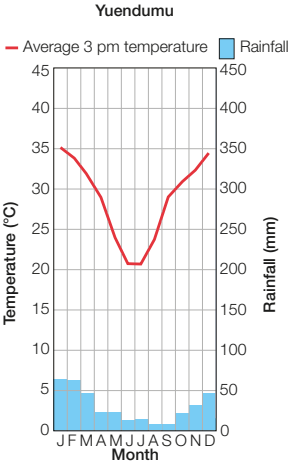
Source 4.35 The Yuendumu Pool opened in 2008. Children can only swim here if they regularly go to school.

Problems and challenges

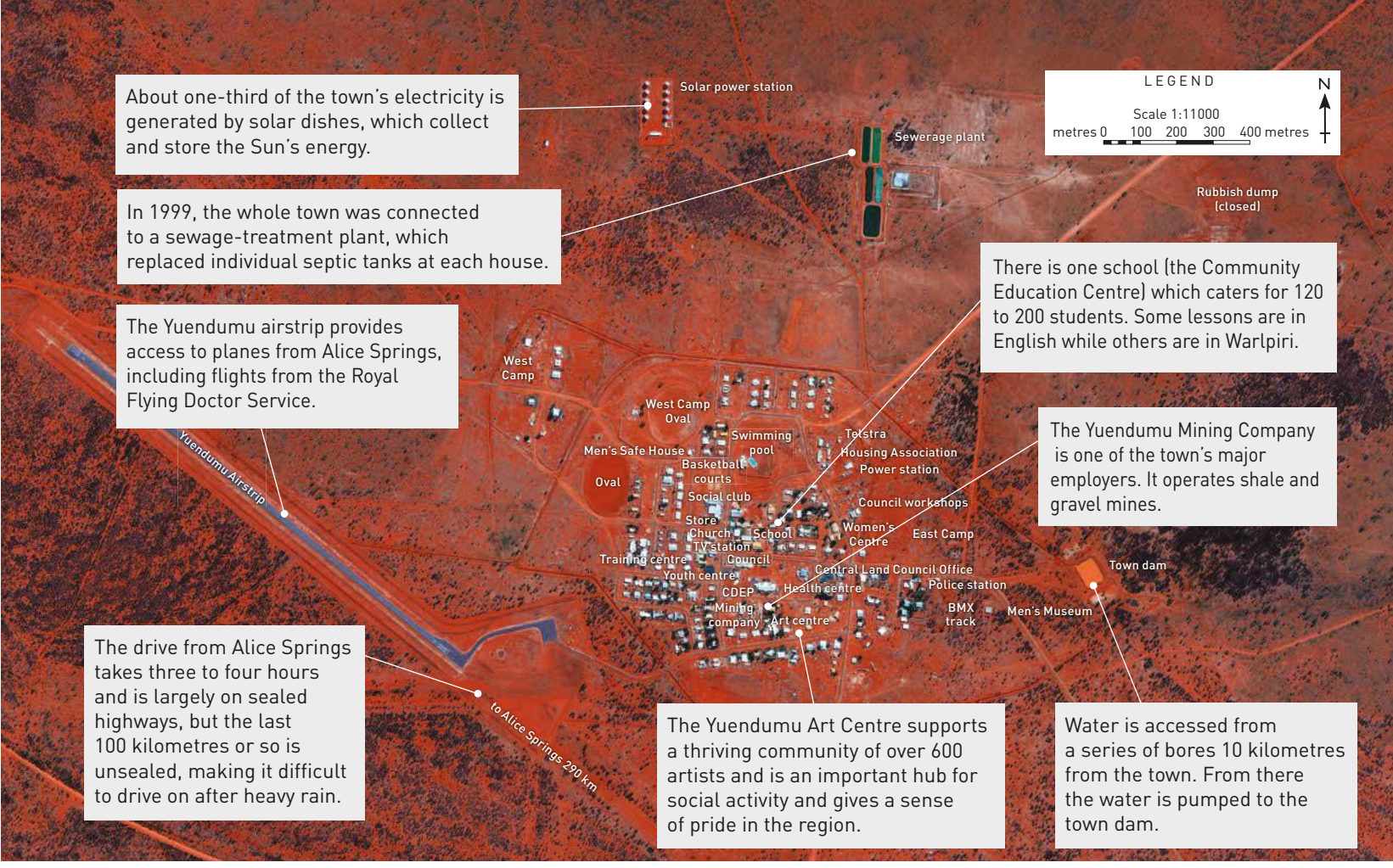
Living in Yuendumu presents many challenges. The isolation from other places is the most obvious of these. In recent years, sealed roads, the airstrip, telephones, television and the Internet have helped to connect Yuendumu to the outside world. However, many older people in the community worry that better transport and communication will break down the customs of the Warlpiri people.

As with other remote Aboriginal communities, health problems, such as eye diseases, are common. Substance abuse among young people, particularly petrol-sniffing, was once a serious problem, but a strong community response has largely brought an end to this practice. This involved providing young people with a better range of activities and making substance abuse unacceptable.

YUENDUMU: CLIMATE GRAPH



Source 4.36



Source 4.37 A satellite image of Yuendumu



Source 4.38 The solar power station provides 50 per cent of daytime electricity needs to Yuendumu and enables significant reduction in the diesel fuel used in power generators in the community.

Living in the Pilbara

Australia is a mineral-rich country. We have the world's largest deposits of brown coal, mineral sands, nickel, uranium, zinc and lead. We also rank in the top six in the world for reserves of other minerals, such as bauxite, black coal, diamonds, copper, gold and iron ore. Iron ore is used to produce steel, which is an important part of many industries around the world. Some of the world's largest and richest iron-ore deposits are in an area of Western Australia known as the Pilbara.

Some mining workers live in towns in the Pilbara close to the mines where they work, such as Tom Price, Newman and Paraburdoo. These towns can be hard places in which to live as

they tend to be very isolated. Their remote location means that some goods and services can be difficult to access. The perception of these towns as less liveable than other centres in Australia means that workers are offered very attractive salaries and conditions to come and work in the remote Pilbara region. Many miners prefer to live a **FIFO** ('fly in, fly out') lifestyle. This means that they live in large cities, such as Perth, for two weeks and then fly to the mines to work for two weeks. While this type of routine may suit single workers, married workers generally find that this places a strain on their families.

AUSTRALIA: MINERAL, URANIUM AND COAL RESOURCES



Source 4.39

Source: Oxford University Press

CASE STUDY

Tom Price, Western Australia

In many ways Tom Price is a typical mining town. It is home to about 2700 people, almost all of whom are involved, directly or indirectly, in the mining industry. Of the workers in the town over the age of 15, almost 50 per cent work in the mines. Half of these workers categorise their jobs as machinery operators or drivers.

The children who attend one of the three local schools almost all have at least one parent employed at the mine. The local high school works in partnership with the international mining company that owns and operates the mine, Rio Tinto, to educate students about jobs in mining. The supermarket, milk bars, service stations, vets, chemists, doctors, hardware store and carpet cleaner all rely on the income from miners to keep their businesses running. While this is great for the town when the demand for iron ore is high, it can cause problems when demand falls. Industries and places that rely on selling one resource, such as a particular mineral, are sometimes referred to as being in a 'boom or bust' cycle.

Another problem facing the residents of Tom Price is a shortage of homes. During boom times, new workers and people looking for work at the nearby mine arrive regularly and need accommodation. This demand for housing means that house prices go up quickly, making it difficult for young adults in the town to buy a house. In the Pilbara mining town of Newman, for example, houses tripled in price between 2004 and 2008.

SKILL DRILL

Understanding population pyramids

Population pyramids are bar graphs that show the percentage of males and females of different ages in a population. They help geographers compare different groups within a population and also allow them to identify trends and patterns of change (for example, in a city or country). Follow these steps in order to understand population pyramids:

Step 1 Be sure to read the title of the population pyramid carefully. This will tell you exactly what population is being studied. Also look at the labels running along the bottom (percentage or total population) and through the middle of the pyramid (age groups).

Step 2 Population pyramids are organised so that the younger age groups are at the bottom and the older age groups are at the top. Percentages (or numbers) of men are always shown on the left-hand side and percentages (or numbers) of females are shown on the right-hand side.

Step 3 To compare the percentage of males and females in the same age groups, read across the rows. The scale on the male side begins at zero and increases from right to left. The scale on the female side begins at zero and increases from left to right.

Step 4 To compare the percentage of only males or females, look up and down the columns.

Apply the skill

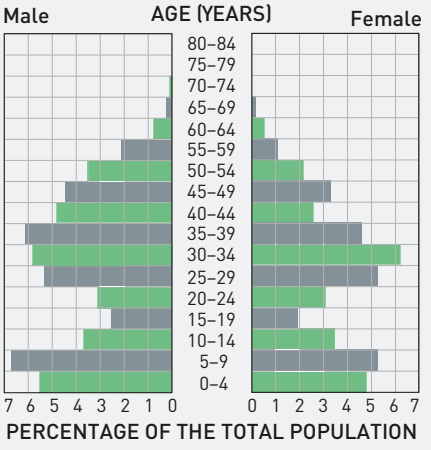
1 Using Source 4.41, complete the following tasks:

- **a** What percentage of the population in Tom Price is girls aged 10–14?
- **b** Are there more men or women aged 35 to 39 in Tom Price?
- **c** Which is the largest single group in Tom Price?
- **d** Is there a greater percentage of males or females in Tom Price? Why might this be the case?
- **e** Which group in Tom Price is the smallest? Try to estimate what percentage of the total population is made up by this group.



Source 4.40 Tom Price iron-ore mine in Western Australia

TOM PRICE: POPULATION PYRAMID



Source 4.41
Source: Oxford University Pres

REVIEW 4.2.5

Remember and understand

1 What services are difficult to supply to remote areas?

2 Explain why not many people live in the centre of Australia.

3 Why don't the local Warlpiri people just move to a different area with more services?

4 How many people live in the town of Tom Price and what work do they do?

5 Why do some people choose FIFO?

Apply and analyse

6 Use the information provided in Source 4.37 to create a table listing all the services available in Yuendumu. List each of the services under the following headings: water and sanitation; transport; power; industry; education; and recreation.

7 Explain how the land ties the people of Tom Price and Yuendumu to their remote locations.

Investigate and create

8 'People come and go all the time and there's just no community spirit … no one's helping out in the volunteers groups, there's no one playing sport, there's no one shopping.' (East Pilbara Shire Chief Executive Allen Cooper [*ABC News*, 22 November 2015] criticising FIFO in his town.) Explain why this is happening and suggest a possible solution.

CASE STUDY

LIVING ON MACQUARIE ISLAND

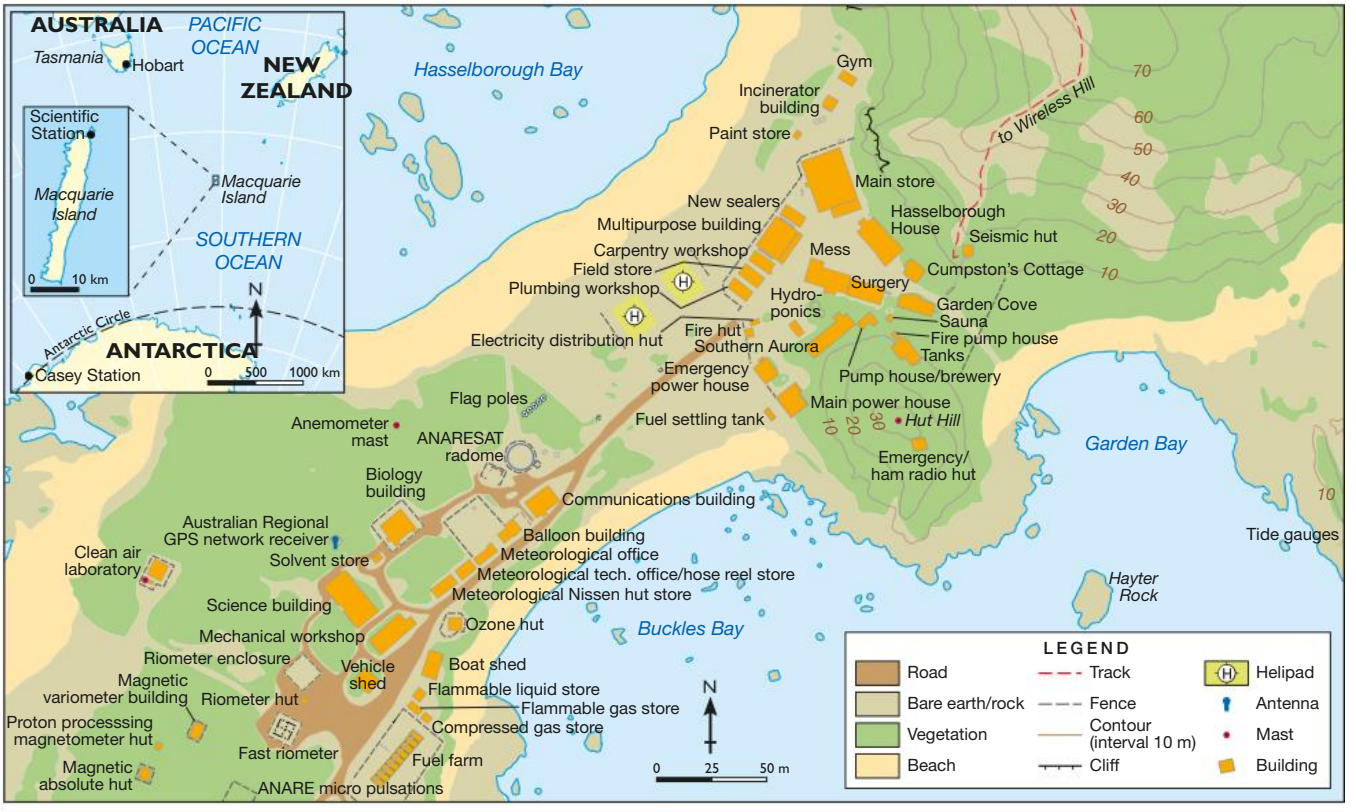


Macquarie Island is one of the most remote places on Earth. It is located in the Southern Ocean, approximately halfway between Australia and Antarctica. Macquarie Island is an Australian territory and home to about 40 scientists in summer and about 20 in winter. They live and work in the research station on the northern tip of the island. At the station there are facilities such as buildings in which to sleep and eat, a diesel power station, a hydroponics building for growing vegetables, helicopter pads and even a brewery. From here the scientists explore the island and try to find out more about the island itself and the animals and birds that live there.



Source 4.42 Oblique aerial view of the scientific base on Macquarie Island

MACQUARIE ISLAND SCIENTIFIC STATION (INSET: MACQUARIE ISLAND'S LOCATION)



Source 4.43

Source: Oxford University Press

SKILL DRILL

Preparing fieldwork sketches

Fieldwork sketching helps geographer's record and label important aspects of the landscapes they are investigating. It is a skill that you will need to practise before taking part in any field trips.

Apply the skill

Step 1 Boundaries and border: Establish the boundaries of your landscape and draw a border of the correct shape.

Step 2 Sketch outlines: With a pencil, lightly sketch the main landscape lines. If there is a horizon in the scene put this about one-third from the top of the frame.

Step 3 Details: Keeping in mind the features on which you want to focus, add detail to your sketch. Label those parts of the scene that you consider to be most important.

Step 4 Shade: Add shading, which helps to establish depth in your sketch and to show the shape of objects.

Step 5 Colour: Add some colour if you wish. Do not try to copy every subtle colour of nature; just give a hint of the right colour.

Step 6 Finishing touches: Label your sketch with the location and date.

1 Imagine you are on a field trip to Macquarie Island and that the scene in Source 4.21 is in front of you. Follow the steps to create a field sketch of the scene and use the map to help you label the key features.

REVIEW 4.2.6



Remember and understand

1 Why is Macquarie Island considered remote?

2 How do you think people on Macquarie Island access supplies?

3 Use the scale on Source 4.43 (inset) to estimate the distance from Hobart to Macquarie Island.

Apply and analyse

4 Consider the challenges faced by those living in remote places.

- **a** What challenges do you think the scientists on Macquarie Island would face?
- **b** In what ways are these challenges similar to those faced by people living in a remote region on the Australian mainland? In what ways are they different?

5 How do you think modern communication technology, such as satellites and the Internet, help to overcome some of the challenges faced by scientists on Macquarie Island?

6 What difficulties might the scientists experience travelling to their work sites?

Investigate and create

7 Macquarie Station is used for scientific research but is also a home to a team of scientists and researchers.

- **a** Find three features of the station that show that this is a place where people live.
- **b** Make a list of the buildings that are used for science and research.
- **c** What do the names of these buildings tell you about the type of research that is undertaken on the island?

8 Compare the **oblique aerial photograph** of the station (Source 4.42) with the map (Source 4.43).

- **a** What is the large circular object in the centre of the photograph?
- **b** What colour is the hydroponics building? What is hydroponics and why is it important in this place?
- **c** In which direction was the photographer facing?

4.2

CHECKPOINT

WHAT EFFECT DOES ENVIRONMENTAL QUALITY AND ACCESS TO SERVICES HAVE ON PEOPLE'S WELLBEING?

- **Investigate the impact of environmental quality on the liveability of places**
- **Investigate the influence of accessibility to services and facilities on the liveability of places**

1 Identify people's basic requirements for life. [5 marks]

2 Why do most people in Australia choose to live in large capital cities? [5 marks]

3 List three challenges to wellbeing of living in a remote community. [6 marks]

4 Think of a town or city you know well. What services and facilities could make this town or city more liveable? [10 marks]

5 Describe the type of climate that makes a place more liveable. [4 marks]

6 Rank the following factors in order of what makes a place most liveable for you: safe, easy to get around, good health care, good work and education opportunities, affordable, diverse, sustainable, attractive. Justify your first and last ranked factors. [6 marks]

7 The town of Yuendumu (Source 4.37) is one of the most remote places in the world. Identify seven examples of infrastructure in the town and describe how each has contributed to improving liveability. [14 marks]

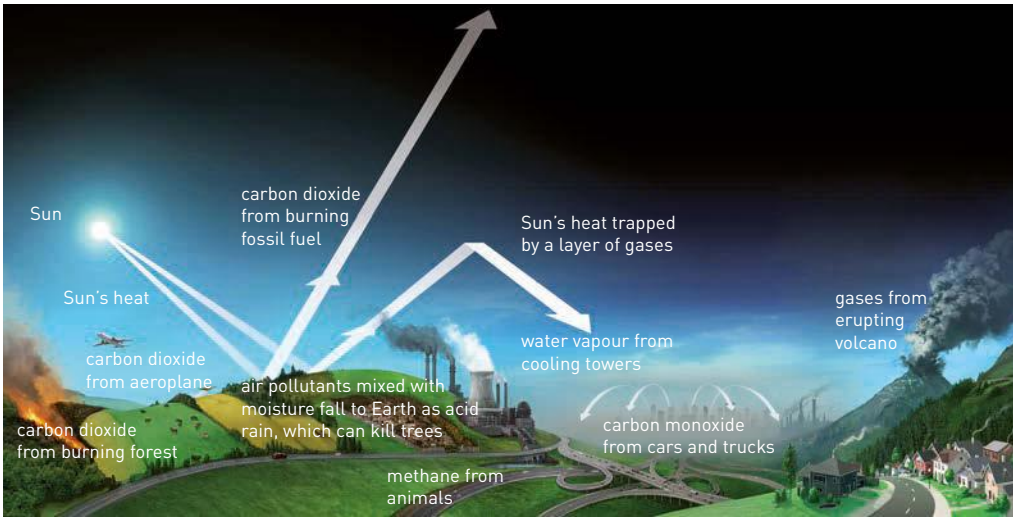
TOTAL MARKS [/50]

RICH TASK

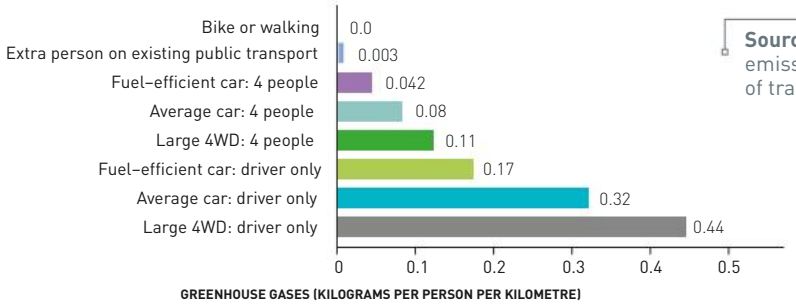
A sustainable lifestyle

Living a sustainable lifestyle attempts to reduce an individual's or society's use of the Earth's natural resources. The more we consume – water, energy, food, paper, plastic, glass, metals – the more waste and pollution we generate. The results of overconsumption can have a big impact on our health. The quality of air, water and parklands in cities, for instance, is an important part of liveability for both health and aesthetic reasons.

Air pollution tends to be worse in large cities where factories, power stations and motor vehicles spew harmful gases into the air. The polluted air can sometimes be trapped close to the Earth's surface as smog, or thrown high into the atmosphere where it can contribute to a layer of gases responsible for global warming. Increasing numbers of people and cars on our roads mean we need to take action to improve the quality of the air we breathe.



Source 4.44 Sources of air pollution



Source 4.45 Greenhouse gas emissions from different forms of transport

Acquiring geographical information

1 Look carefully at Source 4.44.

- **a** List the causes of pollution in cities.
- **b** List the causes of pollution in rural areas.
- **c** Why do cities such as Sydney, Los Angeles and Mexico City suffer from smog?

2 Look at Source 4.46.

- **a** On which continent are most of the top 10 polluted cities located?
- **b** Why do you think pollution is such an issue in these cities?

Processing geographical information

3 Study Source 4.45.

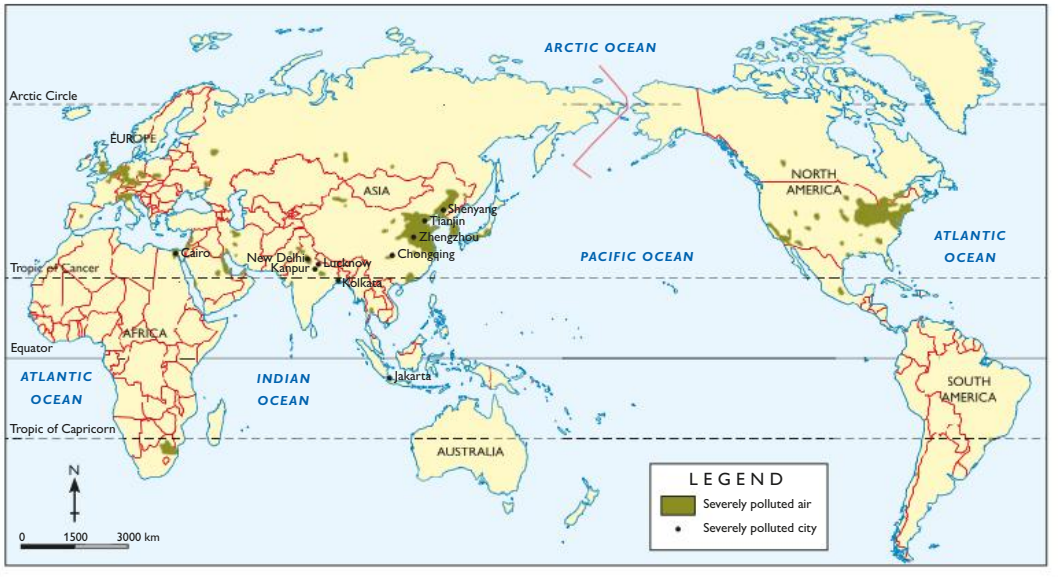
- **a** What is the difference in the amount of greenhouse gases released per person between one person driving a 4WD and four people travelling together in a 4WD?
- **b** What could governments do to encourage more people to share their cars as a way of reducing air pollution?
- **c** List the ways in which car sharing could potentially improve the liveability of a city.

Communicating geographical information

4 How sustainable is your lifestyle? Use the online World Wide Fund for Nature (WWF) ecological footprint calculator to work out your own ecological footprint.

- **a** How many planets does it take to support your lifestyle?
- **b** Suggest four ways that you can reduce your ecological footprint.

WORLD: MOST POLLUTED CITIES



Source 4.46

Source: Oxford University Press

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Environment, Sustainability
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Graphs and statistics, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHECKPOINT

CHAPTER

5



Source 5.1 A young boy living in a slum in the Bangladeshi capital, Dhaka, uses a toilet perched over a river that is also used for drinking and bathing.

LIVEABLE PLACES

There are a range of factors that make places more or less liveable. Liveability is generally measured by factors that provide quality of life, such as access to fresh water, food, housing, transport, health care, education, and a safe and stable environment. A strong sense of community will enhance the liveability of a place. People of all ages who feel a sense of belonging to a community tend to lead happier and healthier lives. In turn, strong communities create a more stable and supportive society, even where environmental quality and access to services and facilities are relatively poor.



HOW CAN STRONG COMMUNITY AND SOCIAL CONNECTEDNESS ENHANCE THE LIVEABILITY OF PLACES?

5.1 SECTION

In this section you will investigate:

- the influence of social connectedness and community identity on the liveability of places

CHECKPOINT 5.1

WHAT APPROACHES CAN BE USED TO IMPROVE THE LIVEABILITY OF PLACES?

5.2 SECTION

In this section you will investigate:

- strategies used to enhance the liveability of places using examples from different countries

CHECKPOINT 5.2



GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Place:** the effect of global trade, transport, information and communication technologies on places across the world
- **Sustainability:** pressures on the Earth's water resources and landscapes; sustainable management approaches
- **Space:** how location influences the ways people organise places
- **Change:** changes to places over time through natural and human geographical processes and events

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** concept maps, topographic maps, street directory maps, thematic maps, choropleth maps
- **Graphs and statistics:** bar and compound column graphs, proportional circles, data tables
- **Spatial technologies:** satellite time-lapse overlays, computer-generated images
- **Visual representations:** oblique aerial photographs, concept maps, infographics

5.1 CONNECTING THROUGH COMMUNITIES

HOW CAN STRONG COMMUNITY IDENTITY AND SOCIAL CONNECTEDNESS ENHANCE THE LIVEABILITY OF PLACES?

A community is a group of people who share something in common. It may be the place in which they live, their religion, their interests or hobbies, their **ethnicity**, their school or their language. Every person on Earth is a member of one or more communities, some by choice and some just by being who they are. To make sense of all the world's communities, geographers take into account the features that all members of a community share. One way to classify these features uses the five Ps shown in Source 5.4.

A group of people who share the same goals and objectives often join together to form communities of purpose to enhance the liveability of places. They are able to achieve much more if they work together than if they work as individuals. One of Australia's largest communities of purpose is Surf Life Saving Australia (SLSA), which has over 150 000 members, virtually all of whom are volunteers. The shared vision of SLSA members is 'to save lives, create great Australians and build better communities'.



Source 5.2 Surf lifesavers making one of the 12 600 rescues carried out in 2015 – they are an example of community of purpose.

SKILL DRILL

Drawing a concept map

A **concept map** is a visual tool used to show the links between different ideas or pieces of information. Each idea (or piece of information) is usually represented in a circle or box and the relationship between two ideas is shown by a line or arrow connecting them. Words on the line or arrow explain the relationship between the two ideas. Concept maps can be hand drawn or prepared using computer software.

To draw a concept map, follow these steps:

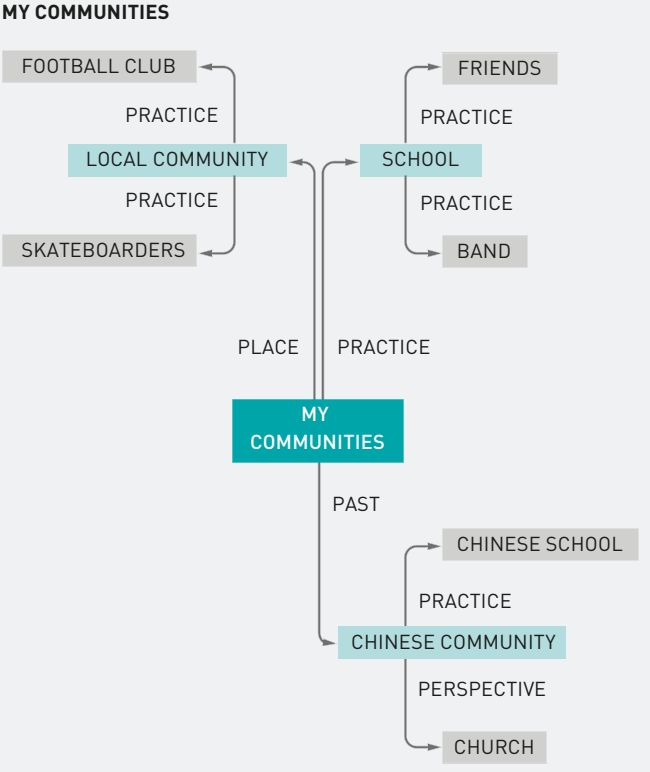
Step 1 Draw and name the focus, central idea or main problem you are trying to explore. In the example in Source 5.3, this is 'My communities'.

Step 2 Build the concept map by adding ideas related to the central idea.

Step 3 Add a title to help the reader quickly understand your concept map.

Apply the skill

1 Construct your own concept map to show the communities you are connected to. Place your name in the centre box. Add the types of communities to the connecting lines. Choose from the five types of communities shown in Source 5.4, such as place.



Source 5.3 An example of a concept map

TYPES OF COMMUNITIES



PAST
Communities of past are made up of people who share similar histories, such as family, language and ethnic groups. War veterans are a community of past as are the separate ethnic groups that make up the population of Australia, for example, Greek Australians or Vietnamese Australians.



PLACE
Communities of place are made up of people who live in the same area, such as a neighbourhood, region, town or country. Indigenous Australians are members of a community of place, as are the residents of individual towns, such as Broken Hill and Broome.



PERSPECTIVE
Communities of perspective are made up of people who share similar beliefs and values, such as members of religious communities or political parties. The Australian Greens and Roman Catholics are both communities of perspective.



PURPOSE
Communities of purpose are made up of people who share similar goals and visions, such as being members of a particular volunteer organisation, such as Surf Life Saving Australia or volunteer fire brigades. Communities of purpose are often involved in improving the lives of people other than themselves.



PRACTICE
Communities of practice are made up of people who have activities in common, such as the work they do, or the hobbies they enjoy. Health workers such as nurses and doctors belong to a community of practice, as do members of a book club or sporting group.

Source 5.4 Classifying communities



REVIEW 5.1.1

Remember and understand

1 What type of community is a school?

Apply and analyse

2 Explain why SLSA can be considered to be a community of purpose.

3 Name three other communities of purpose.

4 Classify each of these groups under one of the five types of communities:
- **a** the Labor Party
- **b** employees of BHP Billiton
- **c** residents of Yamba in New South Wales
- **d** a Scout group
- **e** your family.

5 The surf lifesavers in Source 5.2 are members of a community of purpose. Why is it likely that they are also members of a community of place?

Investigate and create

6 Identify opportunities for young people to connect in your community. Choose one of these community groups or activities and create a poster to entice young people at your school to join in. Seek permission to display your posters in your school grounds or a shared space such as the library.

COMMUNITY IDENTITY

CASE STUDY

Sydney's Hindu community

People who share similar histories (such as family, language and ethnic groups) are communities of past. More than 40 per cent of the population living in the Sydney CBD and in the suburb of Harris Park are Asian-born. If at least one parent was born in Asia, then about 10 per cent of the Australian population could be said to have a strong Asian heritage. The Indian community has influenced the character of Sydney by sharing its culture, clothing, festivals, beliefs, celebrations and food.

Often communities of past, such as the Indian community, share the same religious and spiritual beliefs, so they are also an example of communities of perspective. Hinduism is the world's third largest religion and one of its oldest. About one billion people today are Hindus and about 98 per cent of them live in India. As Indians migrate to other countries, such as Australia and New Zealand, the number of Hindus in those countries also increases. Today there are more than 70 000 Hindus in Sydney, and Hinduism has become one of Australia's fastest growing religions.

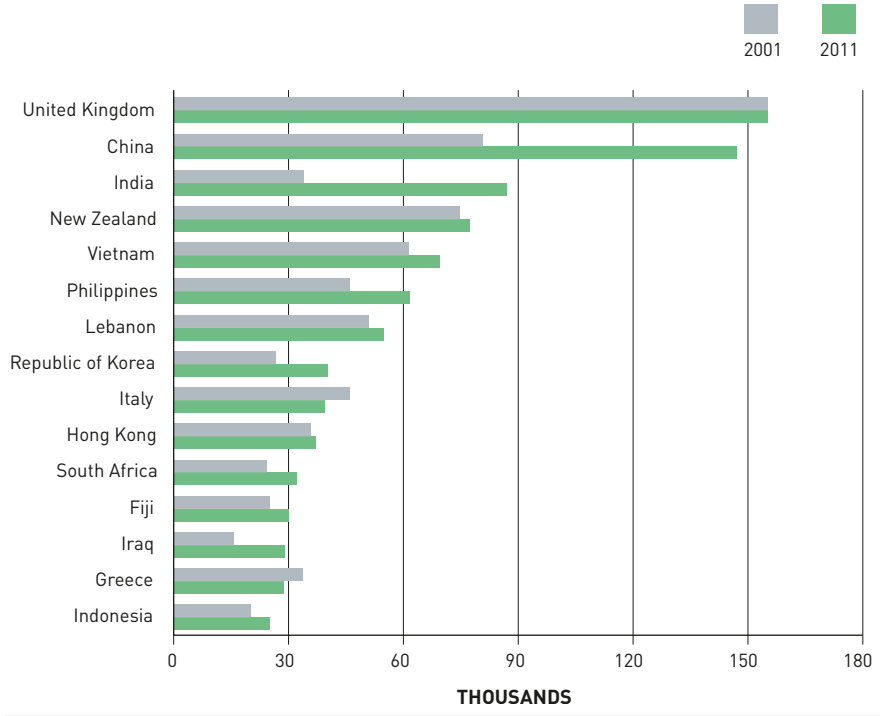
Belonging to a religious community is a vital part of many people's identity. As a multicultural country, Australia has a wide range of religious communities and, despite a few isolated examples of intolerance, religions here happily coexist. This is not always the case overseas; in some countries, religion is often the basis of conflict and war.



Source 5.5 Murugan Hindu Temple, May's Hill in Sydney, Australia



MIGRANTS IN SYDNEY BY COUNTRY OF BIRTH, 2001 AND 2011



Source 5.6

Source: ABS Census of Population and Housing, 2001 and 2011



SKILL DRILL

Reading compound column graphs

A **compound column graph** divides each column into its different parts. This allows us to easily see patterns in the information. For example, in Source 5.7 the columns show religious affiliations in selected years. The columns are divided to show the different religions, such as Anglican or Catholic.

To interpret Source 5.7 and other compound graphs follow these steps:

Step 1 Read the title carefully so that you understand what is being shown on the graph.

Step 2 Look closely at each scale. In this graph you will notice that the vertical axis shows percentages rather than numbers.

Step 3 Look closely at the legend and colours so that you understand the divisions within each of the columns.

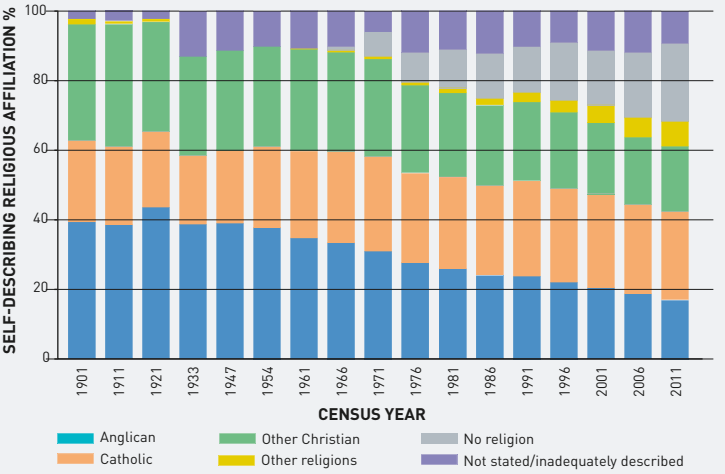
Step 4 Look for major patterns. In this graph, there has been an obvious decline in the percentage of Australians who are Anglicans, and an increase in the percentage of people who practise no religion.

Apply the skill

1 Study Source 5.7. Which of these statements are true and which are false?

- **a** Most Australians are Christians.
- **b** In 1921, most Australians were Anglicans.
- **c** In 2011, there were more people with no religion than there were Catholics.
- **d** Up to the 1970s, virtually all Australians were Christians.

RELIGIOUS AFFILIATIONS IN AUSTRALIA, 1901–2011



Source 5.7 A compound column graph comparing the percentage of Australians following various religions, from 1901 to 2011

REVIEW 5.1.2

Remember and understand

1 Look carefully at Source 5.5. Suggest two ways in which the Indian community has influenced the character of May's Hill.

2 Look at Source 5.6. In 2011, how many migrants in Sydney were from India? How does this compare with migrants from other countries?

3 Settlers from China are the second biggest group of migrants moving to Sydney. What impact would you expect this group to have on communities in Sydney?

4 The Hindu community of Sydney is a community of perspective. Explain what this means.

Apply and analyse

5 Carefully study the compound column graph (Source 5.7).

- **a** Describe the changes over time in the religions followed by Australians.
- **b** Why do you think these changes have occurred?
- **c** Based on the pattern shown in the compound column graph, do you think Christianity will cease to be the dominant type of religion followed in Australia?
  If so, when do you think this will occur?

Investigate and create

6 Identify and describe a local community of perspective where you live. How does this community contribute to the liveability of your local area?

INDIGENOUS COMMUNITIES



Source 5.8 Thursday Island children play on the beach of their island home.

Indigenous Australian communities share an ethnic background, have strong family ties and centuries of shared history and beliefs. These factors make them an example of a community of the past. Indigenous Australian communities are found throughout Australia and tend to have strong spiritual connections to the land. These factors also make them an example of a community of place.

There are two distinct groups of Indigenous Australians. The largest group are Aborigines from mainland Australia and Tasmania. The second group are native to the Torres Strait Islands, the islands between Australia and Papua New Guinea. Although they are more closely linked (in terms of ethnic origins) to the Melanesian people of Papua New Guinea than with Aboriginal Australians, Torres Strait Islanders are Australian citizens. The border between Australia and Papua New Guinea means that Thursday Island (along with many other islands in the Torres Strait) is considered part of Queensland, not part of Papua New Guinea.



REVIEW 5.1.3

Remember and understand

1 Explain why Torres Strait Islanders have strong connections to Papua New Guinea even though they are Australian.

2 What community services are located on Thursday Island?

Apply and analyse

3 Examine Source 5.9.

- **a** Which of these statistics do you find most surprising? Why?
- **b** Explain why so many Thursday Islanders work in local government.
- **c** Write a paragraph of four to five sentences comparing key characteristics of the population on Thursday Island with the wider Australian population. Use the PEEL paragraph structure.
  - **P**oint: Always start with your main point in the opening sentence(s). For example: 'Torres Strait Islanders are the second group of Indigenous Australians and a minority within a minority. They are a separate people in origin, history and way of life.'
  - **E**xpand/elaborate: Provide details comparing the key characteristics of the population.
  - **E**xamples: Use Source 5.9 as evidence to illustrate your comparison.
  - **L**ink: Always link or connect your points to the question.

Investigate and create

4 Examine Source 5.11.

- **a** What are the advantages of the location of the main urban area on Thursday Island? What are the disadvantages?
- **b** Where would you have chosen to build the urban centre?
- **c** What is the name of the highest point on Thursday Island? How many metres above sea level is it?

CASE STUDY

Thursday Island communities

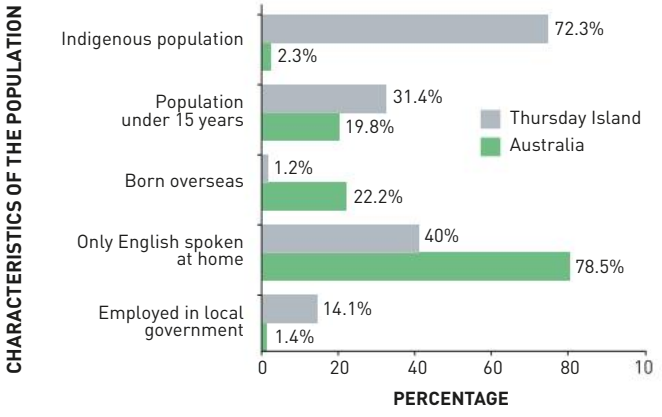
Thursday Island lies in a cluster of Islands in the Torres Strait just off Cape York, the northernmost tip of Australia. Thursday Island has the largest population of all the Torres Strait islands, and is where most of the local government functions for the islands are located. As the administrative centre, Thursday Island's 2600 people have access to excellent facilities, including several schools, a TAFE college, a hospital, a childcare centre, a library, a sports stadium with a swimming pool, parks and gardens. There is little fresh water on the island so a pipeline brings water from nearby Horn Island. Daily flights from Cairns to Horn Island and then a short ferry ride to Thursday Island reduce the isolation of life on the island.

With year-round warm temperatures and easy access to tropical reefs, the beach is the main focus of most leisure activities for children on Thursday Island. The islanders are keen fishermen and the warm waters support a great variety of marine life. Many islanders are also passionate about sports, with NRL player Sam Thaiday and basketballer Patrick Mills, both of Torres Strait Islander descent, being particular favourites.



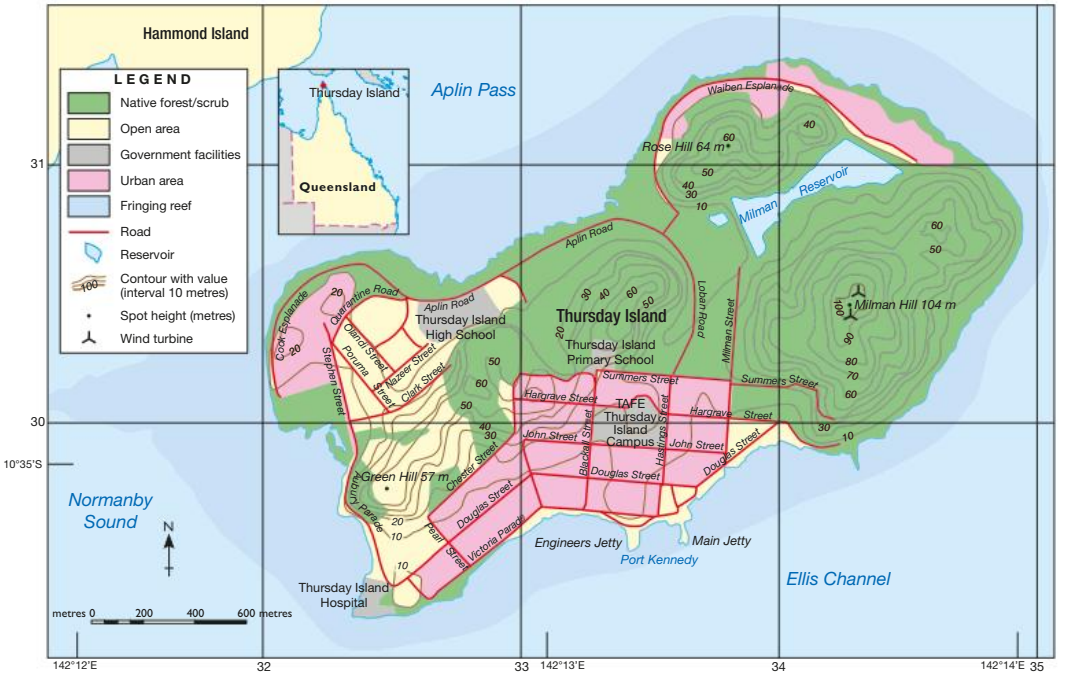
Source 5.10 An oblique aerial photograph of Thursday Island showing the Thursday Island Hospital in the foreground (left) and Hammond Island in the background

THURSDAY ISLAND AND AUSTRALIA: CHARACTERISTICS OF THE POPULATION



Source 5.9 This bar graph compares some key population statistics on Thursday Island with mainland Australia.

THURSDAY ISLAND: TOPOGRAPHICAL MAP



Source 5.11
Source: Oxford University Press

LIVEABILITY IN COMMUNITIES

A community of place refers to a group of people with a common interest or goal. This common interest may be linked to where they live, work or spend a large part of their time. The word community can be used to describe groups like neighbourhoods, towns, workplaces, schools, sports clubs, church groups, or very large groups like members of the same religion, or citizens of the same country.

People connect with places where they feel included and safe. They connect through community services (such as schools, hospitals and libraries), job opportunities (such as the type and amount of work available) and entertainment and recreation (such as concerts, sporting events and festivals).

Community services

We are all part of a broad community based on where we live. This may be a suburb in a city, a town or a small settlement, but it can even be as big as a whole country. Governments and local councils supply a range of services to these communities, such as schools, hospitals, libraries, transport, parks and rubbish removal.

Different communities require different services. For example, a community with a younger population might require more schools and facilities such as skate parks. An older community might require greater access to health care and retirement villages.



Source 5.12 The Fletcher International Abattoir is both the largest employer in Dubbo and the largest meat exporter in Australia. See J2 on the map opposite.

Job opportunities

Local communities provide employment opportunities or good access to places of work, training and education. Businesses and industries, as well as providing services for the community, also provide jobs. Some examples of businesses found in many local communities include shops, hairdressers, plumbers, banks and solicitors. An industry may be a one-person operation or a large manufacturing business that employs hundreds of people. Industrial areas are usually grouped together. Industries generally require large areas of flat land and access to power, transport and parts.

Entertainment and recreation

Leisure facilities such as basketball courts and skate parks are provided and maintained by local councils. Special areas are also set aside for recreation, such as parklands and sporting fields. These areas allow residents to socialise and exercise outdoors. In addition to these recreation areas, special conservation zones are set up by councils to ensure that native plants and wildlife are protected.



Source 5.13 Taronga Western Plains Zoo. See C12 on the map opposite.

DUBBO



Source 5.14

Source: Oxford University Press

REVIEW 5.1.4

Remember and understand

1 What is a community of place?

2 How is the liveability of a community measured?

Apply and analyse

3 Use Source 5.14 to provide a grid reference for a:

- **a** recreation facility
- **b** transport hub
- **c** source of employment
- **d** education facility.

4 Dubbo is largely populated by families. What evidence can you find using Source 5.14 that the local community is made up of many families?

Investigate and create

5 Identify all the opportunities to connect in your community. Copy the table into your notebook and complete.

Community services	
Job opportunities	
Entertainment and recreation	

BUILDING SAFE COMMUNITIES



The most liveable cities are those where people feel safe – not only for themselves, but also for their families and their property. Fear of crime can affect quality of life, reducing social interaction between people and forcing people to avoid certain places. Every year the Property Council of Australia surveys local residents across Australia about 17 different liveability factors. Each year the results clearly show that safety and security is the most important liveability factor for residents in our cities and towns.

Safety in the community is not just about crime rates, but also about how safe people feel in their community. The compound column graph in Source 5.16 shows the percentage of Australians (in all states and territories) who feel at risk from a range of different crimes and antisocial behaviours taking place in their communities. (For more information on compound column graphs refer to section GT.3 of 'The geographer's toolkit'.) For example, 32 per cent of people surveyed in the Northern Territory feel threatened by people hanging around in groups, whereas in the ACT, it's only 11 per cent.

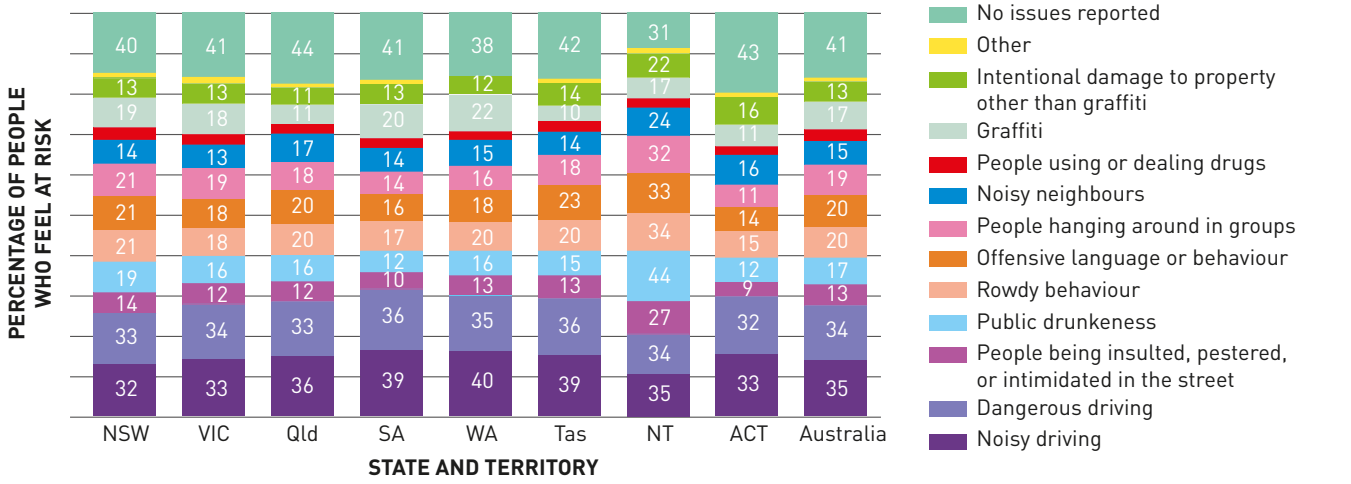
Governments and local councils are always trying to improve the design of local environments to create safer places and encourage community-based activities. Surveys of local areas assist authorities to identify the key issues and map problem areas. With this information, they can then work to find solutions to these problems.

Source 5.15 Dark alleyways and parks are places where crimes can go undetected. These areas are generally avoided by local residents.

Safer community design

A key step towards improving local safety has been making public areas more visible. This has been achieved by different methods such as designing buildings to face public space, removing bushes to give a clear line of sight, improving lighting and introducing surveillance cameras. These strategies help reduce the numbers of crimes by making places, and therefore any criminal activity, easier to see.

AUSTRALIA: PEOPLE WHO FEEL AT RISK FROM CRIME AND ANTISOCIAL BEHAVIOUR, 2011



Source 5.16

Source: Australian Bureau of Statistics



Source 5.17 Neighbourhood Watch (along with other community policing programs) has been used to reduce crime in local communities and create stronger ties between the police and members of their communities.



Source 5.18 Soup kitchens and food vans provide meals for the homeless.

Community policing

In recent decades, the police have developed community programs to create stronger ties between the general community and the police. The goal here is to involve members of the community in keeping their own streets safe. The most successful of these programs has been Neighbourhood Watch. The police work with local communities to educate communities on safety and security issues and to encourage people to look out for, and report, any suspicious behaviour. The program also encourages community members to get to know each other, share safety concerns and support each other to stay safe.

Helping at risk groups

Many government and not-for-profit groups work within local communities to provide outreach services for the most vulnerable members of the community. These services include things such as temporary and permanent housing, food trucks for the homeless and poor, support services for victims of domestic violence, rehabilitation programs for alcoholics and drug addicts, drop-in centres for disadvantaged youths, and home services such as Meals on Wheels for the elderly. These services help to protect and care for those in our communities who need it most.

REVIEW 5.1.5

Remember and understand

1 Why do you think safety is the most important liveability factor for communities across Australia?
2 What example is given of police working with the community to reduce crime and increase feelings of safety?
3 How does increased visibility in streets and public spaces help to prevent crime? What strategies help to increase visibility?

Apply and analyse

4 Look carefully at Source 5.16.
   a What crime issues were most reported in the survey?
   b In which categories did the Northern Territory score the highest? What strategies might police introduce to try to reduce this behaviour?
   c In what state is graffiti considered to be the biggest problem? Why might this be the case?

Investigate and create

5 Visit the NSW Police website to discover the what, why and how of Neighbourhood Watch.
   a What is Neighbourhood Watch?
   b Why should you get involved?
   c How can you get involved?

5.1

CHECKPOINT

HOW CAN STRONG COMMUNITY IDENTITY AND SOCIAL CONNECTEDNESS ENHANCE THE LIVEABILITY OF PLACES?

- **Investigate the influence of social connectedness and community identity on the liveability of places**

1 What does Source 5.1 tell you about the availability of services (such as water, housing and education) in Dhaka? [5 marks]
2 Why are people attracted to urban communities? [5 marks]
3 How do people connect with places they live in to improve their liveability? [10 marks]
4 Explain how technology can make remote places more liveable. [5 marks]
5 Why will increasing employment opportunities in outer city suburbs improve the liveability of these places? [5 marks]
6 How would community identity change with the influx of a large group of:
   a families with small children?
   b migrant families?
   c retirees? [15 marks]
7 Why are safety and stability important factors in determining a city's liveability? [5 marks]

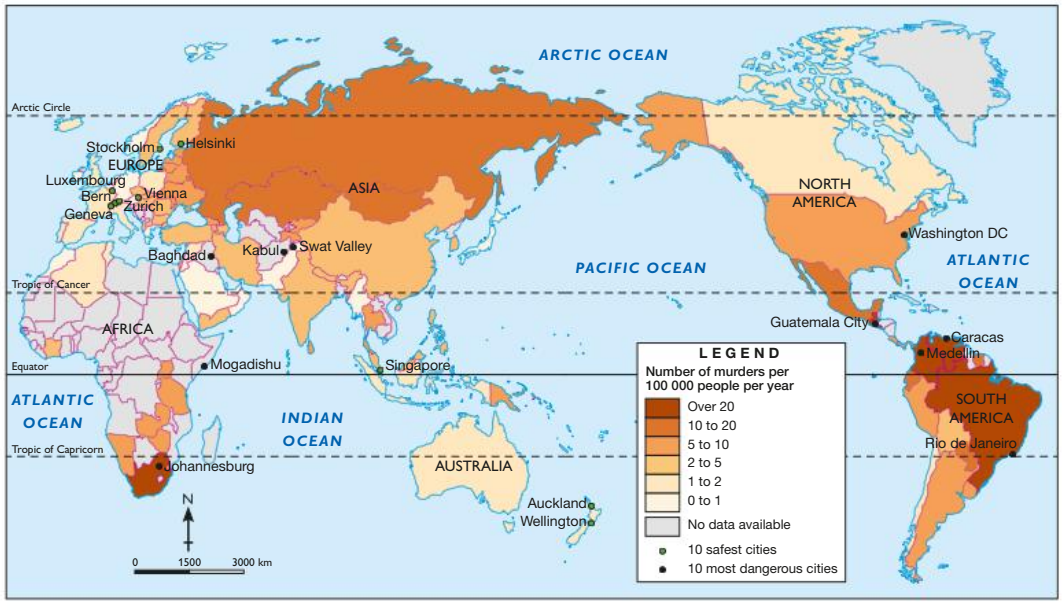
TOTAL MARKS [/50]

RICH TASK

Safety and stability

Like people everywhere, Australians want to feel safe. Even though it is tempting to believe everything that is presented in the media, if you did, you would probably think that Australian cities are in the grip of a crime wave and have become unsafe. While it is true that many crimes are committed in Australia, by world standards it is considered one of the safest places to live. Crime statistics also show that rates of some crimes, such as thefts, have actually declined in recent years.

WORLD: MURDER RATES AND SAFEST AND MOST DANGEROUS CITIES



Source 5.19

Source: Oxford University Press

Acquiring geographical information

1 In which regions of the world are the safest cities?
2 In which regions of the world are the least safe cities?
3 What makes some cities safer than others?

Processing geographical information

4 Collect reports of crime from your local newspaper. What impression do these reports give of safety in your community?
5 Use the online NSW Bureau of Crime Statistics and Research crime tool to research crime in your local area.

Communicating geographical information

6 Do media reports of crimes in your community match the actual data? Create a table to tally all the crimes reported in your local newspaper over a 7-day period. How representative is your weekly tally of the yearly information provided by the NSW Bureau of Crime Statistics and Research? Is crime under-reported, over-reported or about the same?

SKILL DRILL

Using the BEESTOP method to describe a map

BEESTOP is a tool used by geographers to help them consider the many different factors that might contribute to the patterns identified in their data. It is an alternative to the SHEEPT method (refer to section GT.2 of 'The geographer's toolkit'). There are seven steps to follow when using the BEESTOP method but all factors might not apply in every situation. BEESTOP is a skill that you will use more in your senior Geography studies, but it's a good skill to begin using at Years 7 and 8.

Step 1 Biophysical (B): factors relating to the natural environment (climate, soils, landforms)

Step 2 Ecological (E): factors relating to sustainability and resource use

Step 3 Economic (E): factors relating to the earning and spending of money

Step 4 Sociocultural (S): factors relating to culture, tradition, history and people

Step 5 Technological (T): factors relating to the availability and use of different types of technology (transportation, information technology, biotechnology, alternative energy sources)

Step 6 Organisational (O): factors relating to big businesses (ownership, decision-making, control, influence)

Step 7 Political (P): factors relating to governments (laws, regulations, policies, quotas, tariffs, agreements)

Apply the skill

1 Use the PQE method to describe the global distribution of murder rates and the world's most dangerous cities (go to section GT.2 of 'The geographer's toolkit' to refresh your memory of the PQE method).
2 Now have a go at using the BEESTOP method to account for the global distribution of murder rates and the world's most dangerous cities. Remember: all factors may not necessarily apply.

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

» Concepts: Space, Environment, Interconnection, Change
» Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
» Tools: Maps

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

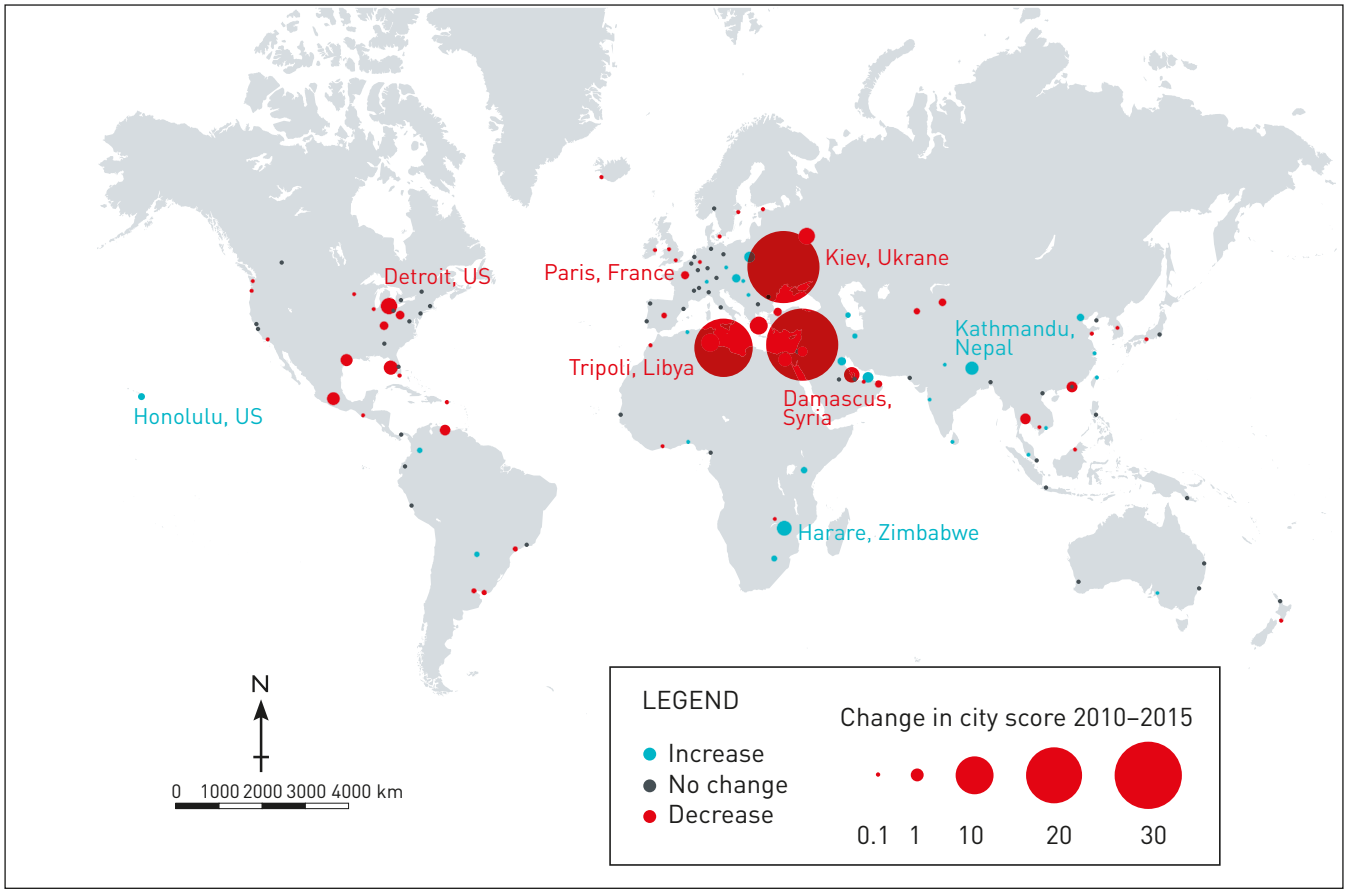
5.2 THE WORLD'S MOST LIVEABLE CITIES

WHAT APPROACHES CAN BE USED TO IMPROVE THE LIVEABILITY OF PLACES?

It is difficult to compare one city to another as people who live in one city tend to favour their own city. This can make it difficult for others who are considering moving to a new location to find out what it is really like to live there. In response to this problem, a number of companies research the world's biggest cities and rank them from the most liveable to the least liveable. These companies vary in what they study and measure, and so their liveability rankings differ. For example, one company may emphasise personal safety in their study, while another may put a greater emphasis on the climate of a place. This means their scores and rankings will differ.

These liveability rankings are useful for geographers as they give us the opportunity to compare places and to consider what makes one place more liveable than another. Importantly, it also allows us to make better decisions about improving the liveability of cities around the world. The following map shows the change in liveability over a five-year period (2010–15), using data from the annual survey by the Economist Intelligence Unit (EIU) of 140 of the world's cities. In its survey the EIU gives each city a score based on its stability (such as crime and terrorism threats), health care, culture and environment (such as climate, shopping and religious freedom), education, and infrastructure (such as roads, public transport and water).

WORLD: CHANGE IN LIVEABILITY OF CITIES, 2010–15



Source 5.20

Source: The Economist Intelligence Unit

	Most liveable cities
1	Melbourne
2	Vienna
3	Vancouver
4	Toronto
5	Adelaide
6	Calgary
7	Sydney
8	Perth
9	Auckland
10	Helsinki

Source: EIU 2015

Source 5.21 The top 10 of most liveable cities in the world, 2015

Over the five-year period, 89 of the 140 cities surveyed saw some change in overall liveability. Fifty-seven cities experienced a decrease in liveability. The three worst – Tripoli, Kiev and Damascus – were undermined by conflict. The cities that scored best tend to be medium-sized cities in wealthier countries with relatively low **population densities**. These cities can provide a range of recreational activities without leading to high crime levels or overburdened infrastructure. Seven of the top 10 scoring cities are in Australia and Canada.



Source 5.22 The Vancouver skyline

CASE STUDY

Vancouver, Canada

The Canadian city of Vancouver is usually near the top of any list of the world's most liveable cities and had been placed first by the EIU for 9 years in a row since 2002. In the 2015 survey, it received a score of 97.3, placing it third, with a perfect score for health care, education and culture and environment. The culture and environment category included climate, levels of corruption and censorship, religious freedom, sporting and cultural facilities, and shopping.

Because cities are given a new score every year, the rankings of their liveability can change with little perceivable change to living conditions in that city. Vancouver, for example, slipped from the most liveable city to the third most liveable largely because its infrastructure score fell as a result of increased traffic congestion in the city.

REVIEW 5.2.1

Remember and understand

1 Why can it be difficult to compare the liveability in different cities?

2 Explain why Vancouver is considered to be less liveable in recent years.

Apply and analyse

3 Examine Source 5.20 carefully.
   - **a** Compare the change in liveability of the cities shown in Africa with those shown in Western Europe.
   - **b** Describe three patterns that you observe on this map.
   - **c** Select one of these patterns and give an explanation for it.

4 Of the top 10 most liveable cities, all had perfect scores in education and health care but only one, Vancouver, had a perfect 'culture and environment' score. Why do you think only one city would score perfectly for its culture and environment?

Investigate and create

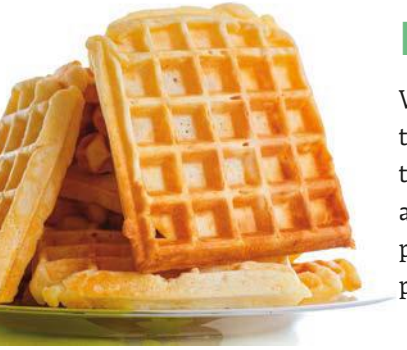
5 Some people are critical of comparing cities in this way and believe that it is unfair to the people who live there. Why do you think people would feel this way?

6 As well as companies looking to move employees to a new city and geographers, who else would find liveability rankings of the world's cities useful?

CASE STUDY

VIENNA: A LIVEABLE CITY

Vienna, the capital of Austria, usually scores highly in any survey of the world's most liveable cities. In 2015, it was rated by the Economist Intelligence Unit (EIU) as the second most liveable city and by another agency (Mercer) as the city with the highest quality of living in the world. It has topped this second list for five years in a row.



Infrastructure and safety

Vienna has excellent infrastructure, which has been designed to meet the changing needs of the city while ensuring sustainability. Vienna features particularly strongly in terms of its public transport and public housing. The city provides affordable public transport and has invested in an extensive bicycle network to keep traffic congestion in the streets low. Vienna has a large public housing system that provides high-quality housing for the majority of the Viennese population. This has kept housing affordable for everyone.

One of the features of Vienna that makes it liveable is the number of parks and other green spaces for people to enjoy. More than half the metropolitan area of Vienna is made up of these green spaces. This gives each resident of the city about 120 square metres of open space in which to socialise and exercise. (The World Health Organization suggests that at least 9 square metres of open space should be available to every city dweller.) Serious crime is rare and employment levels are high, creating a safe and stable environment for the city's residents.

Health care and education

Vienna has a wide range of hospitals offering different types of treatment and a high level of hospital care, and every worker in Vienna has health insurance. Education through the school system is provided to every child free of charge.



Source 5.23 Vienna is known for its shopping and safe public spaces.

KEY CONCEPT: SUSTAINABILITY

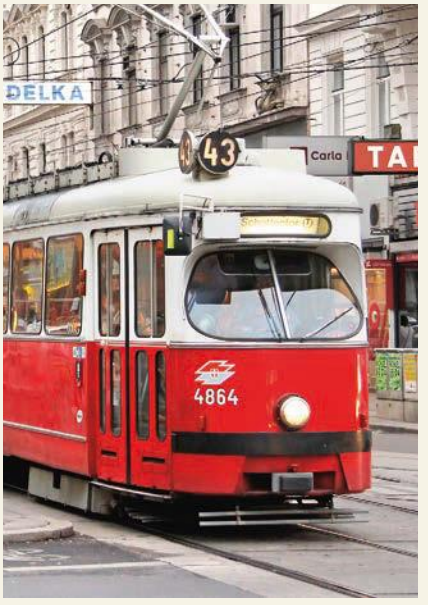
Sustainability and liveability in Vienna

Vienna is leading the world in the reduction of the **greenhouse gases** that are changing the global climate. In 1999 they began a program that encouraged companies to change the way they used energy and water and also the ways in which they disposed of their waste. The aim was to reduce gases by 2.6 million tonnes a year by 2010. The program was so successful that the target was achieved 4 years early and new targets have been set for 2010–20. More than 9000 individual projects have been put into place to reduce greenhouse gases since 1999. These have resulted in some impressive reductions: more than 100 000 fewer tonnes of solid waste, 42 000 fewer tonnes of greenhouse gases and more than 1 million fewer cubic metres of drinking water used. This has resulted in less water and air pollution in Vienna, making it even more liveable than before.

For more information on the key concept of sustainability, refer to section GT.1 of 'The geographer's toolkit'.



Source 5.24 In this Viennese building, solid waste is incinerated to produce heat and electricity, which is used to power a nearby hospital.



Source 5.25 Vienna has a well-developed public transport network that includes buses, trains and trams.



Source 5.26 An amusement park in Prater Park near the centre of Vienna

REVIEW 5.2.2

Remember and understand

1 What are some of the features of Vienna that make it very liveable?

2 How is Vienna becoming more liveable?

Apply and analyse

3 The exterior of the waste incinerator in Source 5.24 was designed by an artist.
   - **a** What does this tell you about the people of Vienna?
   - **b** What do you think of the exterior of this building?

4 In what ways do open spaces make cities more liveable?

5 How is open space used in your community?

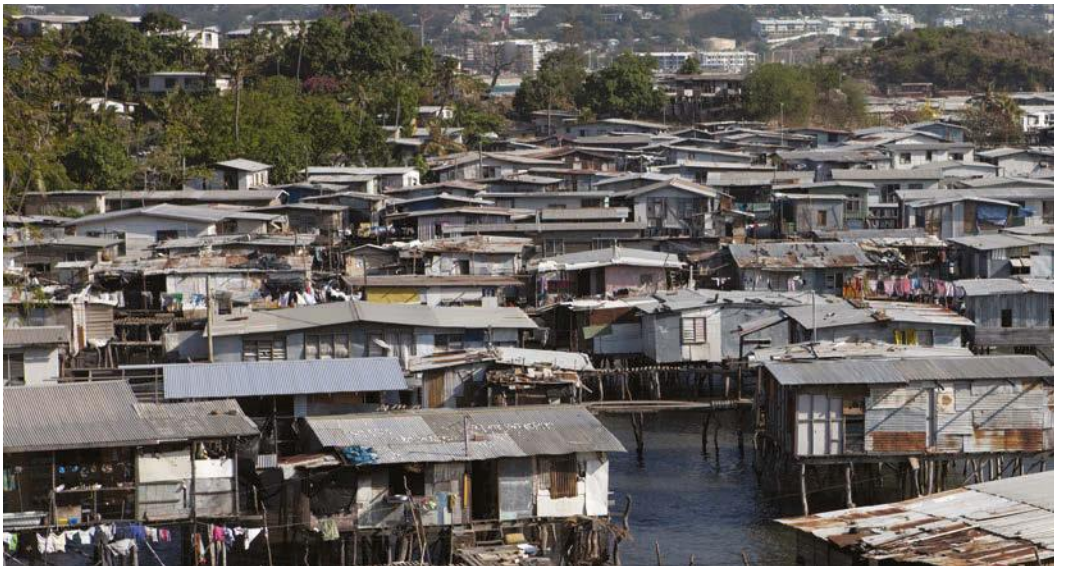
Investigate and create

6 Imagine that you are designing a brochure advertising Vienna as the city with the world's best quality of life.
   - **a** Which of the photographs of Vienna would you use in the brochure and why?
   - **b** Which ones would you not use? Why not?

THE WORLD'S LEAST LIVEABLE CITIES

While cities in Europe, Canada and Australia dominate the top of lists of the world's most liveable cities, Asian and African cities tend to dominate the bottom of these lists. It is important to remember, however, that these lists are made by companies in wealthy countries to provide their workers with a guide to lifestyles in cities around the world. The lists therefore tend to measure aspects of each city that most interest those workers rather than the experiences of the people who live there.

In 2015, one of these companies published the following list of the 10 least liveable cities. It was taken from a list of 140 cities around the world. While the same 10 cities were essentially still ranked in the bottom group in 2014, their order and overall ratings had changed. Most notable was the continued improvement in Harare's score and ranking. Rated as the least liveable city in 2011, improvements in stability over the previous 4 years have moved it up seven places. A city's stability is a measure of crime, terror and conflict. The world's least liveable cities tend to be the least stable and least safe; that is why Damascus and Kiev were included in the bottom 10 least liveable cities.



Source 5.27 Housing area near the Port Moresby harbour

Source 5.28 Liveability scores for the 10 least liveable cities in 2015

Country	City	Rank	Overall rating (100 = ideal)	Stability	Health care	Culture and environment	Education	Infrastructure
Cameroon	Douala	131	44.0	60	25.0	48.4	33.3	42.9
Ukraine	Kiev	132	43.4	20	54.2	45.8	75.0	42.9
Zimbabwe	Harare	133	42.6	40	20.8	58.6	66.7	35.7
Algeria	Algiers	134	40.9	40	45.8	42.6	50.0	30.4
Pakistan	Karachi	135	40.9	20	45.8	38.7	66.7	51.8
Libya	Tripoli	136	40.0	30	41.7	38.2	50.0	48.2
Nigeria	Lagos	137	39.7	25	37.5	53.5	33.3	46.4
Papua New Guinea	Port Moresby	138	38.9	30	37.5	44.2	50.0	39.3
Bangladesh	Dhaka	139	38.7	50	29.2	43.3	41.7	26.8
Syria	Damascus	140	29.3	10	29.2	44.7	33.3	32.1

Source: The Economist Intelligence Unit

CASE STUDY

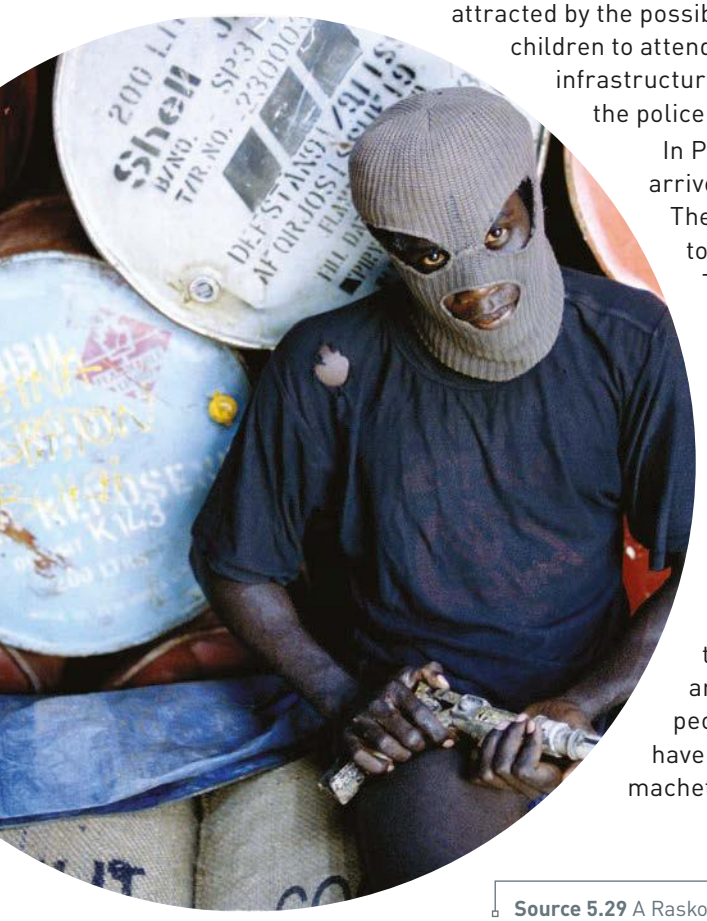
Port Moresby, Papua New Guinea

Port Moresby, the capital of Papua New Guinea, is often ranked as one of the world's least liveable cities. This is largely due to high crime rates and a lack of safety experienced by many residents and visitors.

In many developing countries, such as Papua New Guinea, large numbers of people move from rural areas to the cities hoping for a better life. They are attracted by the possibility of a steady job or the chance for their children to attend high school. This puts a strain on the city's infrastructure and services such as hospitals, schools and the police force.

In Port Moresby, many of the young men who have arrived in the city have not been able to find jobs. They join crime gangs to survive, to earn money to buy food and to gain a sense of belonging. The most notorious of these gangs is the Raskols (from the English word 'rascals'). Other gangs have names such as Mafia or Ook (Devils). These gangs are responsible for much of the violent crime in Port Moresby, such as robberies, car jackings, beatings, murders and rape.

Armed battles between the Raskols and the police are common, creating a dangerous environment. Many wealthier people in Port Moresby have responded to the dangers by building fences of razor wire and hiring armed security guards. The poorer people, having no access to these defences, have instead armed themselves with clubs and machetes.



Source 5.29 A Raskol gang member guards a stockpile of food and fuel.

REVIEW 5.2.3

1 Why do people move to cities such as Port Moresby?
2 Explain how this movement can affect a city's liveability.

Apply and analyse

3 Examine Source 5.28, showing the rankings and scores of the world's 10 least liveable cities.
   - **a** Why do cities move up or down this list over time?
   - **b** Which city is the least stable? Suggest a reason for this.
   - **c** Of these cities, Kiev has by far the best health-care score. In what areas does it perform particularly poorly?

4 Use an atlas to locate each of the 10 least liveable cities on a world map. Identify which of these 10 cities is not in Asia or Africa.

Investigate and create

5 Draw a geographic sketch of Source 5.27. Add these labels to your sketch: central business district, poor housing standards, lack of sewerage, lack of electricity, houses built on stilts over the water, better quality housing.
6 What do Sources 5.27 and 5.29 tell you about inequalities in wealth in Port Moresby?

CASE STUDY

HARARE: A LEAST LIVEABLE CITY

Harare, the capital of Zimbabwe, has been in the 10 lowest ranked cities in terms of liveability for many years. Harare is a city of great contrasts. Many people live prosperous, healthy lives there. They have good jobs, access to good health care and their children attend some of Africa's best schools. But this is not the reality for most Harare residents, many of whom live in extreme poverty.

Infrastructure and safety

Only 40 per cent of Harare residents have access to safe drinking water; most of the remaining 60 per cent collect their water from Lake Chivero, Harare's main water source. The lake is also the place where the city's untreated sewage is dumped as the treatment plant is unable to cope with the rapid expansion of the city's population.

Perhaps one of the greatest struggles facing many people in Harare is the struggle to find a secure home. In 2005, the country's president, Robert Mugabe, ordered the destruction of **slums** throughout the city. He claimed it was to restore order in the city, but many others believe that it was done to intimidate his political opponents. It is estimated that about 700 000 people were made homeless or lost their jobs. As well as homes, the slum clearance program destroyed schools, shops, workplaces and pharmacies. In November 2013, a second slum clearance occurred; and other in October 2014. Many people are reluctant to rebuild their homes in case this happens again.

A recent report that measured the liveability of 140 of the world's cities described Harare's level of petty crime, its threat of **civil unrest** or conflict, its public health care and its quality of public transport as intolerable. It also rated very poorly in other important areas, such as the amount of violent crime, the threat of military conflict and the provision of electricity and water.

For most of Harare's three million residents, daily life is a series of struggles. They struggle to find enough clean water to drink and with which to wash and they struggle to find enough food. They struggle to find work to earn money and they struggle to give their children a quality education.

STRANGE BUT TRUE

While life expectancy in Africa has increased over the past decade, it still has a long way to go. Currently, average life expectancy in Africa is 54 years; in Australia it's 84 years.





Source 5.30 These boys are collecting water from a puddle in a Harare street.



Source 5.31 Untreated sewage flows into a Harare street from an overflowing pipe.

Health care and education

Harare ranked the lowest for health care of all the cities surveyed. Many people struggle with disease and illness. Fifteen in every 100 adult Zimbabweans have **HIV/AIDS**, the fifth highest rate in the world. Poor **sanitation** and unsafe water supplies have led to outbreaks of cholera and typhoid in Harare, which have further strained the health services in the city and affected the ability of people to work.

A lack of government funding has made it difficult for hospitals and doctors to provide care for sick patients. The public health-care system has collapsed and many common medical services are no longer available – patients cannot get prescriptions or drugs, hospitals have run out of medical supplies, and equipment has become unusable. The hospitals have had to stop performing operations and the wards are empty because the hospitals are unable to care for patients or even provide them with meals.

The only health care still available is in private clinics, which only the rich can afford. Poor patients are left without care and are dying as a result.



Source 5.32 This cholera victim is being taken to a clinic in Harare.

REVIEW 5.2.4

Remember and understand

1. Why is Harare considered to be one of the least liveable cities?
2. Explain the link between Source 5.31 and Source 5.32.

Apply and analyse

3. The boys in Source 5.30 are collecting water from the street. Discuss with a partner some problems that these boys may face every day. Then use your discussion to create a story that describes a day in the boys' lives. Write in the first person, as though you are one of the boys.

Investigate and create

4. Make a list of the problems faced by many Harare residents. Rank them from the one that is the easiest to solve to the one that is hardest. Write a few sentences explaining why you have ranked them in this way.
5. For the problem you considered the easiest to solve, describe a possible solution. Why do you think this problem has not been solved in Harare?



Source 5.33 The suburb of South Yarra near the Melbourne CBD – one of the most loveable suburbs in the most liveable city in the world

AUSTRALIA'S LIVEABLE CITIES

In the 2015 Global Liveability Survey, Melbourne retained its place as the world's most liveable city for the fifth year in a row. Adelaide (5), Sydney (7) and Perth (8) were also ranked in the top 10. Australian cities usually score well in liveability studies because they generally have open spaces for recreation, relatively low crime rates, low population densities and good education and health care. Large cities in a wealthy country, such as Australia, also have a wide range of goods and services available to the people who live there. The infrastructure in large Australian cities includes schools and universities; efficient transport networks; clean water delivered to homes and businesses through a vast network of dams, treatment plants and pipes; and electricity supplied through a system of overhead and underground wires and cables.

How do Melbourne's residents view their city?

In a different survey conducted by Deakin University, using the same themes as the World Liveability Index, Melbourne residents were asked about the 'lovability' of their city. The survey asked eight qualitative questions to sense how people felt about how they lived. Questions included are shown in Source 5.34. While the city performed poorly in affordability, public transport and road network, it scored well among residents for culture, environment and education. The survey found people from almost all regions rated their suburbs' lovability higher than they scored the other six liveability measures. Melburnians love where they live!

What do you love most about where you live?
If you could improve one thing about where you live, what would it be?
The Melbourne I share with my friends is ...
My favourite experience in Melbourne is ...
My hidden gem in Melbourne is ...
The Melbourne I love to look at ...
When away from Melbourne, I miss ... and ...
The one thing I wish for Melbourne is ...

Source 5.34 The Melbourne Lovability Index questions (Deakin University, 2015)

REVIEW 5.2.5

Remember and understand

1 What Australian cities featured in the top 10 most liveable cities in 2015?

2 Explain why Australian cities feature highly in these surveys.

3 What features of their city do Melburnians like the best? How do these features help to make the city more liveable?

4 What features of their city do Melburnians not like?

Apply and analyse

5 Look at the oblique aerial view of Melbourne (Source 5.33). What features shown in this photograph might suggest that Melbourne is a liveable city?

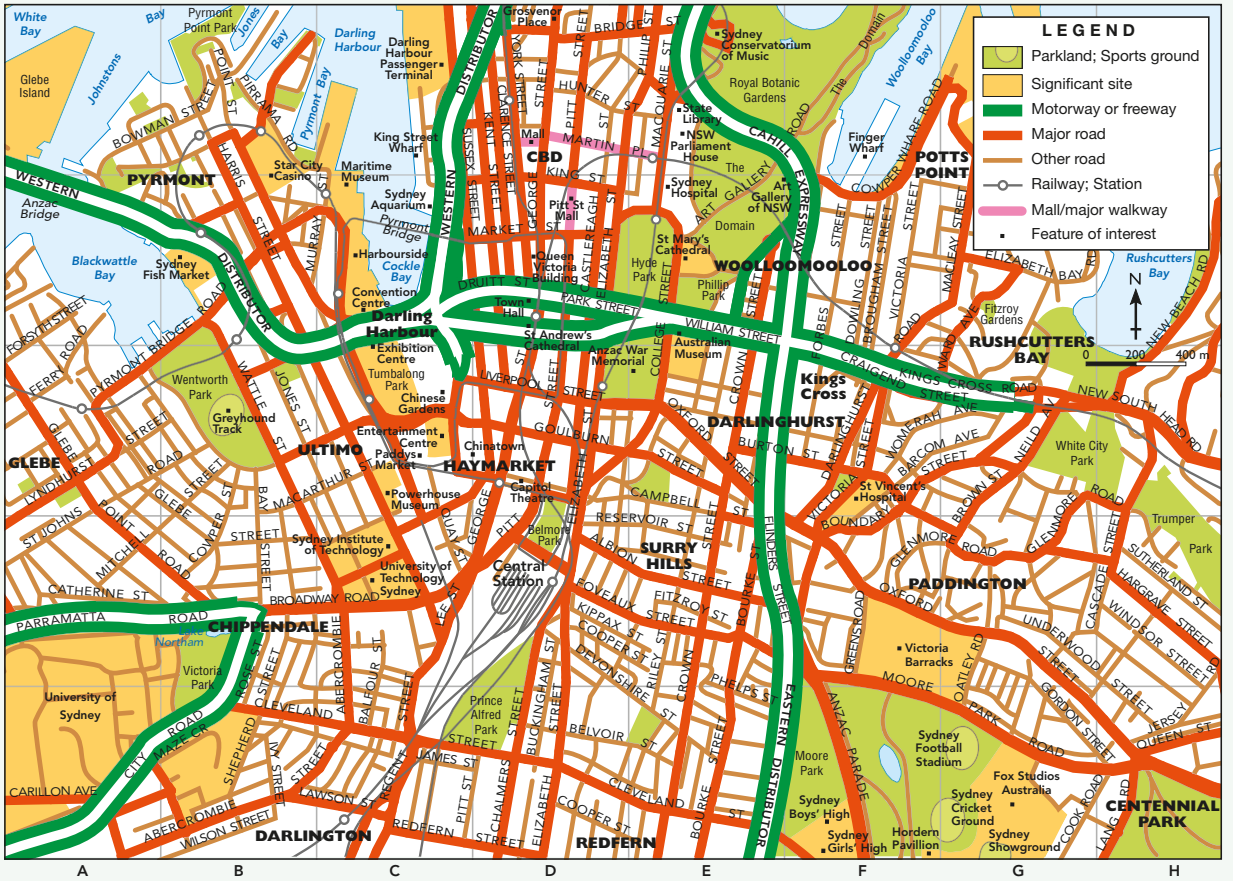
6 Examine the map of central Sydney (Source 5.35). Then copy and complete the table. Try to add more than one example to each category.

Liveability category	Examples from Sydney	Grid reference
Availability of public health care	St Vincent's Hospital	F3
Recreation: sports	Sydney Football Stadium	
Recreation: culture		E4
Availability of consumer goods and services	Paddy's Market	
Religious freedom		E4
Availability of schools		
Availability of higher education	University of Sydney	
Quality of road network		
Quality of public transport		

Investigate and create

7 Create a lovability survey for your town or suburb. Modify the eight Melbourne questions for your 'place' and ask five people for their responses. How 'loved' is your town or suburb? Communicate your findings in a mind map.

SYDNEY: CBD AND INNER SUBURBS



Source 5.35

Source: Oxford University Press

LIVEABLE SUBURBS

In a 2015 study, each of Melbourne's 321 suburbs was rated in terms of its liveability. The study used available data, much of it from the census, to score each suburb on 14 key indicators. These included access to shops, schools, restaurants and public transport as well as crime rates, open space and traffic congestion. The study found the inner-city suburb of East Melbourne to be the most liveable suburb in the most liveable city in the world.



Source 5.36 Skye – Melbourne's least liveable suburb

East Melbourne scored highly because of its closeness to the city centre as well as its good public transport and cafes. Living in East Melbourne, however, has its drawbacks. The study found that residents of East Melbourne have to tolerate poor telecommunications coverage and extremely high house prices.

The suburb of Skye, on Melbourne's outskirts, was rated as the least liveable. Skye rated poorly in terms of access to shopping, public transport and open spaces. It was also brought down by high crime rates.

MELBOURNE: KEY MAP SHOWING GEOGRAPHICAL FEATURES



Source 5.37

Source: Oxford University Press

REVIEW 5.2.6

Remember and understand

1 What pattern do you notice on the map showing access to trains (Source 5.38)? Describe this pattern using the names of specific places.

2 What feature on the key map (Source 5.37) helps to explain this pattern?

Apply and analyse

3 Examine Source 5.37.
   - **a** How has Port Phillip Bay affected the shape of Melbourne?
   - **b** What influence have major roads had on the shape of the outer suburbs?

4 These maps of Melbourne show that liveability is not the same for everyone in a city. Who would find these maps useful?

Investigate and create

5 Can you identify differences in liveability in your town or suburb? Where do you consider are the best and worst places to live? Explain your choice.

SKILL DRILL

Explaining patterns on maps

Geographers look for patterns on maps such as Sources 5.38–5.40 and then try to explain the patterns they see. By following these steps you will move from describing features of a map to explaining them.

Step 1 Look for an obvious pattern in the map you are exploring. This may be a cluster of similar features in a small region or a line of features. In the map showing the liveability of Melbourne's suburbs (Source 5.40, lighter colours (less liveable) tend to be near the fringes of the city whereas darker colours (more liveable) are nearer to the centre.

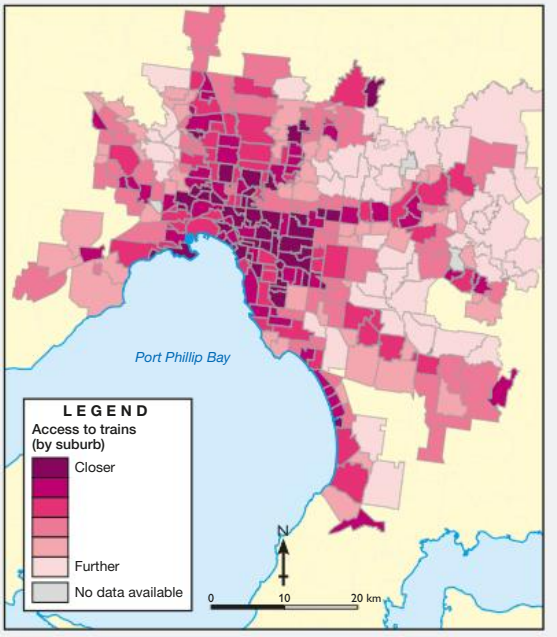
Step 2 Describe the pattern using names of specific places in your description.

Step 3 Look for clues that explain the pattern you have described. There may be clues in other maps or in the way the map has been drawn. In the case of the liveability map, the explanation for higher liveability in inner suburbs may be that there tends to be many restaurants, shops and train stations there. These factors were all taken into account in determining the liveability of each suburb.

Apply the skill

1 Explain the pattern in Source 5.39 showing access to restaurants in Melbourne's suburbs.

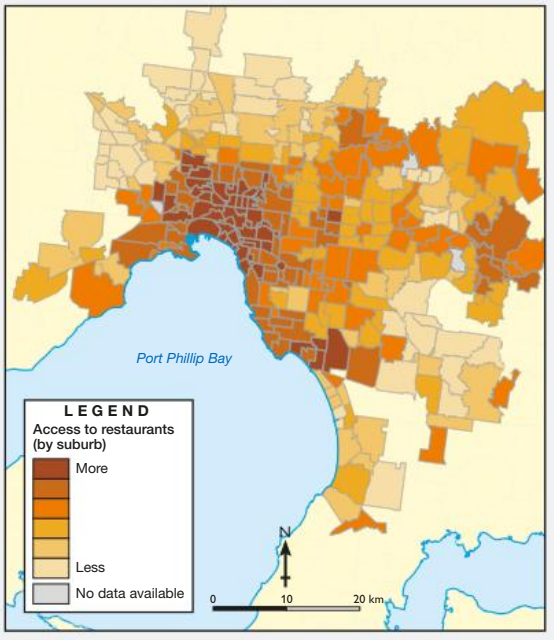
MELBOURNE: CHOROPLETH MAP SHOWING ACCESS TO TRAINS



Source 5.38

Source: Oxford University Press

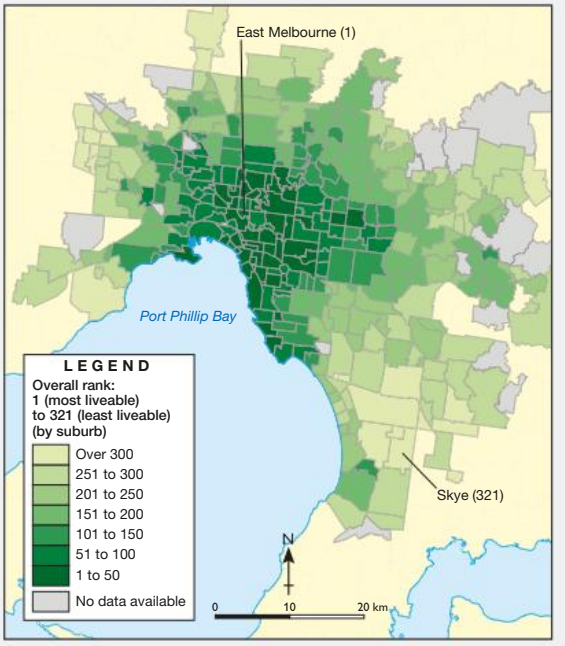
MELBOURNE: CHOROPLETH MAP SHOWING ACCESS TO RESTAURANTS



Source 5.39

Source: Oxford University Press

MELBOURNE: CHOROPLETH MAP SCORING EACH OF THE 321 SUBURBS ON ITS LIVEABILITY



Source 5.40

Source: Oxford University Press

STRATEGIES FOR IMPROVING LIVEABILITY

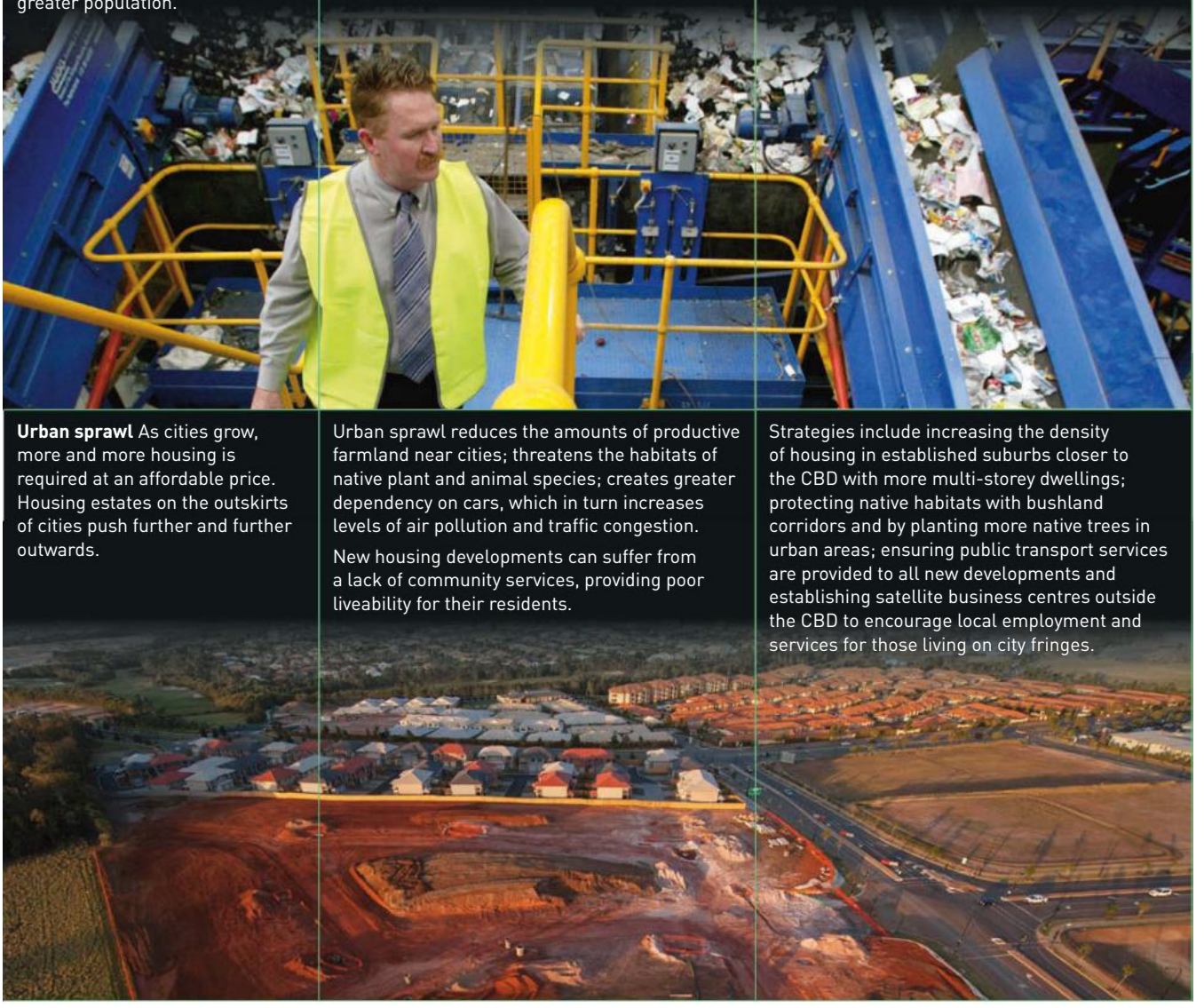
Over time, cities change and grow and the needs of people living in cities also change. To maintain and improve the liveability of a city, the services and facilities provided by governments and councils need to be regularly reviewed. Experts within government, universities, private business and community organisations, including geographers, are needed to identify problems in our cities and offer solutions.

In developing strategies to improve the liveability of our cities, planners must first identify the problems and their underlying causes, identify the impact on liveability, and then come up with strategies to try to overcome the problems. Source 5.41 shows some of the liveability issues currently facing people in Australian cities along with some of the strategies that have been suggested to cope with them.

Source 5.41 Some issues faced by modern city dwellers and some strategies for improving liveability

The problem and underlying cause	The impacts on liveability	Some strategies for solving the problem
Traffic congestion As cities grow, people need to travel further to work and school. Higher rates of car ownership see more cars on the road, leaving the road network struggling to cope.	Traffic congestion results in people spending less time at home and more time in their cars; increases levels of air and noise pollution; increases levels of stress and frustration in drivers leading to increased incidents of road rage.	Strategies include building new roads that take road users around rather than through the city; increasing public transport options to encourage people to leave their cars at home; encouraging alternative modes of transport, for example building bike paths for cyclists.
Social inequalities As cities grow, some people within the community are left without work and are unable to access services such as schools, health care and housing.	Social inequalities can result in homelessness, unemployment and poverty; leaves some people with a sense of alienation from the community; can have a particularly negative impact on young people.	Strategies include ensuring access to opportunities through good education facilities and public transport; assessing needs and providing support through community services; providing facilities for young people where they can get together and receive the help they need.

The problem and underlying cause	The impacts on liveability	Some strategies for solving the problem
Environmental issues As cities grow, they have a greater impact on the environment. Water resources are used up, pollution increases, and more and more energy is required to service the greater population.	Environmental issues include air pollution from increased energy usage, land contamination from landfill, water shortages and damaged waterways.	Strategies for sustainable use of the environment include recycling rubbish materials, restricting water use, developing buildings and cars to be more energy efficient, and using renewable energy sources.
Urban sprawl As cities grow, more and more housing is required at an affordable price. Housing estates on the outskirts of cities push further and further outwards.	Urban sprawl reduces the amounts of productive farmland near cities; threatens the habitats of native plant and animal species; creates greater dependency on cars, which in turn increases levels of air pollution and traffic congestion. New housing developments can suffer from a lack of community services, providing poor liveability for their residents.	Strategies include increasing the density of housing in established suburbs closer to the CBD with more multi-storey dwellings; protecting native habitats with bushland corridors and by planting more native trees in urban areas; ensuring public transport services are provided to all new developments and establishing satellite business centres outside the CBD to encourage local employment and services for those living on city fringes.



REVIEW 5.2.7

Remember and understand

1 How does traffic congestion reduce the liveability of a city?

2 What is an alternative to urban sprawl when a city needs to increase its housing supply?

Apply and analyse

3 Which urban issues described here affect people in the city in which you live (or in a city you know well)?

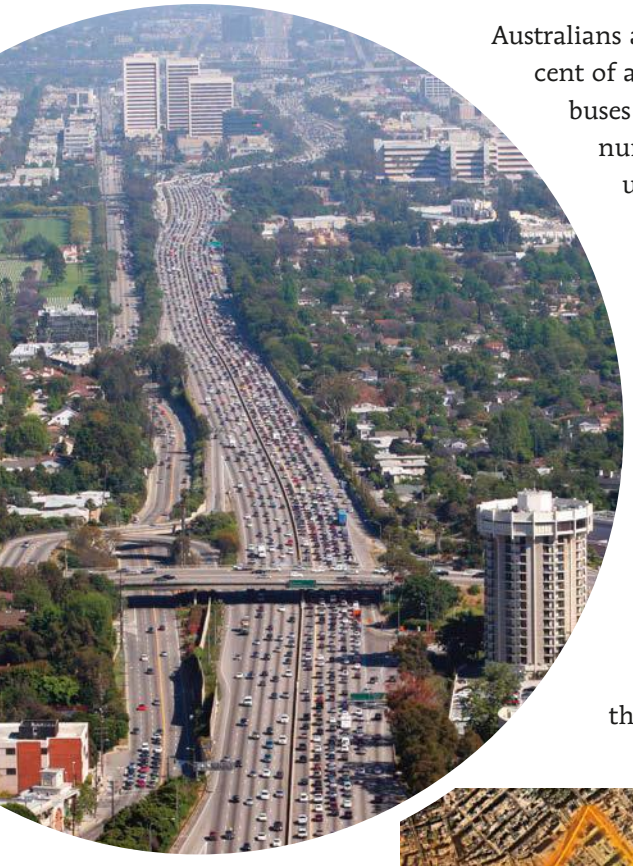
4 What would you describe as the biggest issue faced by people in that city?

5 Select one of the problems described in Source 5.41 and come up with a list of strategies of your own that you think could be used to reduce the problem and improve liveability.

Investigate and create

6 Make a list of all the items that you could scavenge from around your school to build an overnight shelter for you and your family. Draw an annotated picture of the shelter. How well would you sleep if it were raining?

IMPROVING TRANSPORTATION



Source 5.42 A Los Angeles traffic jam: more lanes, more cars, more traffic, more pollution

Australians are among the most car-addicted people in the world. About 90 per cent of all journeys made in Australia are made by car, with trains, trams, buses and bicycles accounting for the remaining 10 per cent. As the number of people in cities grows, so too does the number of cars. Many urban roads are struggling to cope. Road congestion, particularly during morning and evening peak times, is threatening the liveability of many of our large cities.

The avoidable costs of congestion in Australia's capital cities could reach up to $37.3 billion a year by 2030. These costs are a result of extra travel time needed, greater travel time variability, increased vehicle operating costs and poorer air quality.'Urban congestion contributes to traffic delays, increased greenhouse gas emissions, higher vehicle running costs and more accidents. It is a tragedy that many parents spend more time travelling to and from work, than at home with their kids. Relieve urban congestion and we improve our quality of life' (Anthony Albanese, Australian Minister for Infrastructure and Transport, March 2010).

In the United States, Los Angeles traffic congestion is the worst in the nation (see Source 5.42).



Source 5.43 Graphic representation of the paths taken by 380 taxis in a single day in London. Bright splashes of light show paths taken by many taxis while darker areas have seen few, if any, taxis.

Strategies for improving transportation

Here are some solutions that planners around the world are experimenting with to improve traffic flows:

- *Change the roads*
  - Build more ring roads and bypasses that take traffic around the city centre and other busy places.
  - Change the traffic flow in the inner city by introducing a one-way system for most of the roads.
  - Make the main roads smarter by installing: overhead signs advising of variable speed limits; signs that use GPS satellites to provide drivers with traffic information; traffic lights on entry ramps; monitoring systems in the road surface to detect traffic incidents and congestion; overhead closed circuit television monitors; and traffic signals that give priority to public transport.
- *Get people off the roads*
  - Introduce a 'park and ride' system where drivers park their cars on the edge of the central business district (CBD) and then travel to the CBD by bus or train.
  - Ban cars from the CBD.
  - Charge car drivers a toll when they enter the city centre.
  - Develop a better public transport system that encourages people to get out of their cars into trams, trains, buses and ferries. The world's best public transport systems involve all these modes working together on a single ticket and with an integrated timetable rather than as individual pieces of different puzzles.
  - Encourage people to walk or cycle by building more footpaths and bike lanes and promoting the health benefits of walking and cycling.
- *Keep doing what we're doing*
  - Build more multi-storey car parks in the city centre.
  - Build more roads to carry the increased traffic.
  - Increase motoring taxes to pay for new roads through increases in petrol prices.
  - Encourage private companies to build toll roads.

STRANGE BUT TRUE

After years of development, Los Angeles reached a milestone that few other, if any, major cities can claim: every single traffic light, all 4398 of them, can be monitored and controlled remotely.



REVIEW 5.2.8

Remember and understand

1 What does the graphic representation of London taxis (Source 5.43) reveal about transport flows in large cities?

2 What are the causes of traffic congestion?

3 What problems does traffic congestion cause for people and cities?

Apply and analyse

4 Here we have described many possible solutions to traffic congestion.

a Which do you believe are the three solutions most likely to relieve congestion? Explain your response.

b Which solutions do you think are most likely to make congestion worse rather than better? Explain your response.

Investigate and create

5 As the planner responsible for traffic congestion in your city, you have chosen one of these solutions to put into place. Design an advertising campaign that explains this solution to drivers and the general public. Remember to explain it clearly and simply and to point out the benefits of this solution for drivers and for all the residents in the city. You may choose to create a poster, brochure, bumper sticker or short TV or radio ad explaining your campaign.

IMPROVING LIVEABILITY FOR YOUNG PEOPLE

When trying to improve the liveability of a town or city, planners need to take into account the varying needs of people of different ages. The needs of children and young people are obviously very different from the needs of older retired people. Each of these groups, however, benefit from having special attention paid to their particular needs. Here we will look specifically at strategies for improving the liveability of places for children and young people.

Strategies for young people

The views of young people need to be taken into account when planning for more liveable cities. Some of the key liveability factors relevant to a younger population are:

- *Public transport*
  Young people are the community group most likely to be dependent on public transport services. Public transport needs to be safe and reliable to encourage young people to use it. Public transport routes also need to be designed to meet the needs of young people with services regularly going past local schools, shops, entertainment and sports facilities.
- *An attractive and healthy natural environment*
  When cities experience environmental issues such as air pollution, those often the worst affected are children, and negative impacts to their health can last a lifetime. With housing density increasing, the need for green spaces is increasing. Access to public parks and playgrounds provides healthy natural environments for children who are living in housing without gardens. These playgrounds also provide opportunities for children to develop their coordination and physical strength while enabling them to make friends and socialise.
- *Good schools and other educational facilities*
  Schools need to have teaching spaces that offer the flexibility for group work and individual work and also provide good outdoor spaces. As students use more technology in the classroom, schools need to adapt to meet the needs of this new technology by providing fast Internet and Wi-Fi.
- *A wide range of recreational environments for young people*
  One of the keys to improving liveability for young people is providing good public spaces. Public spaces should be designed to cater for their specific needs and interests. These include sportsgrounds and facilities such as skate parks and skating rinks, and entertainment facilities including cafés, cinemas and music venues. Community festivals and events can also be organised to include activities specifically designed to interest young people.
- *Services for young people at risk*
  Vulnerable young people who are at risk from abusive family members, homelessness or substance abuse need special attention to ensure that they are not disadvantaged by their circumstances and can reach their potential. Community services can provide support through counselling and mentoring, or by helping to arrange alternative accommodation.



CASE STUDY

'Our Youth – Our Future', Western Australia

In 2012, the Western Australian Government released a set of strategic goals designed to improve the lives of young people. Western Australia has Australia's fastest growing youth population. People aged between 12 and 25 years living in Western Australia make up about 20 per cent of the state's total population.

The Western Australian government is working with communities and consulting with young people to improve liveability in the areas that matter most to them. Through policies, services and community programs they aim to:

- increase young people's participation in community life through sport and recreation, culture and arts, and volunteering
- provide opportunities for young people to learn life skills and prepare for their working future
- create environments that appeal to young people and encourage healthy lifestyles.

The Esplanade Youth Plaza

One example of a community space created specifically to appeal to young people and improve liveability is the youth plaza on Fremantle's Esplanade Reserve (Source 5.45). The local council and the contractor, Convic Skateparks, provided information on the various options available and collected feedback from the community through workshops and online surveys. Stage one of the plaza, completed in 2014, has an area designed for skateboarders and BMX riders. Stage two will include a basketball half-court, table tennis, a stage area for youth concerts and children's play areas.



Source 5.44 Areas designed for young people, like this free graffiti wall in Warringah, can increase youth participation in the community.



Source 5.45 Stage one of Fremantle's Esplanade Youth Plaza

REVIEW 5.2.9

Remember and understand

1 What are three liveability issues that affect young people?
2 How does a skate park provide a more liveable community for some young people?
3 What facility or service would you like to see in your local community to make it more liveable for you?

Apply and analyse

4 Consider the case study from Western Australia above. What vision does the Western Australian Government have for young people?

Investigate and create

5 Provide one example of a service or a place that you think would make your local community a more liveable place for young people. What would be the expected outcome from your plan? (For example, location, approximate cost, stakeholders, support, opposition.)

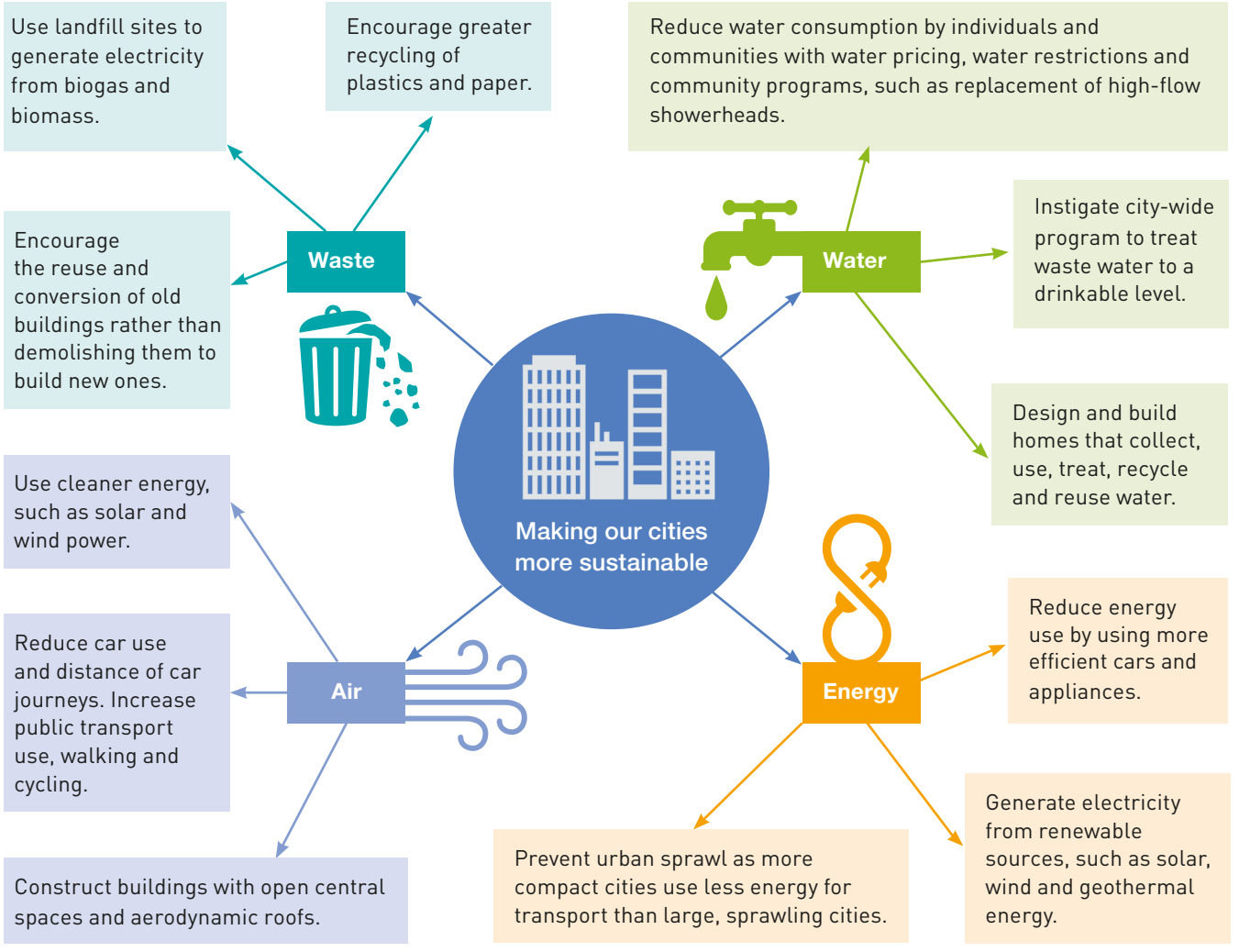


IMPROVING SUSTAINABILITY

The quality of the environment has a big effect on the liveability of a place. Cities consume large amounts of **natural resources**, such as water and energy. They also produce substances that are harmful to the environment, such as greenhouse gases, as well as solid waste, such as sewage and rubbish. Rapidly growing cities in developing countries are struggling to deal with these and other environmental issues.

In the last decade, Australian cities have become more sustainable by reducing their impact on the environment in many significant ways. We now use less energy, produce less rubbish, consume less water and have cleaner air than was the case at the beginning of this century. This is largely because of new technologies in such things as power stations and the phasing out of old technologies such as less efficient cars that pollute more.

There have also been changes in behaviour that have been encouraged by governments. City dwellers, for example, now take for granted that recyclable material is not waste and should be separated out in the weekly rubbish collection. Local restrictions on the use of water in households have also helped to make our cities more sustainable. But there is still much more that can be done.



Source 5.46 Concept map showing strategies for a more sustainable city

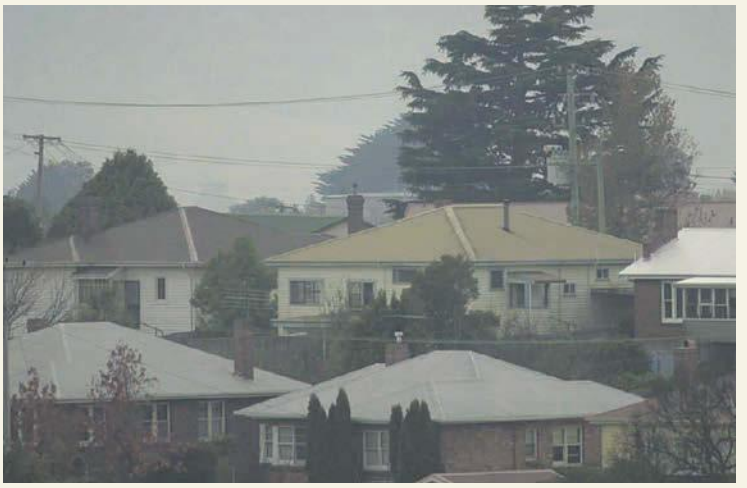
KEY CONCEPT: SUSTAINABILITY

Clearing the air in Launceston

The city of Launceston in northern Tasmania was once one of Australia's most polluted cities. This was due to a combination of natural processes and human activities. About two-thirds of households in the early 1990s used wood fires to heat their homes and this produced large quantities of smoke, particularly during winter. Launceston's location in a valley meant that the smoke was trapped and people's health began to suffer. Researchers linked Launceston's smoke to high rates of asthma and lung disease and likened it to the effects of tobacco smoking.

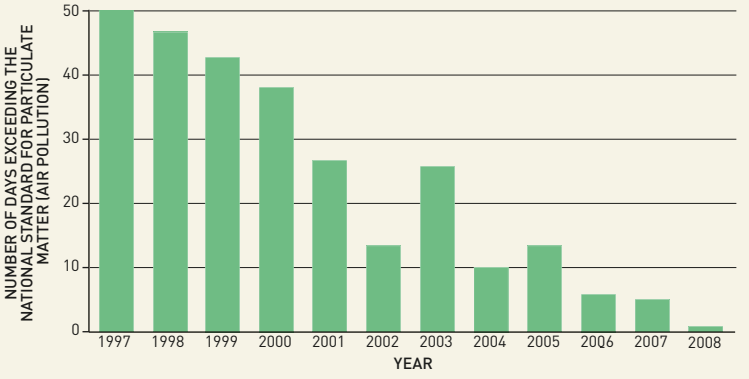
In 1997 there were 50 days in which Launceston's air exceeded the national standard for the amount of pollution. By 2008, this had fallen to only one day a year. This was due not to wood heaters but to a nearby bushfire. This dramatic change is largely because of a government scheme where Launceston residents were given $500 to change their home heating from wood fires to other methods, such as a gas fire or electric heater. More than 2000 residents have so far taken advantage of the scheme and thousands of others have changed their heating methods because of the publicity generated.

For more information on the key concept of sustainability, refer to section GT.1 of 'The geographer's toolkit'.



Source 5.47 The hills that surround Launceston trapped wood smoke, making it one of the world's most polluted cities.

LAUNCESTON: AIR POLLUTION, 1997–2008



Source 5.48

REVIEW 5.2.10

Remember and understand

1 Why did Launceston have such poor air quality?

2 How did the people of Launceston improve their air quality?

Apply and analyse

3 Solutions to some of the environmental problems faced by city dwellers can be easy to find but hard to put into place. Give some examples of solutions that have been difficult to put into place.

4 Select one of the four environmental issues shown in Source 5.46.
   - **a** Explain why this is an issue in cities.
   - **b** Which of the three solutions given do you think has the best chance of helping to address the issue?
   - **c** Can you think of two more solutions? Share these with your classmates and use the discussion to describe how cities can be made more sustainable.

5 Examine Source 5.48.
   - **a** Describe the change in air pollution in Launceston from 1997 to 2008.
   - **b** Give a possible reason for the sudden increase in pollution in 2003.

Investigate and create

6 Cities are one of the main causes of global climate change as much of the gas that traps heat comes from burning fossil fuels in cities. In a small group discuss how cities can lead the way in reducing the emission of these gases.

5.2

WHAT APPROACHES CAN BE USED TO IMPROVE THE LIVEABILITY OF PLACES?

CHECKPOINT

- **Investigate strategies used to enhance the liveability of places, using examples from different countries**

1 Identify four factors that can be used to rank the liveability of cities. [4 marks]
2 Why do geographers rank liveabiity? [3 marks]
3 Where in the world are the most liveable cities located? [2 marks]
4 Where in the world are the least liveable cities located? [2 marks]
5 Identify:
  a three issues or problems that reduce a city's liveability. [3 marks]
  b the underlying causes of each problem. [6 marks]
  c the impacts of each problem. [6 marks]
  d two strategies to address each problem. [12 marks]
  e the person or group responsible for carrying out each strategy. [6 marks]
6 Why are governments creating plans specifically to improve liveability for young people? [5 marks]
7 Explain the relationship between liveability and sustainability. [6 marks]

TOTAL MARKS [/55]

RICH TASK

Hamburg: a green city

The city of Hamburg in Germany is one of the most environmentally friendly cities in the world. Green spaces, parks, woodlands and nature reserves make up 16.7 per cent of the urban area and renewable energy accounts for 17 per cent of the city's power usage. Hamburg is one of the 20 most liveable cities in the world.

Hamburg is currently building an inner-city development called HafenCity in the location of the old port warehouses. HafenCity will provide housing for 12000 residents and jobs for around 45000 people. It will create 10.5 kilometres of new waterfront and 26 hectares of public parks, squares and promenades.

The HafenCity community will use 30 per cent less power thanks to environmentally friendly design and materials and wind and solar-power technologies. Many rooftops will be covered in greenery to slow stormwater run-off and reduce heat from the development.



Source 5.49
An oblique aerial photograph of the HafenCity development in Hamburg, Germany. It is Europe's largest inner-city redevelopment project.

Acquiring geographical information

1 Examine the photograph of HafenCity shown in Source 5.49.
   - **a** Are the buildings in HafenCity (in the foreground) generally lower or higher than those in the background? How can you tell?
   - **b** Would the width of the channel behind HafenCity be easier to measure on a plan or oblique view?

2 Conduct some research on the Internet to find out more about the HafenCity development in Hamburg.

3 In what year was the project first announced?

4 When do the developers estimate the project will be completed?

5 How many homes will HafenCity contain once the project is complete?

Processing geographical information

6 Find some images of the HafenCity site before it was developed and compare them with Source 5.50.
   - **a** In what ways has the HafenCity site changed since development began?
   - **b** How has the HafenCity development improved the liveability of the city of Hamburg?

Communicating geographical information

7 HafenCity has been designed to be highly sustainable – using environmentally friendly building materials and wind and solar power. Using Source 5.46, suggest three more ideas that could be introduced to improve the sustainability of HafenCity.



Source 5.50 A computer-generated plan of HafenCity from an oblique aerial view

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Space, Scale, Sustainability
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.



3

WATER IN THE WORLD



6 CHAPTER
WATER AS A RESOURCE

7 CHAPTER
VALUING AND MANAGING WATER

8 CHAPTER
INVESTIGATING ATMOSPHERIC AND HYDROLOGICAL HAZARDS

Hoover Dam - A massive dam. Hoover Dam was built in 1936 on the Colorado River in the United States. Located at a height of 221 metres, it serves as an irrigation supply, flood control, recreation and a source of hydroelectricity.

CHAPTER

6



Source 6.1 Hindus in India believe that bathing in the holy waters of the Ganges River gives them spiritual blessings.

WATER AS A RESOURCE

A resource is anything we use to satisfy a need or a want. Resources we use from the natural world are called environmental resources. All life on Earth depends on these environmental resources to survive. The water we drink, the Sun we depend on for light and warmth, the soil we use to grow our crops, and the trees we rely on to produce the oxygen we breathe are all environmental resources. As the world's population grows, we continue to place more and more pressure on these resources. The availability of many of these environmental resources (including oil, forests, and of course, fresh water) is becoming increasingly uncertain.



WHY DOES THE SPATIAL DISTRIBUTION OF WATER RESOURCES VARY GLOBALLY AND WITHIN COUNTRIES? 6.1

SECTION

In this section you will investigate:

- the characteristics and spatial distribution of global water resources
- the quantity and variability of water resources in Australia and other places

CHECKPOINT 6.1

HOW DO NATURAL AND HUMAN PROCESSES INFLUENCE THE DISTRIBUTION AND AVAILABILITY OF WATER AS A RESOURCE? 6.2

SECTION

In this section you will investigate:

- how the operation of the water cycle connects people and places

CHECKPOINT 6.2

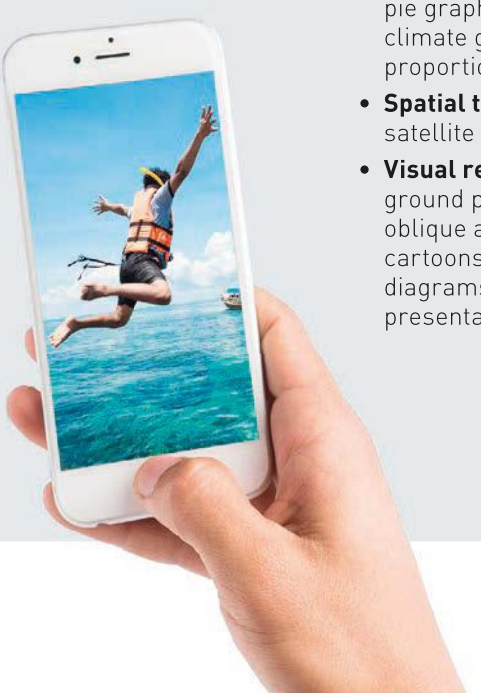
GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Space:** spatial distribution of global water resources
- **Environment:** the effect of human activities on natural environments
- **Interconnection:** how people affect the environment such as people's use of water on its quality and availability as a resource
- **Scale:** management of geographical challenges across a range of scales from local to global
- **Sustainability:** pressures on the Earth's water resources
- **Change:** changes to resources over time through natural and human geographical processes and events

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**



Geographical tools

- **Maps:** topographic maps, political maps, sketch maps, choropleth maps
- **Fieldwork:** virtual local area
- **Graphs and statistics:** pie graphs, bar graphs, climate graphs, proportionate graphs
- **Spatial technologies:** satellite images
- **Visual representations:** ground photographs, oblique aerial photographs, cartoons, annotated diagrams, posters, presentations, infographics

6.1 ENVIRONMENTAL RESOURCES: AN OVERVIEW

WHY DOES THE SPATIAL DISTRIBUTION OF WATER RESOURCES VARY GLOBALLY AND WITHIN COUNTRIES?

Over thousands of years, humans have developed ways of life that depend on almost all environmental resources found on Earth. Water from rainfall, minerals from rocks, and food from the forests and oceans have allowed us to build homes, farms, cities and highways all over the world. We have found and used resources in almost every corner of the Earth. Oil is drilled from beneath polar **ice caps** and water is drilled from far below barren **deserts**. Deep in the rainforests we have found plants that can cure illnesses and we have even worked out how to generate electricity from the waters flowing in our rivers.

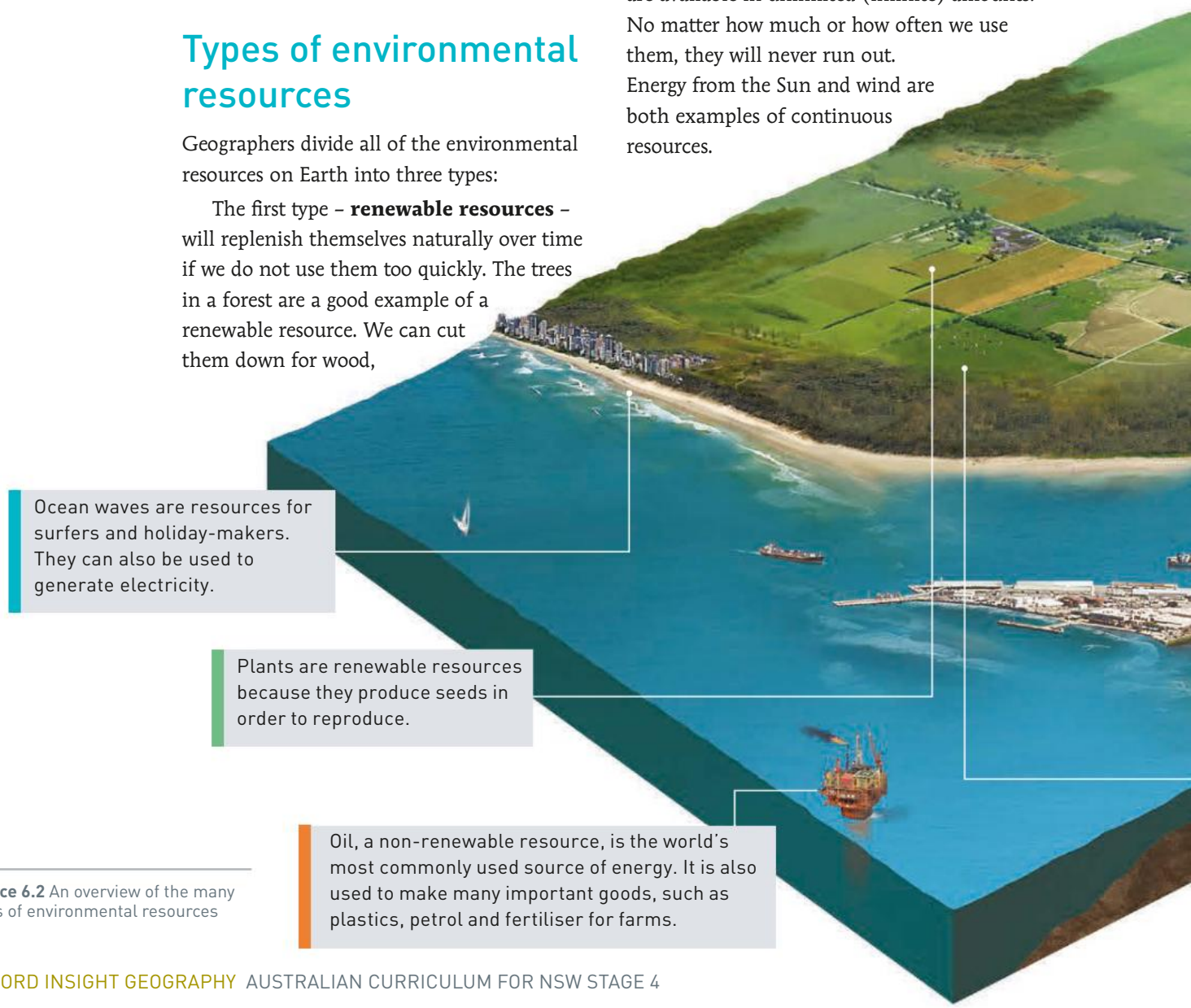
Types of environmental resources

Geographers divide all of the environmental resources on Earth into three types:

The first type – **renewable resources** – will replenish themselves naturally over time if we do not use them too quickly. The trees in a forest are a good example of a renewable resource. We can cut them down for wood, but they will grow back in time. We just need to manage them carefully. In countries such as Australia, fresh water is considered a renewable resource, but it needs to be carefully managed to ensure that enough is available for everybody.

The second type – **non-renewable resources** – are only available in limited (finite) amounts. If we overuse them, they will one day run out. Minerals such as coal, oil, diamonds and uranium are good examples of non-renewable resources.

The third type – **continuous resources** – are available in unlimited (infinite) amounts. No matter how much or how often we use them, they will never run out. Energy from the Sun and wind are both examples of continuous resources.



Source 6.2 An overview of the many types of environmental resources



REVIEW 6.1.1

Remember and understand

1 What are the three main types of resources? Give two examples of each type.
2 Why is it important to look after renewable resources, such as fresh water?
3 Describe how you may have used a non-renewable resource in the last hour.
4 What problems might societies around the world face if people continue to rely heavily on non-renewable resources?

Apply and analyse

5 Collect pictures of continuous resources, non-renewable resources and renewable resources from newspapers, magazines or the Internet. Sort these pictures into groups and describe how each resource is used by humans.

Investigate and create

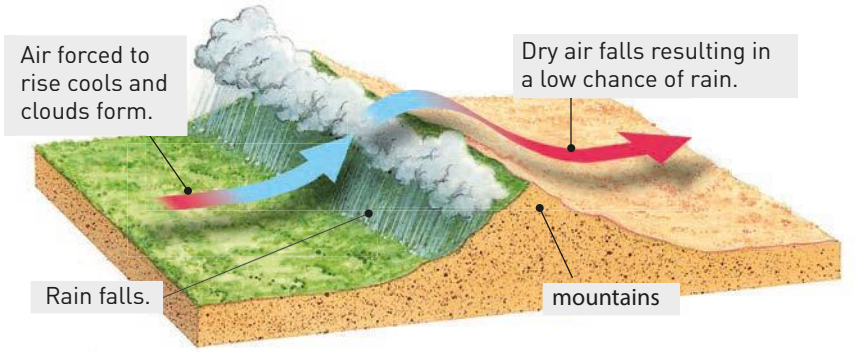
6 What do you think is the most important resource shown in Source 6.2? Give some reasons for your answer and be prepared to discuss this with a partner and with the class.

WHERE WATER COMES FROM

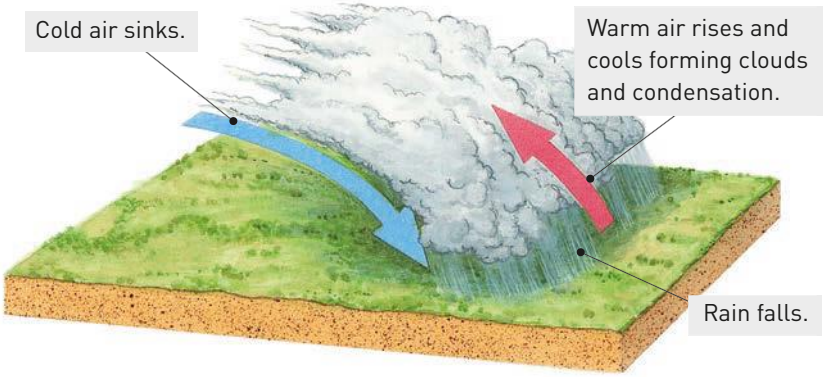
Water is one of our most precious environmental resources. Without it, nothing can survive. It is an essential, renewable resource that occurs naturally on Earth. It can exist as a solid (such as ice in a **glacier**), a liquid (such as water in a river) or a gas (such as fog). Fresh water is an available resource when in liquid form and a potential resource as a gas or a solid. Liquid water is constantly being recycled through the atmosphere, rivers and oceans in a natural system known as the **water cycle** (see Source 6.4).

Source 6.3 Different types of rainfall

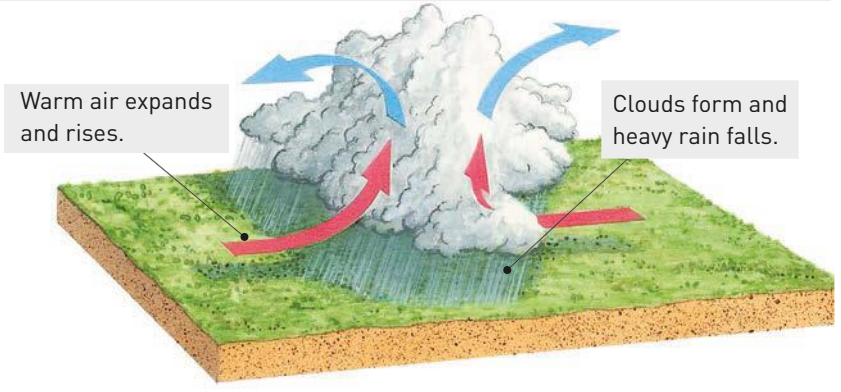
Orographic rainfall – Air is forced to rise due to the height of land masses, such as mountains. As the air cools, condensation forms, producing rain. As the air begins to fall from the high land, it warms up, creating dry regions.



Frontal rainfall – Two air masses meet and the cooler air mass wedges itself under the warmer air mass.This forces the warm air to rise and cool, causing condensation and rain along a distinct line.



Convectional rainfall – Temperatures during the day warm the ground causing warm air to rise rapidly and condense at high altitude. This produces heavy rain and thunderstorms.



In the water cycle, water from the oceans and lakes is heated and evaporated by the Sun. The evaporated water vapour, which is like steam, then rises until it reaches the cooler parts of the atmosphere. Cold air cannot hold as much moisture as warm air, so the water vapour turns back into liquid water in a process known as condensation. These drops of water then form into clouds, which may be carried on to land by winds and forced to rise. The colder air can no longer hold the condensed droplets and they fall as rain. The rainwater finds its way back to the world's lakes and oceans through rivers and streams and the process begins again. Water may change form, but it never disappears. That is why the water cycle is called a 'closed system'.

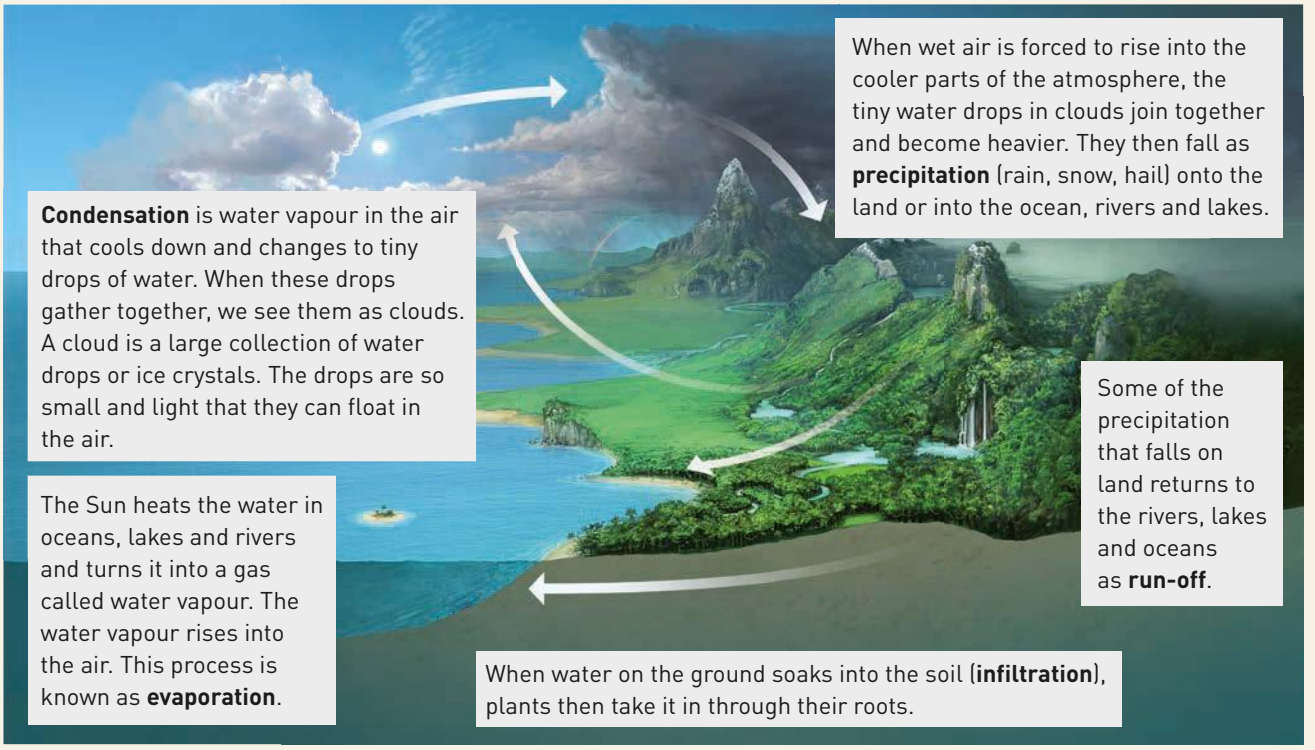
As you can see in Source 6.4, rain falls when wet air masses are forced to rise. There are three reasons that air masses rise. Each of these will produce different types of rainfall at different places on the Earth's surface.



KEY CONCEPT: INTERCONNECTION

The water cycle

The water cycle links together large areas of the natural environment (see Source 6.4). The world's oceans, mountains, rivers and atmosphere are all important parts of this cycle. The water cycle also connects the natural and human environments because water is central to all human activities. The presence of water is key when settling new farms and cities. For more information on the key concept of interconnection, refer to section GT.1 of 'The geographer's toolkit'.



Source 6.4 The stages of the water cycle

REVIEW 6.1.2

Remember and understand

1 What is the water cycle and why is it considered a closed system?
2 What causes water to fall as rain?
3 List these words in the correct order within the water cycle: precipitation, condensation and evaporation. Now write a definition for each in your own words.

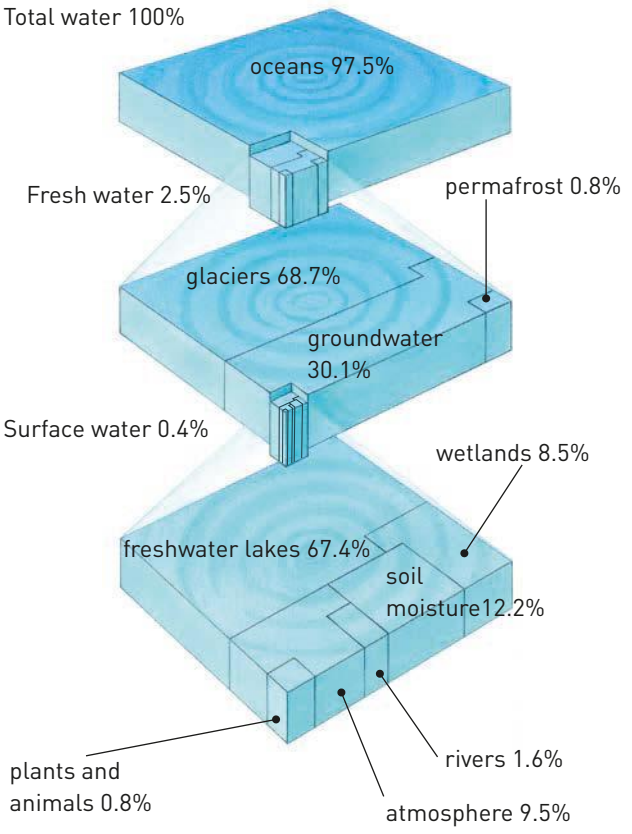
Apply and analyse

4 What is the difference between frontal rainfall and orographic rainfall? How are they similar?
5 Why do you think the wettest place in Australia is near Tully on the eastern slopes of the Great Dividing Range in Queensland? You might like to find Tully in an atlas to help with your answer.
6 The water cycle helps us to understand how water moves in our world but it can also help us understand how rivers change the landscape. How do you think the rivers shown in Source 6.4 have changed this landscape?
7 What type of rainfall do you receive most often in the place where you live? Why will the answer differ for students who live in other parts of Australia?
8 Salt water in oceans cannot be drunk or used to water crops. Is salt water an available or potential resource?

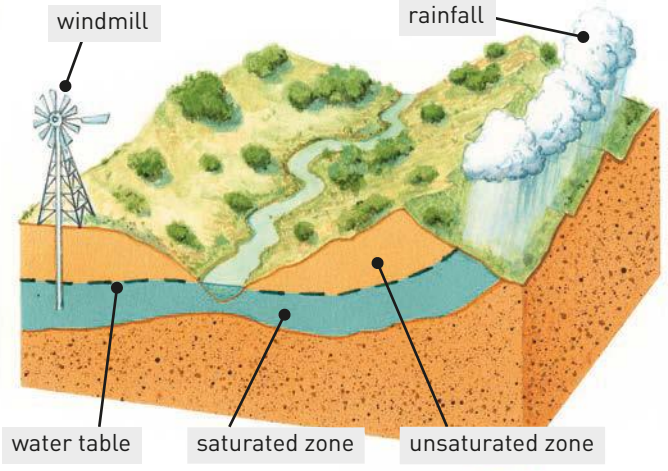
Investigate and create

9 Imagine that you are a water droplet in a cloud. Describe your journey through the water cycle in language that a young child would find interesting. Here is a start: 'Floating along with billions of my closest friends, I thought nothing would ever change ...'

ACCESSING WATER RESOURCES



Source 6.5 Distribution of the world's water



Source 6.6 Groundwater from aquifers is pumped to the surface via bores for use by humans

Although the surface of the Earth is covered with water, only a tiny percentage of that water is fresh and available for **consumption**. Typically this is found in surface water, such as lakes and rivers. Source 6.5 shows the breakdown and availability of this water. As populations grow and more water is used, people are also using groundwater locked away in underground **aquifers**. This water supports every man, woman, child, animal and plant on Earth. This makes water our most precious resource.

To further complicate matters, the available fresh water is not evenly distributed across the planet. Some areas of the world have much more than they need, while other areas do not have enough.

Countries with large rivers, such as the Amazon River in Brazil, and those with high rainfall, such as Indonesia and Papua New Guinea, can be thought of as being 'water rich'. Other countries, including Australia, can be considered to be 'water poor'.

Groundwater

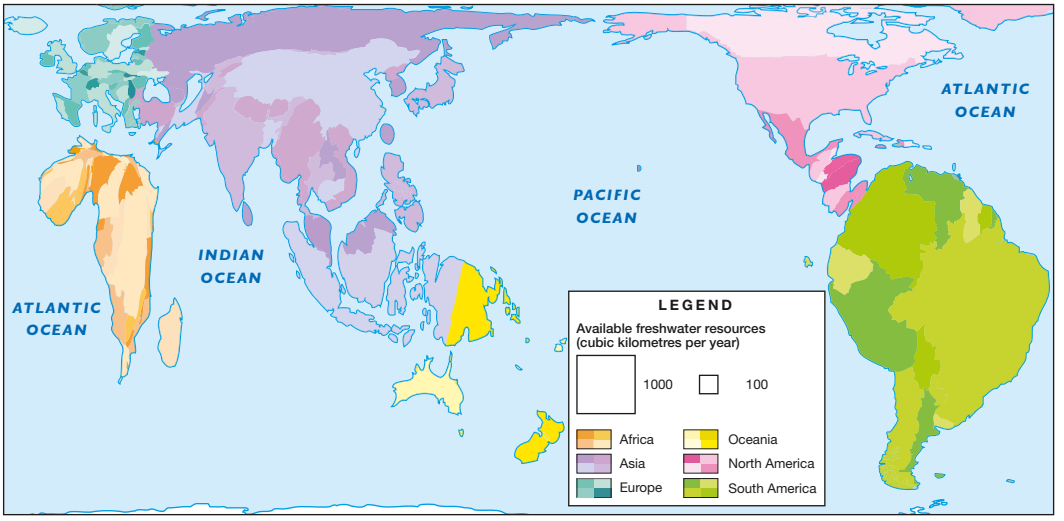
When it rains, water seeps into the soil to provide moisture for plants to survive. As water passes through the spaces between soil and rock it becomes groundwater. In the saturated zone, all the spaces between soil and rock particles are filled with water. The top of this zone is referred to as the water table (see Source 6.6).

Groundwater is fed by surface water from rainfall and rivers and naturally comes to the surface at springs or at oases in dry areas. Groundwater is also drawn to the surface by **bores** drilled into the ground. Most of Perth's water is drawn from an underground aquifer, a layer of permeable rock that stores water.

The world's freshwater resources

Source 6.7 is a map of the world as you have never seen it before. While each country is shown in its correct location, its size shows the proportion of the world's freshwater resources found there. Countries that appear fat are water rich; those that appear thin are water poor. Comparing the size and shape of countries in Source 6.7 with the same countries on a standard world map (like the one provided at the back of this book) will clearly show which are water rich (larger than normal) and which are water poor (smaller than normal).

WORLD: FRESHWATER RESOURCES



Source 6.7 Countries that appear fat are water rich; those that appear thin are water poor.

Source: Oxford University Press

SKILL DRILL

Using the PQE method to describe maps

The PQE method is used by geographers to identify trends and patterns in data and draw conclusions. For more information on the PQE method refer to section GT.2 of 'The geographer's toolkit'. There are three steps to follow when using the PQE (pattern, quantify, exceptions) method to describe maps:

Step 1 *Pattern:* Give a general overview of the pattern, referring to particular places. Which areas seem to have common features? (For example, 'The map of the world's freshwater resources shows that countries throughout South America have lots of fresh water'.)

Step 2 *Quantify:* Quantify your general overview using data for specific regions or countries. (For example, 'Brazil has more than 5000 km^3 of fresh water a year'.)

Step 3 *Exceptions:* Point out any exceptions to the pattern you have described. (For example, 'Madagascar, the island off Africa, appears to have abundant water supplies, whereas the rest of the African continent does not'.)

Apply the skill

1 Use the PQE method to describe the world's freshwater resources. Be sure to describe areas that are water rich and those that are water poor. The world map on the inside back cover will be useful.

REVIEW 6.1.3

Remember and understand

1 How much of the world's water is fresh water, available for our use?

2 Is Australia water rich or water poor? What does this mean?

3 Study Source 6.7.

a Which countries would you consider to be the most water rich? Which are the most water poor?

b Compare the freshwater resources of Australia, New Zealand and Papua New Guinea.

Apply and analyse

4 What can countries that are water poor do to access more fresh water? Brainstorm this as a class. Think first of those methods that you already know about, perhaps those used in your local area, and then expand these into other possibilities.

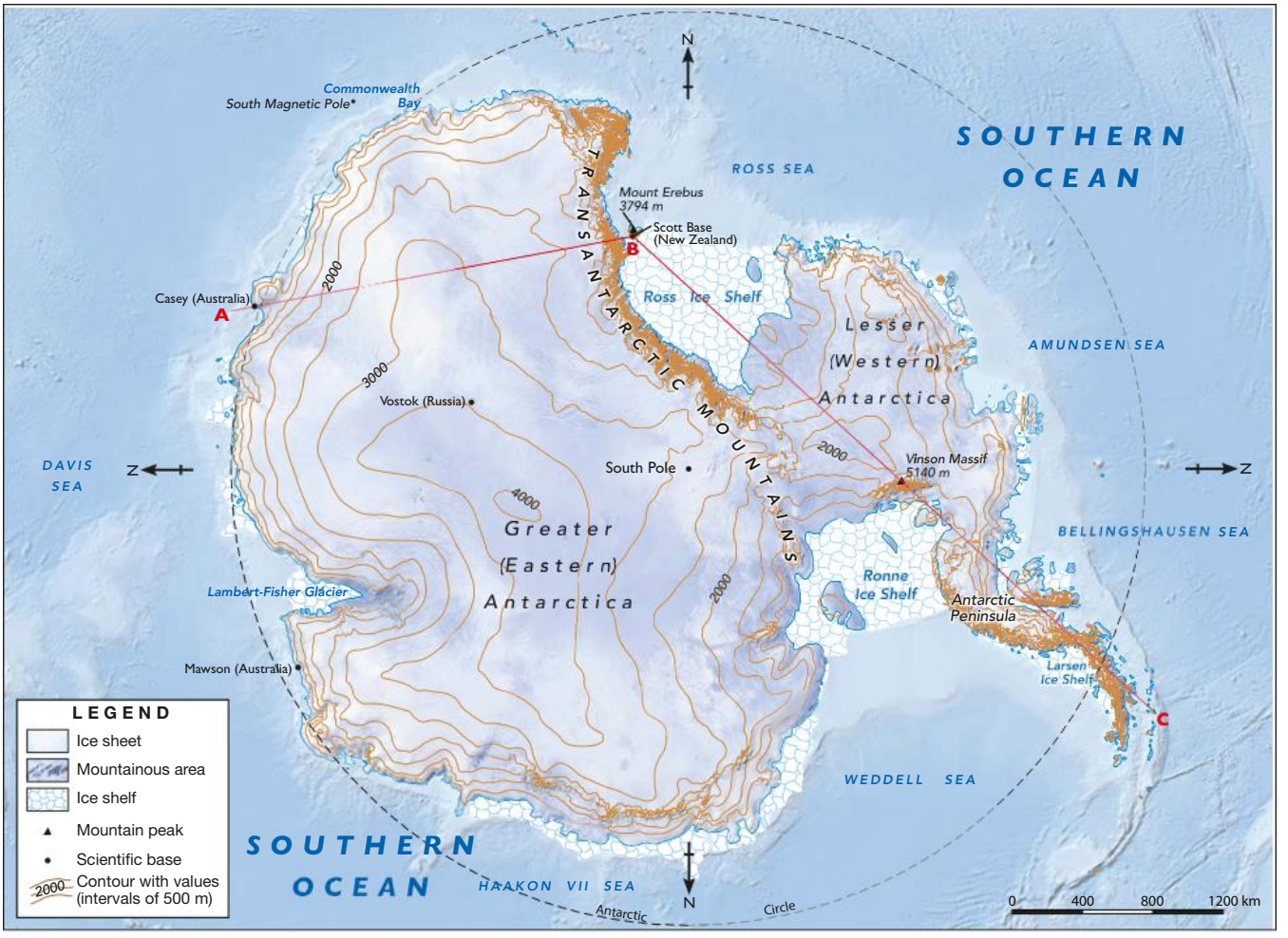
Investigate and create

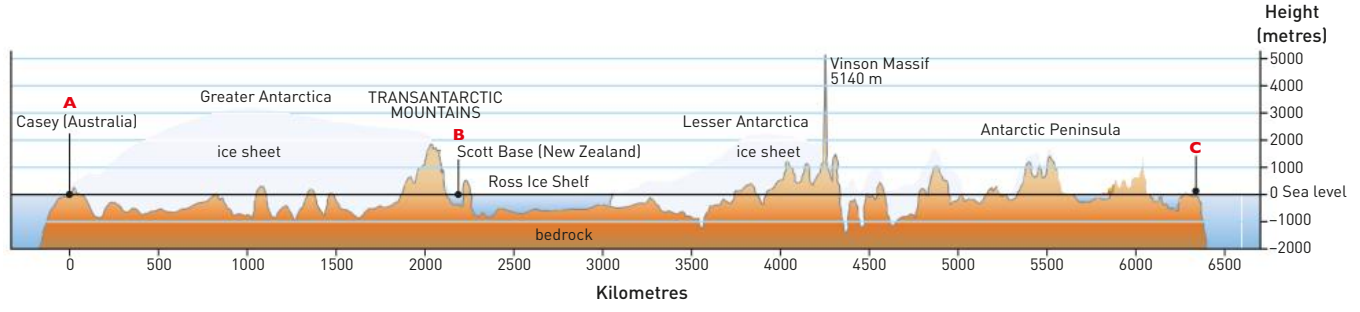
5 Conduct research to investigate the world's 10 largest rivers. Summarise your findings in a table, ranking them from largest to smallest. Also mention in which continent each river is found. Compare this to the world's major rainforests and see if there is a connection between the two. What other factors might be involved?

STORED WATER

The water cycle is the movement of water through the Earth, but most of the fresh water on Earth is in storage. Fresh water can be stored for days or weeks in a lake or for thousands of years underground or in an ice cap, such as the one that covers much of Greenland. About 97.5 per cent of the Earth's water is found in the oceans and is too salty to drink. Much of the remaining 2.5 per cent, which is safe for us to drink, is locked in the polar ice caps and in flowing rivers of ice, known as glaciers.

ANTARCTICA: LANDFORMS





Source 6.8

Source: Oxford University Press



Source 6.9 The ice of Antarctica stores most of the world's fresh water.

Antarctica contains nearly 70 per cent of the world's fresh water as ice in an ice sheet that covers large sections of bedrock (solid ground) in Antarctica. The ice sheet has an average thickness of 2500 metres and scientists have found places where the ice is thought to be twice this thickness. If this ice were to melt, sea levels around the world would rise by up to 60 metres. Because the temperature in the interior of Antarctica remains below freezing, any snow that has fallen there in the last few million years has never melted and has gradually formed into a great dome of ice. The ice is gradually moving towards the sea away from the centre of the continent. As it reaches the sea, the ice breaks off into gigantic **icebergs**.

STRANGE BUT TRUE

The Antarctic has been covered in ice for more than 30 million years. Right now, it is covered by 10 000 trillion tonnes of snow and ice.

REVIEW 6.1.4

Remember and understand

1 List three places where ice is stored.
2 Where is most of the world's fresh water stored?
3 Explain why the ice in Antarctica doesn't melt.

Apply and analyse

4 Look carefully at the map in Source 6.8.
   - **a** What happens to the sea surrounding Antarctica in winter?
   - **b** Explain the difference between an ice sheet and an ice shelf.

Investigate and create

5 Look carefully at the cross-section of Antarctica in Source 6.8. This shows a view of Antarctica from the side as if it had been cut along the A–B–C line on the map.
   - **a** Over which part of Antarctica is the ice sheet the thickest?
   - **b** Describe what Antarctica would look like without its ice sheet.
   - **c** Why is this cross-section a better way of showing the thickness of ice in Antarctica than the map?
6 What would happen if all the ice in Antarctica were to melt? What conditions might cause this to happen?

WATER IN AUSTRALIA

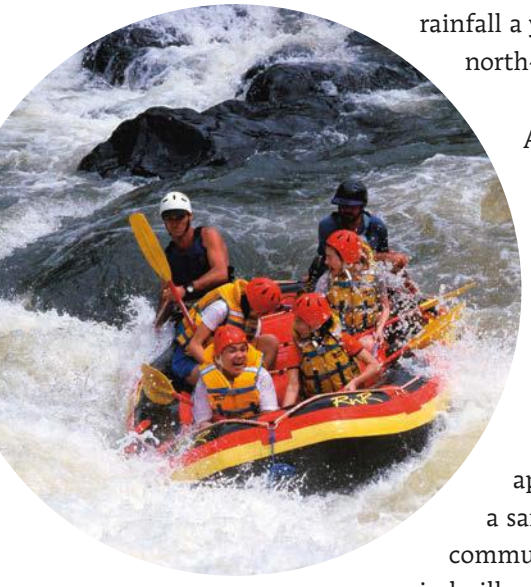
Australia has the lowest volume of water in rivers and the smallest number of permanent wetlands of any continent except Antarctica. Australia's water supplies are not evenly distributed. The northern third of the continent lies in the **tropics** and receives heavy rainfall with **monsoons** in the summer. It is a water-rich area. By comparison, vast areas of the interior receive very little rain.

Virtually all of Australia's large cities and towns are positioned on the coast, especially in the east and south-east. While most of these areas receive good, reliable rainfall, pressure from a large number of water users has put great strain on water resources in these areas.

Rainfall distribution in Australia

Much of the Australian continent is dry. It is only the northern, eastern and south-western coastal regions that receive good annual rainfall. The climate of the eastern half of Australia is influenced by the Great Dividing Range. It extends 3500 kilometres from the northern tip of Cape York to southern Victoria. Moisture-rich winds from the south-east push warm, moist air over the land. Forced to rise and cool, the water droplets fall onto the east coast as rain, but as the air descends to the west, it becomes warmer and drier.

Being such a large country, Australia has a great deal of variation in rainfall. It is common for one part of the country to have floods while another has a long drought. The wettest place in Australia is Tully, near Innisfail in north Queensland, which averages 4204 millimetres of rainfall a year. Tully receives so much rain because of its location within the tropics on the north-eastern facing slopes of the Great Dividing Range.



Source 6.10 Australia's heaviest rainfall makes Tully the white-water rafting capital of Australia.

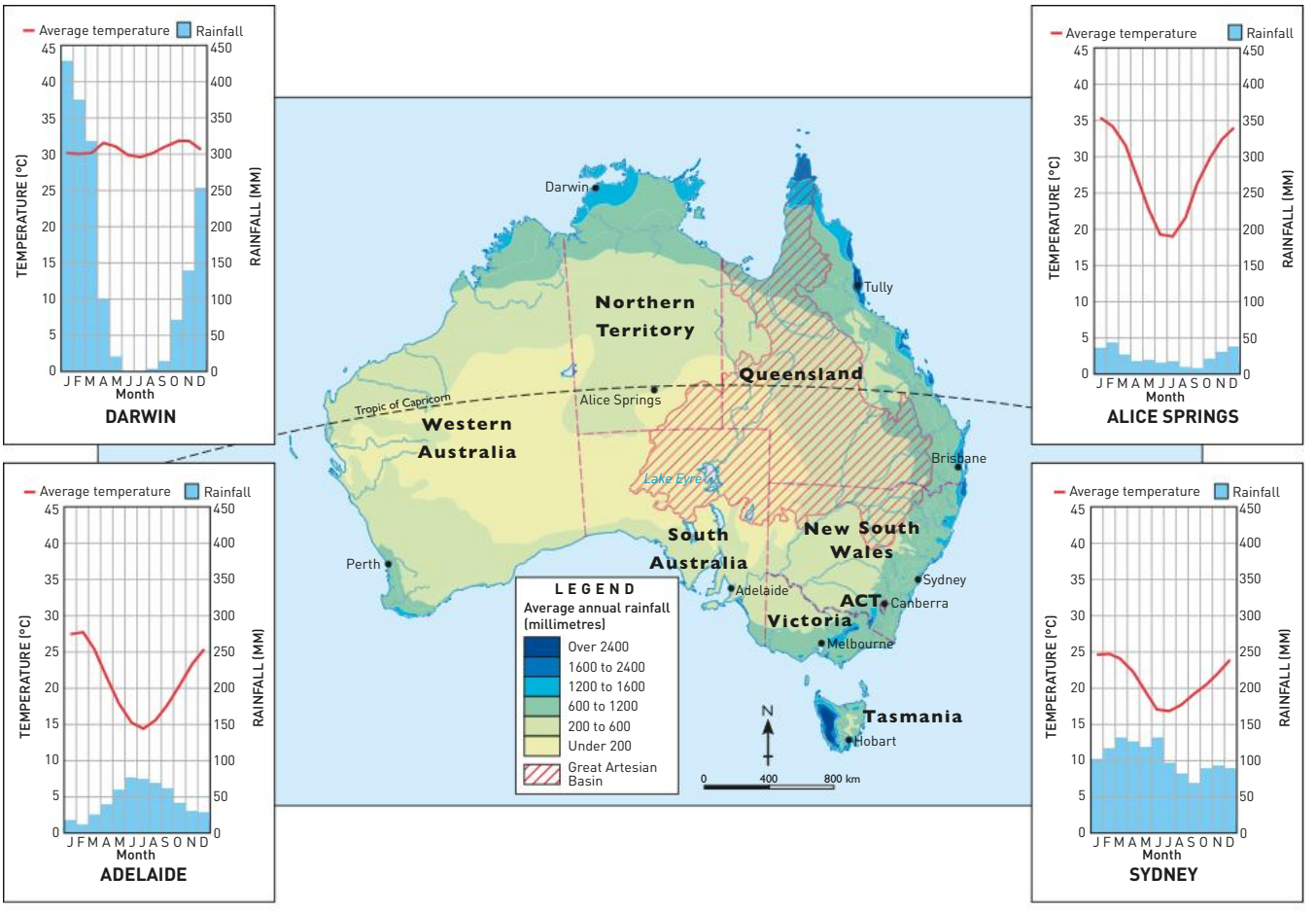
The driest place in Australia is on the shores of Kati Thanda (Lake Eyre) in South Australia, which receives little more than 100 millimetres per year. Kati Thanda receives so little rain because it lies far from any supply of moisture. Air masses reaching the interior of the country have generally dropped their rain on to the south-eastern corner of Western Australia, and so they are dry by the time they arrive at Kati Thanda.

Many communities in the interior of Australia rely on underground water as well as the little rain that falls. Lying beneath much of eastern Australia is the world's largest underground water supply, the Great Artesian Basin (see Source 6.11). It is more than 1.7 million square kilometres in size and covers approximately 22 per cent of Australia. The water is trapped underground in a sandstone layer covered by sedimentary rock, creating an aquifer. Farmers and communities access this water by drilling a well and pumping water to the surface with a windmill.

Australia's river resources

Rivers are a vital source of fresh water for many people. Australia, though, has the lowest volume of water in rivers of any inhabited continent on Earth. On average, just 12 per cent of Australia's rainfall is collected in rivers; this is referred to as the river discharge. The remaining 88 per cent of rainfall is used by plants, held in natural water storages (such as lakes, wetlands and aquifers) or returned to the atmosphere through evaporation. The Darling River, part of Australia's largest river basin (the Murray–Darling Basin), loses enough water every year through evaporation to fill Sydney Harbour four times.

AUSTRALIA: AVERAGE ANNUAL RAINFALL (CLIMATE GRAPHS FOR SELECTED LOCATIONS)



Source 6.11

Source: Oxford University Press

REVIEW 6.1.5

Remember and understand

1 Why do many Australians live on the southern and eastern coast?

2 Where are the wettest regions of Australia? Where are the driest regions?

3 How do many farmers and communities in inland Australia access more water?

Apply and analyse

4 Use the PQE method outlined in the Skill drill on page 205 to describe the distribution of Australia's rainfall from Source 6.11.

Investigate and create

5 Four climate graphs are shown in Source 6.11. Each of these gives us two important pieces of information about the climate at a particular place. Rainfall is shown as a series of blue bars while average temperatures are shown with a red line. The trickiest part of reading a climate graph is reading the correct scales. For more information on reading a climate graph refer to section GT.3 of 'The geographer's toolkit'.

- **a** Which is the most water poor of the four places shown? Why is this?
- **b** Which has the most even or reliable rainfall throughout the year? Why is this?
- **c** Which has the most seasonal rainfall?

6 Create your own climate graph for your school or neighbourhood. Using a rain gauge, or same-size plastic containers for comparison, record the daily amount of rainfall over a given week (check weather forecasts to plan for a rainy period). Also record the daily maximum temperature reading from a classroom thermometer, or from the nightly news weather report. Once you have collected all your data, you are ready to create your climate graph. (Refer to the Skill drill on drawing climate graphs on page 217 in this chapter.)

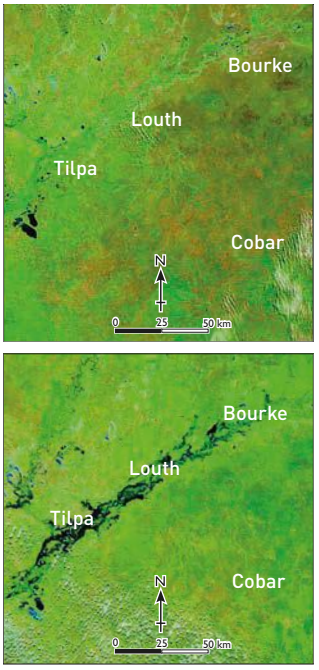
VARIATIONS IN AUSTRALIA'S WATER SUPPLY

Water is particularly difficult to manage in Australia, the driest inhabited continent on Earth. Australia has the lowest amount of water in rivers and the smallest areas of permanent wetlands in the world. Australia's water supplies are not evenly distributed. The northern third of the continent is water rich, while vast areas of the interior receive very little rain. Variable rainfall patterns make it quite common for one part of the country to experience major flooding while others experience extended periods of drought.

The Darling River

The Darling is Australia's third longest river, flowing 1390 kilometres from Brewarrina until it joins the Murray River at Wentworth. The Murray and Darling are the main rivers in the Murray–Darling River Basin, where 40 per cent of Australia's food is produced.

The flow of water in the Darling River varies greatly due to drought and water that is taken to supply farms for irrigation. The Darling can be a small trickle or a raging torrent – it can even dry up completely. The Darling River stopped flowing at the town of Menindee, near Broken Hill in New South Wales, 48 times between 1885 and 1960.



Source 6.12 These satellite images of the Darling River show the river affected by drought in 2011 (top), and flooded in March 2012 (bottom). These images use a photographic technique to help geographers distinguish between water and land. The colours used in the image are blue for water, bright green for vegetation, and an earth-tone for bare ground.

Climate change

Australians have come to see drought as part of the natural cycle of rainfall patterns, but a new threat now faces us – and it is one we do not fully understand. For years scientists have been warning us about the possibility that our climate is changing. While the vast majority of the world's scientific community now accepts that the planet is warming due to the effects of greenhouse gases, these experts are much less sure how this will affect specific places and specific climates. It appears that climate change will mean less water for many Australians in the future, putting even greater pressure on our current supplies. Much of Australia's fresh water comes from water collected in rivers, lakes and dams. This water will evaporate more quickly in the future, meaning that there will be less available for use in cities and rural areas. Source 6.15 shows the trends in annual rainfall over the last four decades. The green areas have had an increase in rainfall while the yellow and brown areas have had a decrease.

I love a sunburnt country,
A land of sweeping plains,
Of ragged mountain ranges,
Of droughts and flooding rains,
I love her far horizons,
I love her jewel-sea,
Her beauty and her terror –
The wide brown land for me! ...

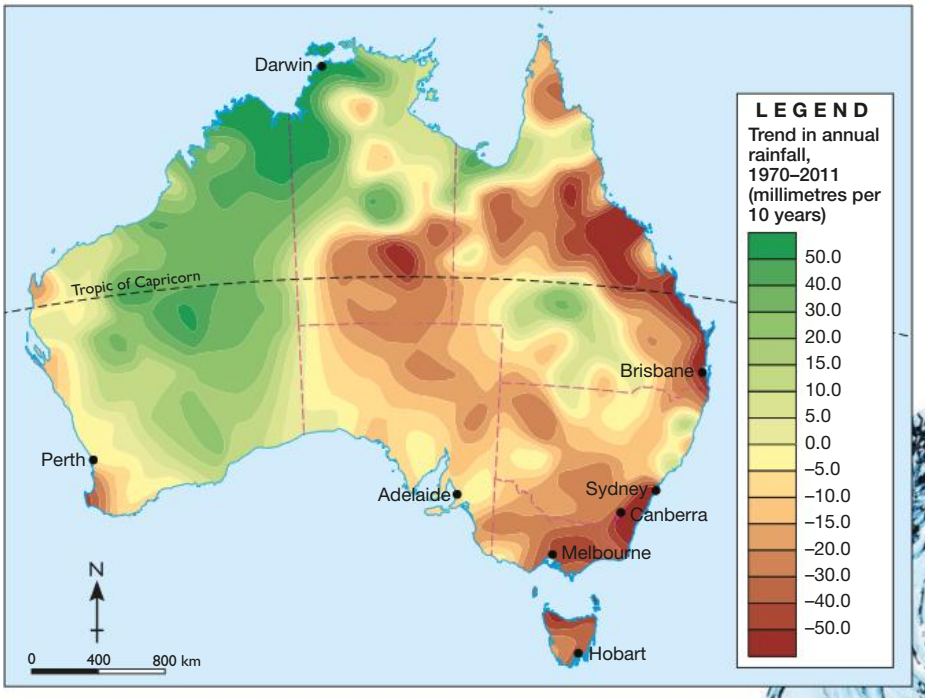
Core of my heart, my country!
Her pitiless blue sky,
When sick at heart, around us,
We see the cattle die –
But then the grey clouds gather,
And we can bless again
The drumming of an army,
The steady, soaking rain ...

Source 6.13 Part of the poem 'My Country' by Dorothea Mackellar (1908)



Source 6.14 A young girl from Wentworth in New South Wales jumps over the Darling River in 2006 (left) and swims in it during a flood in 2008 (right).

AUSTRALIA: RAINFALL TRENDS, 1970–2011



Source 6.15

Source: Oxford University Press

REVIEW 6.1.6

Remember and understand

1 Which part of Australia is the most water poor?

2 Read the extract of the poem 'My Country' in Source 6.13.

- **a** Decide if you think the poem accurately describes the part of Australia you live in.
- **b** Which line in the poem best sums up Australia's variable water supply?

Apply and analyse

3 Why might a warmer future lead to less water being available in Australia?

4 Look at Source 6.12. Explain how and why the flow of water along the Darling River changed between 2011 and March 2012.

Investigate and create

5 Look carefully at Source 6.15.

- **a** Between 1970 and 2011, which parts of Australia experienced significant decreases in annual rainfall?
- **b** Which capital cities have been most affected?
- **c** How has the Murray–Darling River Basin been affected?

WATER IN THE WORLD

In an average year, 577 000 km^3 of rain falls on Earth. Of this, 458 000 km^3 fall on the oceans and 119 000 km^3 on land.

When water falls to Earth as rain, most of it evaporates back into the atmosphere. Of the annual rainfall that falls on land, 74 000 km^3 (or 62 per cent) evaporates. In Australia, around 65 per cent of our total rainfall each year evaporates. The remaining 35 per cent runs off the land, and of this, only about 12 per cent ends up in our rivers. Only Africa has a higher evaporation rate than Australia.

The amount of water in Australian rivers is the smallest of all inhabited continents, with South America experiencing the highest volumes of water in its rivers. For example, the Amazon River (the second longest river in the world) carries more water than any other river on Earth with an average discharge (volume of water flowing through it) greater than the next seven largest rivers combined. Nearly 20 per cent of all the fresh water entering the oceans comes from the Amazon River.



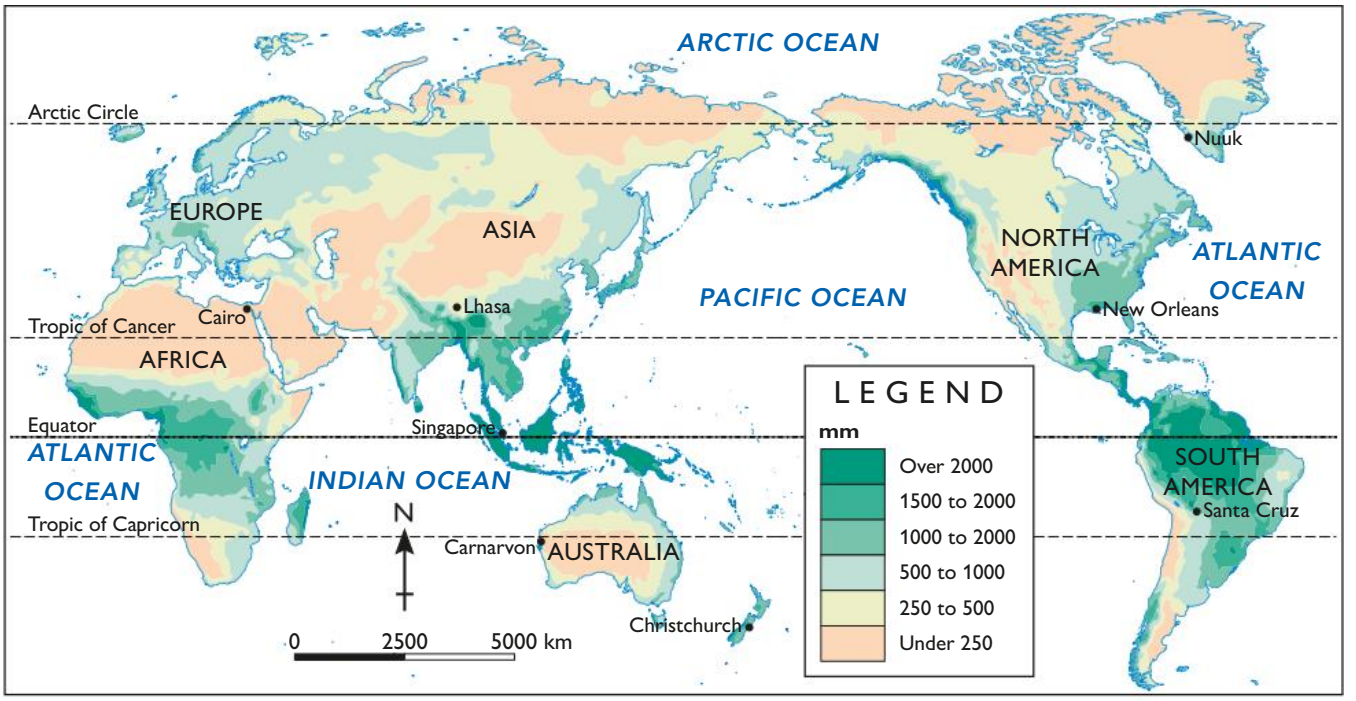
Source 6.16 Average volume of yearly rainfall, evaporation and run-off by world region

Source: FAO Aquastat



Source 6.17 Some of Australia's driest regions are in the desert.

WORLD: ANNUAL RAINFALL



Source 6.18

Source: Oxford University Press



Source 6.19 South America's high rainfall has contributed to the creation of the Igazu Falls, which are 80 metres high and 3 kilometres wide.

REVIEW 6.1.7

Remember and understand

1 Use Source 6.16 to rank the six inhabited continents from the continent with the most run-off to the continent with the least.

2 Which river carries the most water and how does it compare to other rivers?

Apply and analyse

3 Look carefully at Source 6.18.

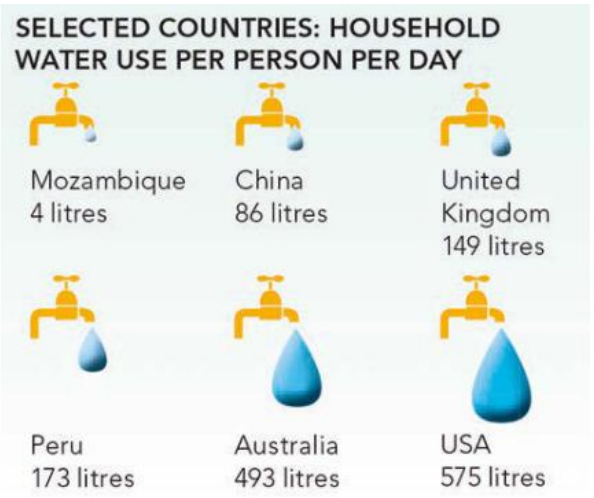
- **a** Which region of the world is the wettest? Why do you think this is the case?
- **b** Which part of Africa experiences the lowest rainfall? What type of landscape would you expect to find here?
- **c** Which part of Asia is the wettest? What are some of the advantages and disadvantages of high rainfall?

Investigate and create

4 Does the region north of the Arctic Circle have low or high rainfall? How might much of the water in this region be stored?

5 Indigenous peoples such as the Sami of northern Scandinavia have lived in these regions for many years. Conduct research into their daily lives and produce an infographic, poster or other presentation showing how they coped in this harsh environment.

THE WORLD'S DRINKING WATER



Source 6.20 Water use per person per day. Mozambique has the lowest daily water use per capita while the United States has the highest. Source: United Nations 2006

Drinking water, sometimes called potable water, is water that is safe to drink and use for cooking and washing. In Australia, most water undergoes some form of treatment to make it safe to drink. Water treatment removes sediments, pollutants and microorganisms that can make us sick. Australians are among the world's biggest water users, using almost 500 litres of water per person per day. This figure is for all water use, including water used in agriculture and industry. While this amount has declined in recent years, it still ranks among the highest in the world. Experts estimate that each Australian will need to use 12 per cent less water by 2030 in order to stay within the limits imposed by our rainfall. Some households have started to use a number of strategies to save water, while many others continue to waste large amounts.

Access to safe drinking water

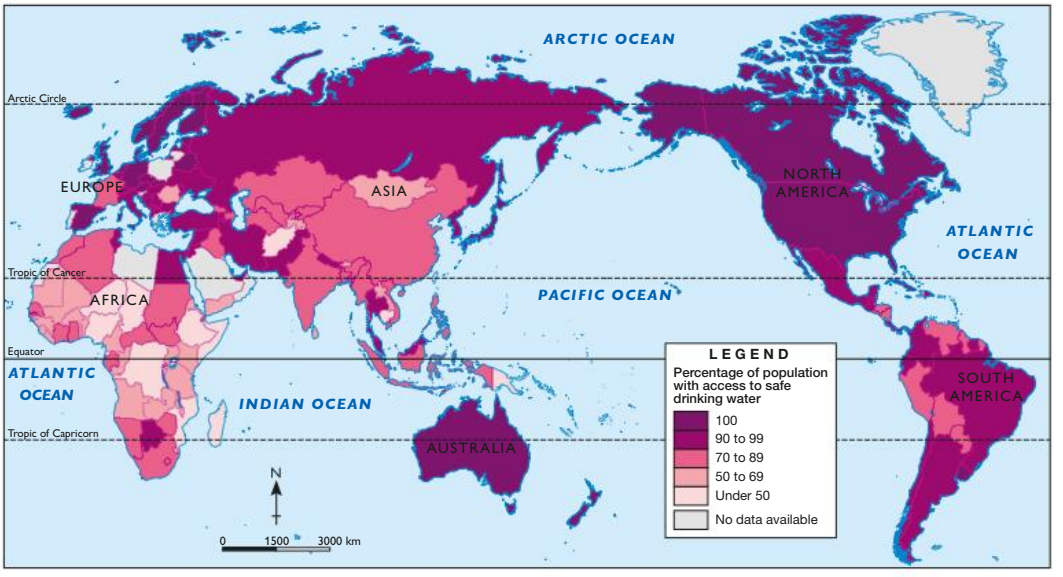
In Australia, we take for granted that we have flush toilets, running water from taps and clean, safe drinking water. However, millions of people around the world get sick or die each year from drinking contaminated water. The United Nations estimates that half the world's population has problems caused by lack of access to clean water. More than one billion people do not have access to a reliable freshwater supply, and 2.6 billion do not have basic sanitation, such as running water to clean their hands or flush their toilets.

It is estimated that, at any one time, almost half the people in poorer countries are suffering from health problems due to a lack of safe water. Each year, millions of people die from diseases carried in their water. Millions of women and children around the world, particularly in Africa, spend several hours a day collecting and carrying enough water to keep their families alive for another day.



Source 6.21 In Chad, as in many African countries, each day begins with a walk to the village well.

WORLD: ACCESS TO SAFE DRINKING WATER



Source 6.22

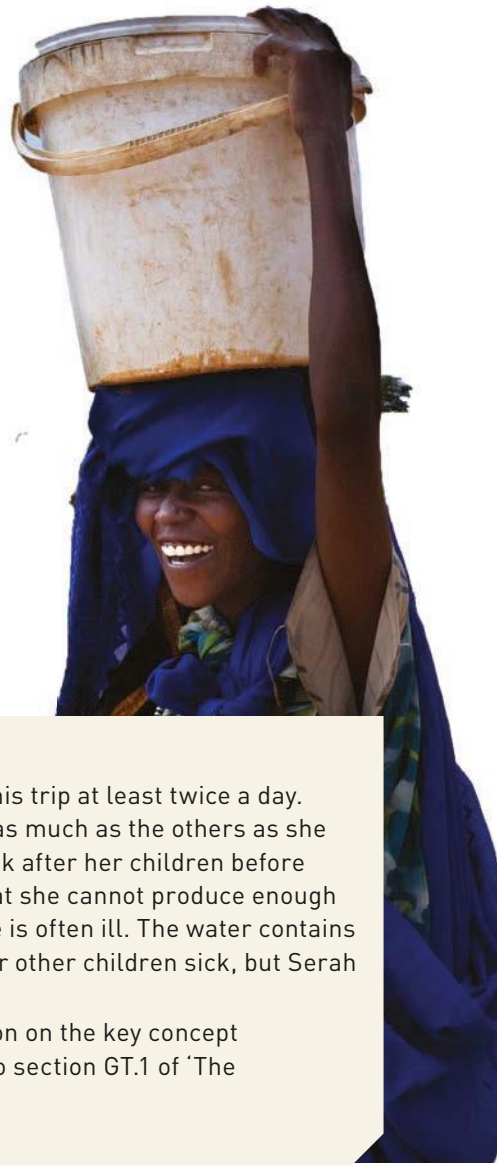
Source: Oxford University Press

EFFICIENT DAILY WATER USE PER HOUSEHOLD IN SYDNEY

PEOPLE PER HOUSEHOLD	SUMMER	WINTER
	249 L/day	233 L/day
	374 L/day	352 L/day
	476 L/day	447 L/day
	564 L/day	529 L/day
	643 L/day	604 L/day
	716 L/day	672 L/day

Source 6.23 This chart shows water consumption targets (known as 'efficient' consumption) for medium-sized properties (501–700 square metres) in summer (November–January) and winter (May–July).

Source: *Water wrap*, 2008–2013



KEY CONCEPT: ENVIRONMENT

Serah's story

Serah and her six children live in Ethiopia in Africa. The scarcest resource in her region is water. Before dawn, she makes her first journey to the village pump. Once there were three wells, but the 8-metre well has dried up. The 9-metre well has a little salty water at the bottom. The flow from the pump of the 25-metre well has slowed to a painful trickle. There is just barely enough for everyone to drink.

While it takes her 25 minutes to walk down the hill to the pump, it will take her 40 minutes to make the return journey with the 10-litre jar balanced on her head. She makes this trip at least twice a day. She tends not to drink as much as the others as she believes she should look after her children before herself. This means that she cannot produce enough milk for her baby, so he is often ill. The water contains parasites that make her other children sick, but Serah has little choice.

For more information on the key concept of environment, refer to section GT.1 of 'The geographer's toolkit'.

REVIEW 6.1.8

Remember and understand

1 What is potable water?

2 How many people in the world do not have access to a reliable supply of fresh water?

3 Describe the differences in the drinking water available in most Australian homes and in Serah's village.

Apply and analyse

4 Using Source 6.22 and the world map on the inside back cover of this book, identify two countries with excellent access to safe water and two countries with poor access to safe water. Which continent has the worst access to safe water?

5 Read Serah's story.

- **a** How much water will Serah collect in two trips to the pump?
- **b** How many people depend on her trips to the pump?
- **c** How much will each person receive?
- **d** The average toilet in Australia uses 8 litres per flush. Write a statement about the way water is used in Australia compared to Ethiopia.

Investigate and create

6 How much water do you use? Keep a diary.

- **a** List all the types of water use in your day. Record how many times you use water and for what reason (for example, showering, washing hands, brushing teeth, preparing food).
- **b** Next day, try to reduce the amount of water you use, while still maintaining good hygiene (for example, do not skip having a shower, but have a shorter one).
- **c** Create a 'Serah and me' infographic or poster to represent water use in different parts of the world. Use Source 6.23 for comparison.

6.1

CHECKPOINT

WHY DOES THE SPATIAL DISTRIBUTION OF WATER RESOURCES VARY GLOBALLY AND WITHIN COUNTRIES?

- Investigate the characteristics and spatial distribution of global water resources
- Investigate the quantity and variability of water resources in Australia and other places

1 Explain why global water resources differ around the world. Support your answer with examples from different countries. [5 marks]

2 Identify the problems that societies around the world might face if they continue to rely heavily on non-renewable resources. [5 marks]

3 **a** Describe the type of rainfall you receive most often in the place where you live. Provide a diagram. [10 marks]

b Why will the answer differ for students who live in other parts of Australia? [5 marks]

4 'Water is the most precious resource of all.' Explain why this statement is true. [10 marks]

TOTAL MARKS [/35]

Source 6.24 Water is a scarce and precious resource in Namibia.



RICH TASK

Windhoek, Namibia

Namibia is the driest country in Africa south of the Sahara Desert. Its capital, Windhoek, receives about 360 millimetres of rainfall a year and its 250 000 people rely on three dams for most of their water. These dams, however, are built on rivers that do not always flow and are therefore unreliable for city water use.

In 1969 the government decided to mix water from traditional sources, such as dams and wells, with recycled water from the city's sewage-treatment plant in order to supplement Windhoek's fresh water. As the city's population continued to grow rapidly, in the 1990s it was decided to build another treatment plant to convert sewage into drinking water. This was completed in 2002. Now more than one-third of Windhoek's drinking water comes from this unlikely source, making the city the world leader in turning waste-water into drinking water.

Source 6.25 Climate data: Windhoek, monthly average.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (mm)	76	74	79	41	8	0	0	0	3	10	23	48
Temperature (°C)	29	28	27	25	22	20	20	23	25	29	29	30

Acquiring geographical information

1 Describe the annual pattern of rainfall in Windhoek.

2 Explain how this annual pattern makes dams and reservoirs an unreliable water resource.

3 Describe the annual pattern of temperature and explain the impact of these temperatures on the evaporation of water held in dams.

Processing geographical information

4 Compare the climates of Windhoek and Alice Springs (Source 6.11). Identify differences or similarities.

5 Examine the map of Namibia (Source 6.26). Identify three water resources on this map.

b Explain what the people of Windhoek have done to make their water supply more sustainable and safe.

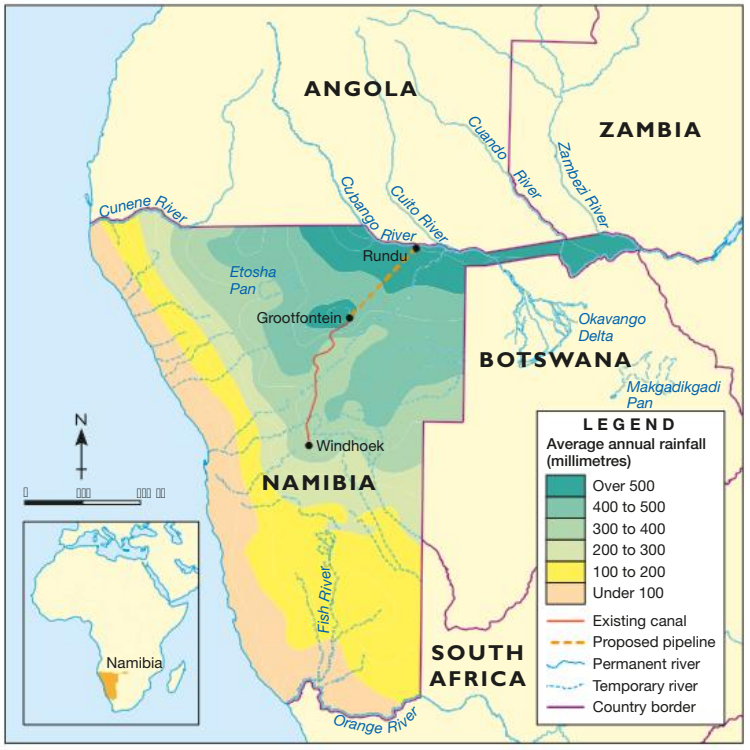
b What problems does lack of access to safe water cause?

Communicating geographical information

6 Use the information on the map (Source 6.26) to explain why a pipeline is proposed to be built from the Cubango River to Grootfontein.

7 Why would the people of Botswana be concerned about this proposed pipeline?

NAMIBIA: AVERAGE ANNUAL RAINFALL



Source 6.26

Source: Oxford University Press

SKILL DRILL

Drawing climate graphs

Climate graphs combine bar graphs and line graphs to help us interpret the climate in a specific location. In order to draw a climate graph, geographers gather climate data – the monthly average rainfall and temperature – for the location they are investigating.

Step 1 Look carefully at the climate data to find the lowest and highest temperature figures that you will need to show on your graph. In this example, Windhoek's temperature varies from 20 to 30 degrees Celsius. Decide on a scale that shows this range of data, then place it on the left-hand axis of your climate graph.

Step 2 Using graph paper, plot the temperature data on your graph by placing a small, neat dot in the centre of each month at the correct height. Join the dots with a smooth red line and continue the line to the edges of the graph.

Step 3 Look carefully at the climate data to find the lowest and highest rainfall figures that you will need to show on your graph. In this example, Windhoek's rainfall varies from 0 to 79 millimetres a month. Decide on a scale that shows this range of data, then place it on the right-hand axis of your climate graph.

Step 4 Plot the rainfall on your graph by drawing a blue bar to the correct height for each month. You may like to very lightly shade the bars with a blue pencil.

Step 5 Complete your graph with a suitable title and a label for each of the three axes.

Apply the skill

1 Using the steps shown above and the data in Source 6.25, construct a climate graph for Windhoek.

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Space, Environment, Interconnection, Scale, Sustainability
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Graphs and statistics

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

6.2 WATER CONNECTS PLACES

HOW DO NATURAL AND HUMAN PROCESSES INFLUENCE THE DISTRIBUTION AND AVAILABILITY OF WATER AS A RESOURCE?

Because people rely on water to survive, easy access to water influences where people choose to live. Cities, towns and villages are often located near fresh-water sources such as rivers, lakes and underground water reserves. Water sources also directly influence the way people live; for example, the crops they grow or the transport they use. As human settlements tend to cluster around the same types of water sources, these water sources need to be shared by the communities. Because of this, many places around the world are connected with each other through these water sources. Generally, three main factors relating to water influence where people settle: historical and enviornmental factors, agriculture, and trade and transport.



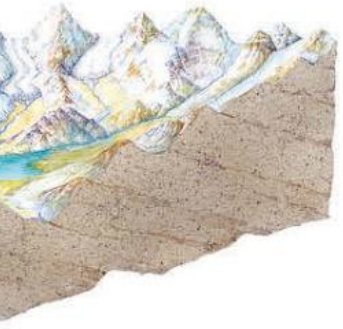


Source 6.27 The water that flows through the river systems around the world connects people and places in many ways.

Source 6.28 Large cities and towns around the world are connected by rivers. River waters allow people to travel and goods to be transported and traded. This barge on the Rhine river is carrying coal from the city of Cologne south to Switzerland.



Source 6.29 Communities in the Himalayas (a mountain range in Asia) depend on annual glacial melts to replenish their water supplies. Once replenished, excess water flows into rivers, connecting these communities with others downstream.





Source 6.30 Farming communities along the Mekong Delta in Vietnam plant their rice crops in the rich soil of the floodplains.



Historical and environmental factors

Historically, towns and cities have developed along rivers and near lakes and other fresh-water sources. People will settle anywhere there is water, adapting their way of life to the local environmental features. Communities in the Hindu Kush region of the Himalayas in Pakistan and Afghanistan depend on the seasonal melting of the snow and glaciers to provide them with fresh water. This melt also feeds the great rivers in the region, the Indus and the Ganges, that supply water to the many cities and communities that have been established along their banks – around 1.5 billion people.

Agriculture

Communities also rely on fresh water to grow crops and farm animals. The availability of fresh water will determine the sorts of crops grown. In places where water is limited, crops that need little **irrigation**, such as corn, will be grown. Crops that rely heavily on water, such as rice, are grown on **floodplains** where water is plentiful. These floodplains and **deltas**, located on flat land where rivers meet the sea, have particularly rich soil because of the deposits of silt that have travelled down the river from the mountains.

Trade and transport

Rivers move water across the Earth's surface, carrying water great distances to the sea. Rivers, lakes and oceans also act as transport networks, allowing products and people to move easily from one place to another, connecting the communities established on their banks.

REVIEW 6.2.1

Remember and understand

1 Explain why water plays such an important part in where people decide to live.
2 How does the availability of water determine how people in different places live?
3 Name three factors relating to water that influence where people choose to settle. In your own words, describe each of these factors briefly.

Apply and analyse

4 Describe how water flowing along a river can connect people living at different points along it.
5 How has the choice of crops being grown in Source 6.30 been determined by the environment? By contrast, what types of crops do you think would be grown in the location shown in Source 6.29?

Investigate and create

6 Conduct research into one of the great river basins of the world. You may like to use the Murray–Darling Basin as an example to help you construct a similar double-page infographic or poster to highlight the importance of the river basin to those who live within it.

WATER AFFECTS PLACES

As well as connecting different people and places, water can also affect them – in both positive and negative ways. On the positive side, water from the rain and rivers is used to irrigate the crops and farm the livestock that we eat. This water has a positive effect on the places in which we live. Without it, no life could exist. On the negative side, water in all its states – whether as a liquid (water), a solid (snow and ice) or a gas (fog) – can cause serious problems and damage in different places. Snow storms can shut down cities for days, heavy fog can disrupt air travel and cripple airports, and heavy rain can cause widespread flooding.

A good way of understanding how water affects places is to look at some case studies relating to rivers. Rivers are interesting to study because if there is a problem upstream (such as a flood or pollution) this problem will quickly travel downstream, affecting the people who live there. Flooded rivers can affect many settlements along their banks, collecting and carrying debris, such as trees and cars, as they go. If pollution or toxic chemicals enter the water at one location on the river, they quickly affect other parts of the river downstream, as well as the people who use it.

CASE STUDY

Tisza River pollution, 2000

In 2000, a storage pond used by a gold mine in Romania burst its banks. Around 100 000 cubic metres of water containing poisonous cyanide spilt into a local river that flowed into the Tisza River in nearby Hungary.

The cyanide spill killed much of the fish and plant life for several hundred kilometres downstream. Drinking water was polluted in four different countries: Romania, Hungary, Serbia and Bulgaria.



Source 6.31 A Hungarian fisherman pulls out toxic fish from Lake Tisza on the Tisza River 12 days after a serious chemical spill upstream in Romania on 30 January 2000.

CASE STUDY

Thailand floods, 2011

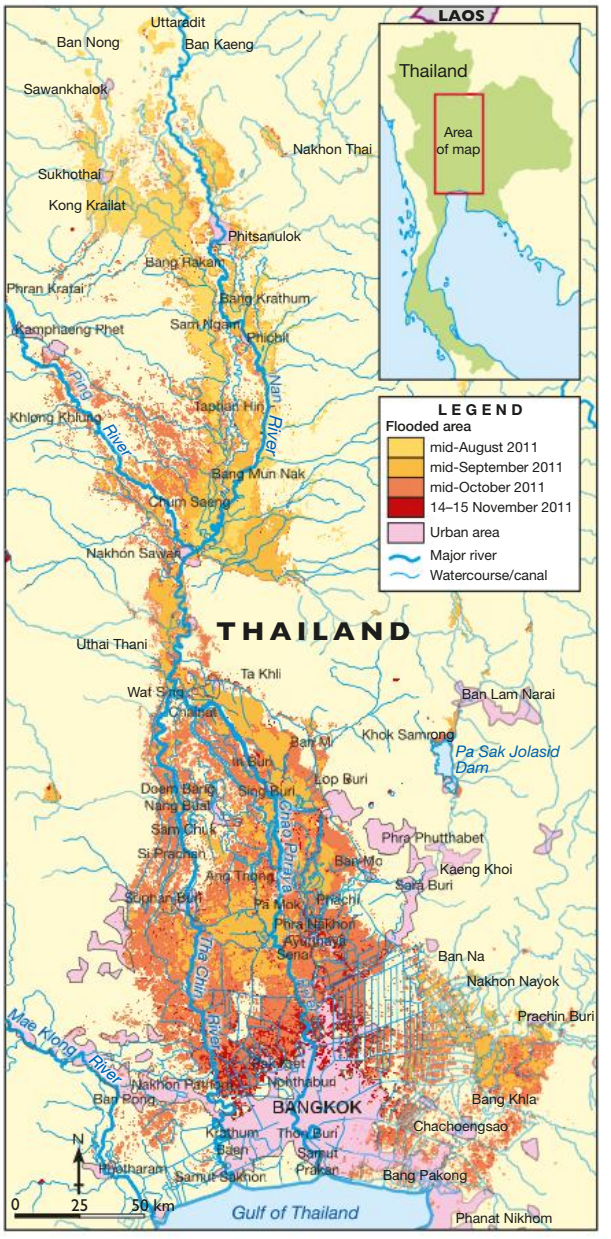
In 2011, the people of Thailand experienced some of the worst flooding they had seen for decades. Areas of Thailand are prone to flooding as the annual monsoon brings heavy rain, particularly in the north of Thailand. In early 2011, a tropical cyclone combined with the monsoon to more than triple the amount of rain falling on northern Thailand. As heavy rains continued for several months, rivers burst their banks in the mountainous north, resulting in flash flooding and at least 13 deaths.



Source 6.32 Floodwaters in the main street of Ayutthaya during the floods in Thailand in 2011 shut down the city and resulted in many deaths.

Flooding continued downstream in many large towns built beside rivers. Soon the country's capital, Bangkok, became the area of greatest concern. Located on a low floodplain at the mouth of the Chao Phraya and Tha Chin rivers, Bangkok is very prone to flooding and, despite an intricate system of flood walls and canals, much of the city flooded. By the time the floodwaters receded, they left more than 500 people dead and a damage bill of more than US$45 billion.

THAILAND: TIME LAPSE MAP SHOWING THE SPREAD OF FLOODWATERS, MID-AUGUST 2011 TO 15 NOVEMBER 2011



Source 6.33

Source: Oxford University Press

REVIEW 6.2.2

Remember and understand

1 Give examples to show how water affects places in its gas, liquid and solid states.

2 What problems did the gold mine in Romania cause downstream?

Apply and analyse

3 Look carefully at Source 6.33.

- **a** When did floodwaters reach Bangkok?
- **b** How far had some of the floodwater travelled? (Use the scale to calculate the distance.)

Investigate and create

4 Decide whether each of the following facts makes flooding in Bangkok more likely or more dangerous. Justify your answer for each one.

- **a** Between June and October, Thailand experiences its wet season with heavy monsoon rains.
- **b** Bangkok has been built on the Chao Phraya River delta.
- **c** Between 1985 and 2010, Thailand's population increased by more than 10 million people.
- **d** The land on which Bangkok is built is sinking by 30 millimetres a year.

WATER FOR FOOD

Farmers are by far the biggest users of water in Australia. About 70 per cent of the fresh water used each year in Australia is used in agriculture. This water is used to produce an enormous range of products, many of which you consume every day (see Source 6.35).

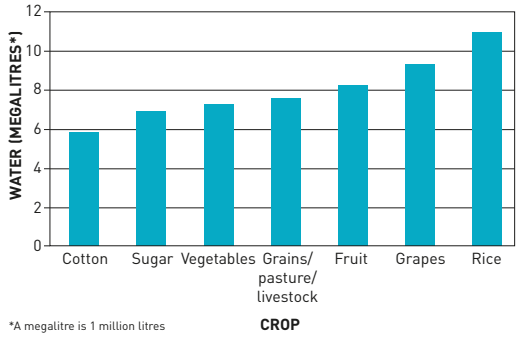
You may not realise it, but a lot of water was needed to produce your breakfast. Many everyday products use even more water. For example, it takes up to 50 000 litres of water to produce 1 kilogram of beef, and 685 000 litres to produce enough wool to make one suit. The amount of water needed to produce an item of food, such as a steak, or a piece of clothing, such as a suit, is known as **virtual water**.

In Australia, many crops are grown in the Murray–Darling Basin in south-eastern Australia (see Source 6.37). While a lot of the water used in this region falls on the farms as rain, much of it is taken from the rivers. Movement and control of water has a large economic impact in this region.

In the past, the rivers in this region had a normal cycle of flood and drought. Farmers needed a more reliable flow of water and so a system of dams and weirs was built along the river. These collect water during wet times and release it gradually during dry times, thereby controlling the flow of the river.

Farmers are allowed to use a certain amount of water each year and are charged for the amount of water they use. Because they have to pay for their water, farmers in this region use it very carefully. Another reason for farmers to use water as efficiently as possible is the scarcity of water in many parts of Australia. In the early years of the 21st century, a widespread and severe drought turned the Darling River and many others into a series of pools separated by kilometres of dry river bed. Because of these factors, many farmers and farming industries have developed more water-efficient methods of farming.

WATER USED PER HECTARE (10 000 M^2) TO GROW SELECTED CROPS



Source 6.34



Apricots
Apricots are grown and processed in northern Victoria and southern New South Wales. They are processed in various plants centred around Shepparton, Victoria.

Estimated water needed to produce 1 kilogram of apricots: 1391 litres



Bread
The main ingredient in bread is wheat. New South Wales produces the most wheat in Australia, most of this is in the east of the Murray–Darling Basin.

Estimated water needed to produce 1 kilogram of wheat: 750 litres



Milk and butter
More than 60 per cent of Australia's milk and milk products comes from Victoria. Leongatha in Victoria is home to a huge dairy factory.

Estimated water needed to produce 1 glass of milk: 200 litres

Estimated water needed to produce 1 kilogram of butter: 18 070 litres



Raspberry jam
The main ingredient in raspberry jam is sugar. Virtually all of Australia's sugar is grown in Queensland. Raspberries grown in the Goulburn Valley make up 40 per cent of the jam.

Estimated water needed to produce 1 kilogram of sugar: 173 litres

Estimated water needed to produce 1 kilogram of raspberries: 713 litres



Rice Bubbles
Rice Bubbles are made from 89 per cent whole white rice, which is grown in the Murrumbidgee Irrigation Area (part of the Murray–Darling Basin). Much of the rice industry is centred around Deniliquin in southern New South Wales.

Estimated water needed to produce 1 kilogram of rice: 1550 litres

Source 6.35 Water requirements to produce typical breakfast foods

Murray River irrigation

Lake Hume is an artificial lake formed by the Hume Weir near Albury–Wodonga on the Murray River. Completed in 1936, it is one of a series of dams and weirs built to control the flow of water in the Murray River. Its main purpose is to trap water during periods when there is a large amount of water in the Murray River and release it gradually to keep the flow of the river relatively constant.

A network of irrigation pipes and open channels carries the water from the Murray River hundreds of kilometres to individual farms. Open channels are generally less efficient than pipes as water is lost to evaporation and water seeping into the soil. However, they are much cheaper to build than pipes.

When the water reaches the farms it flows through gravity or is pumped onto the crops or pastures. A common method of irrigation is the use of a pivot spray. A giant arm with sprayers attached moves around a central pivot point, creating distinctive circles of green.

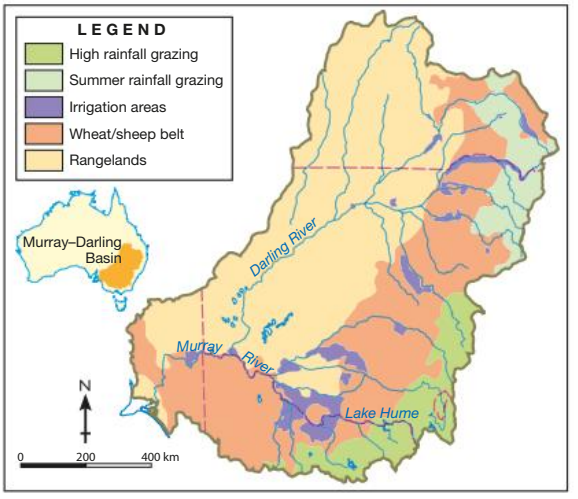
STRANGE BUT TRUE

Water is sticky. The molecules love to stick to things, especially each other. It's what gives it such a large surface tension. It keeps you alive: it means water can pull blood up narrow vessels in the body, often against the force of gravity.



Source 6.36 An irrigation channel in the Murray–Darling Basin

MURRAY–DARLING BASIN: LAND USE



Source 6.37
Source: Oxford University Press



Source 6.38 Pivot spray irrigation

REVIEW 6.2.3

Remember and understand

1 How much of Australia's fresh water is used on farms?

2 Explain how water for irrigation of crops and pastures reaches the farms.

3 Rank the breakfast foods shown in Source 6.35 in order from greatest water need to least water need.

Apply and analyse

4 Can farmers use as much water as they want?

5 Look at Source 6.34.
- **a** Which crop uses the most water?
- **b** Which crop uses the least water?

6 Why do you think it takes so much water to produce 1 kilogram of rice?

7 In what ways is the Murray–Darling Basin one of Australia's most important resources?

8 Look closely at the map (Source 6.37).
- **a** What relationship do you notice between irrigation areas and rivers?
- **b** Explain the nature of this relationship.

Investigate and create

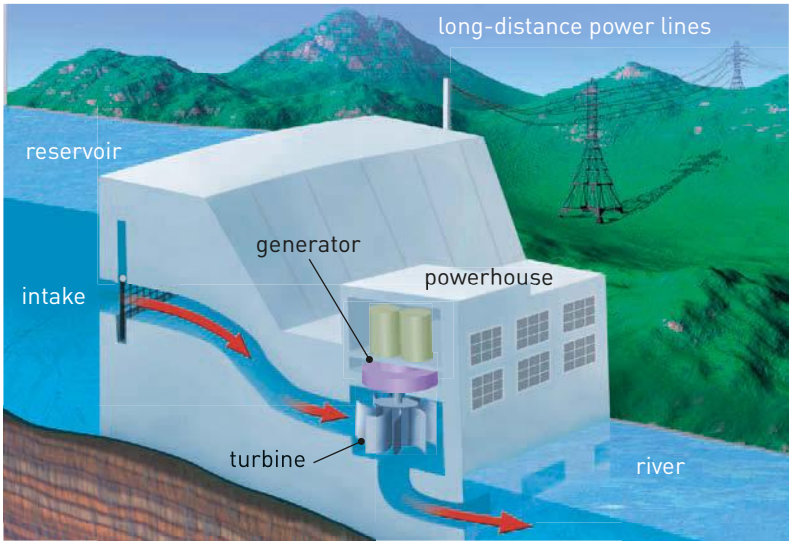
9 Draw a labelled diagram to show how pivot spray irrigation works. Use Source 6.38 to help you. Investigate other types of irrigation methods, and include images and labelling to illustrate the benefits and the disadvantages.

10 Investigate the Murray–Darling Basin and analyse its importance to the people of south-eastern Australia.

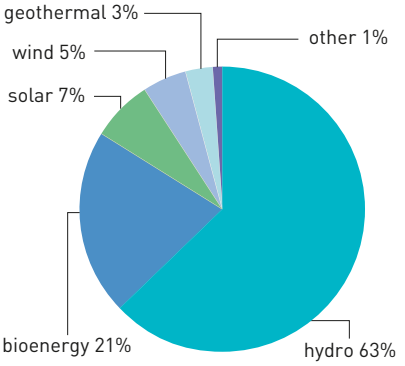
11 Research the Murray–Darling Basin Authority website and create a table to list all the different groups of people who may be affected by changing the water supply in the catchment. Then conduct a class debate on the topic: 'It's my water if it's on my land'.

WATER FOR ENERGY

Moving water has been used as a source of power since 240 BCE, with the invention of the water-driven wheel. Watermills use the force of the flowing water to drive the blades of a large wheel or turbine. This, in turn, rotates an axle to drive the machinery inside the mill.



Source 6.39 How a hydroelectric power station works



Source 6.40 Energy from renewable and continuous sources. Hydroelectric power accounts for most of the total energy produced from these sources around the world.

Hydroelectricity

Hydroelectric power is generated in the same way that early watermills operated. A dam is built across a river, creating a large reservoir of water. This water is then released through turbines, causing them to turn. The spinning turbine rotates giant magnets around a huge coil of copper wire to create electricity. The faster the water flows, the more electricity is created.

Australia's largest plant is the Snowy Mountains Hydroelectric Scheme. More than 100 000 people from over 30 countries constructed the huge tunnels, dams and power stations. Electricity generated by the scheme is used in the Australian Capital Territory, New South Wales and Victoria.

Hydroelectricity is the largest source of renewable, non-polluting energy in the world. The main negative impact of building a hydroelectric plant is that the natural flow of the river is stopped and the land behind the dam is flooded. The flooding of valleys behind the dam can destroy natural habitats and human features, such as houses, fences and roads.

CASE STUDY

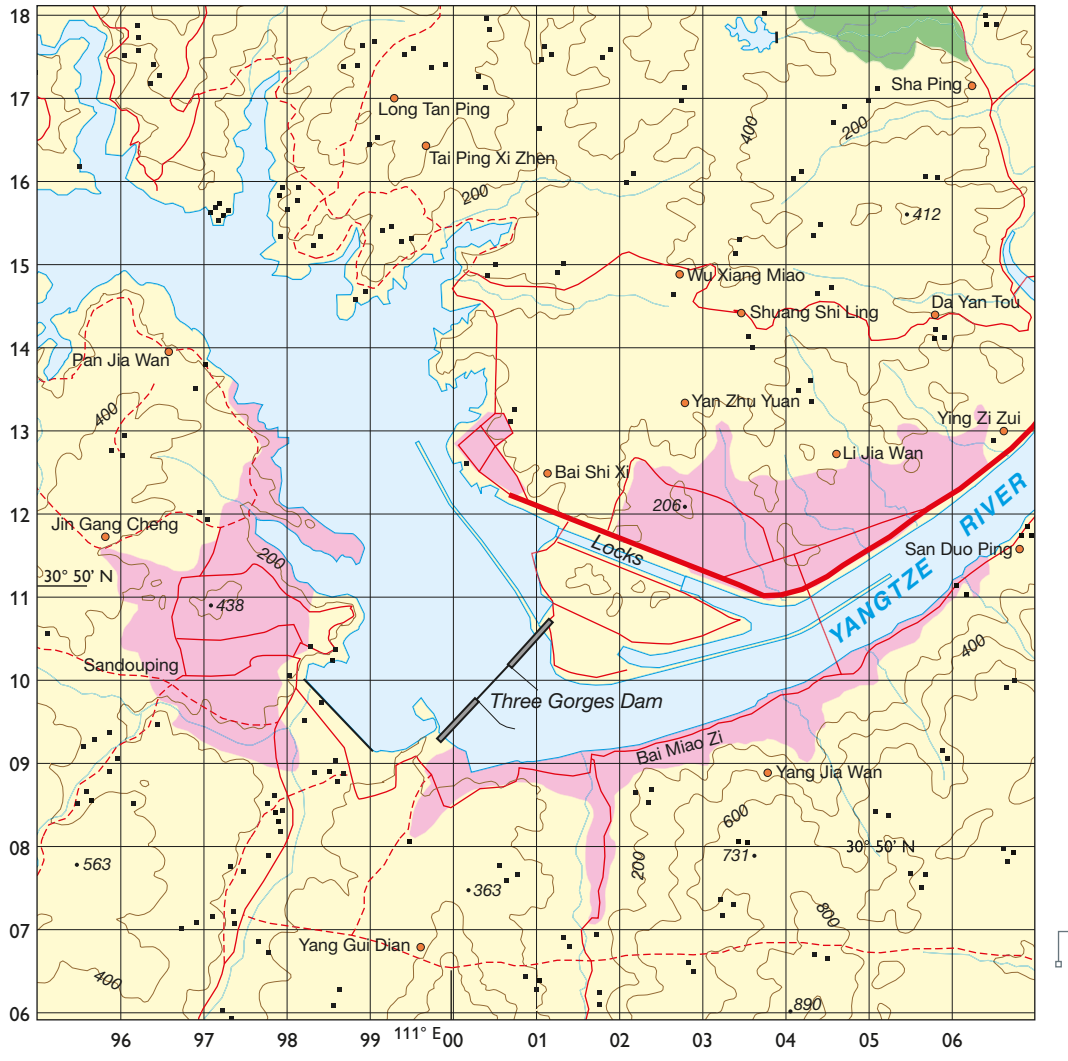
Three Gorges Dam, China

China's Three Gorges Dam is not only the world's largest dam, it is also the largest power station ever built. More than 2 kilometres long and 180 metres high, the dam has turned the Yangtze River into a lake 660 kilometres long. As well as producing electricity, the dam has increased the Yangtze River's shipping capacity, and has reduced the flooding hazard downstream. The building of the Three Gorges Dam stirred protests around the world, as it involved displacing 1.25 million people and flooding more than 600 square kilometres of land; that is about 30 000 times the size of the Melbourne Cricket Ground.



Source 6.41 An oblique aerial view of the Three Gorges Dam on the Yangtze River in China. Water flows through the open sluice gates. The hydroelectric power station is to the left of the sluice gates.

CHINA: THREE GORGES DAM



Source 6.42

Source: Oxford University Press

REVIEW 6.2.4

Remember and understand

1. Explain how water is used to create electricity.
2. What happened to the towns, villages and farms upstream of the Three Gorges Dam on the Yangtze River?
3. What is the main source of renewable energy in the world?

Apply and analyse

4. Identify the advantages and disadvantages of building dams.
5. How can you stop a river flowing to enable a dam wall to be built?

Investigate and create

6. Look carefully at Source 6.41. Oblique aerial images are taken from an angle and show a foreground and a background. Is the dam wall in the foreground or the background?
7. Draw a sketch of the oblique aerial image (Source 6.41) and label the following:
   - Three Gorges Dam
   - Yangtze River
   - hydroelectricity plant
   - flooded valley.

   Mark in where you think the original course of the river flowed.

6.2

HOW DO NATURAL AND HUMAN PROCESSES INFLUENCE THE DISTRIBUTION AND AVAILABILITY OF WATER AS A RESOURCE?

CHECKPOINT

- **Investigate how the operation of the water cycle connects people and places**

1 List the major ways we use water as a community. [5 marks]

b Where do you see humans fitting into the water cycle, and at what stage? [5 marks]

b Justify your answer given in part **a**. [10 marks]

2 Evaluate the importance of water for life on Earth, drawing specific examples from the chapter and around your neighbourhood. [10 marks]

TOTAL MARKS [/30]

RICH TASK

The Ok Tedi mine

The Ok Tedi copper and gold mine is located at the headwaters of the Ok Tedi River, a tributary of the Fly River, in Papua New Guinea. During mining operations large amounts of chemicals are used to separate the precious minerals from other rocks. These chemicals, along with the residue of rocks and ore (known as **tailings**), need to be disposed of. In order to do this, the mine owners (BHP) built a dam known as the tailings dam. The tailings dam allowed heavy metals and solid waste from the mine to settle. Cleaner water would then be released into the river system.



Source 6.43 The Ok Tedi mine

Unfortunately, an earthquake in 1984 collapsed the tailings dam. BHP argued it was too expensive to rebuild it.

Since 1984 the mine has discharged 70 million tonnes of tailings into the river system each year. Chemicals from these tailings destroyed wildlife, particularly fish, in the river, and the materials dumped into the river changed a deep and slow river into a shallow river with rapids. Transport up and down the river became more difficult. The change in the river bed led to frequent floods that spread contaminated mud onto 1300 square kilometres of farms by the Fly River. The discharge from the Ok Tedi mine caused great harm to the 50 000 Indigenous people who live in the 120 villages downstream of the mine. Millions of dollars in compensation was paid to those affected by the misuse of the river system.

Acquiring geographical information

1 What competing uses were there for the Ok Tedi and Fly rivers?

2 What problem did BHP have managing the polluted water in their tailings dam?

3 What environmental impact did the tailings have on the rest of the river?

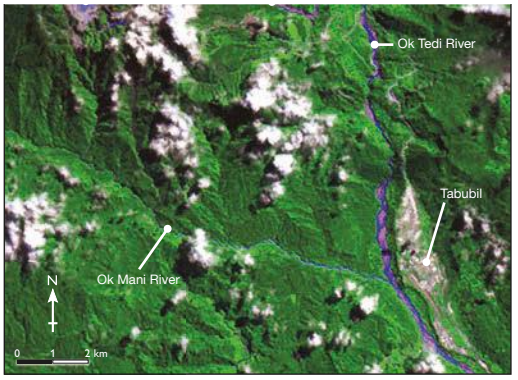
Processing geographical information

4 What social impact did the actions of BHP at the Ok Tedi mine have on the Indigenous users of the river?

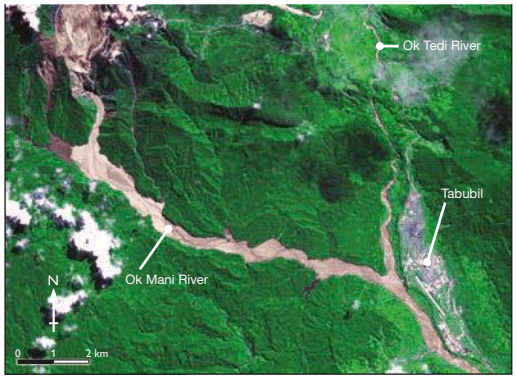
Communicating geographical information

5 Give another example where change in water use in one part of a river has affected water users downstream. You may like to look into a local river for comparison.

6 Many NGOs (non-government organisations) and not-for-profit organisations work hard to bring clean, safe drinking water to remote or disadvantaged people, many in developing countries (see Sources 6.47 and 6.48). Research one such example and report your findings to the class.



Source 6.44 Satellite image of Ok Tedi mine, 5 June 1990



Source 6.45 Satellite image of Ok Tedi mine, 26 May 2004



Source 6.46 Clean Drinking Water Initiative

The Water Project
www.TheWaterProject.org

Source 6.47 The Water Project

SKILL DRILL

Identifying change over time

By carefully examining photographs, satellite images or maps from different times we can see the changes that occur at a location. When studying the same area at two different times:

Step 1 Find a key feature, such as a river or main road, as a reference point on both sources.

Step 2 Note the areas of the image where there has been little or no change.

Step 3 List the differences in the later image where there has been change.

Step 4 Look for other information on the image that shows what might have contributed to the change.

Step 5 Describe the type of change – permanent change or seasonal change (such as different stages of crop production or plant growth).

Apply the skill

1 Study Sources 6.44 and 6.45.

- **a** In what two years were the satellite images taken?
- **b** Were the images taken at different times of the year?
- **c** What changes to the rivers occurred between the two years when these images were taken?
- **d** Why did these changes occur?
- **e** Are these changes permanent or seasonal?
- **f** Draw a sketch map of the area in 2004, using a key and labels to outline the changes that have occurred since 1990.

CHECKPOINT

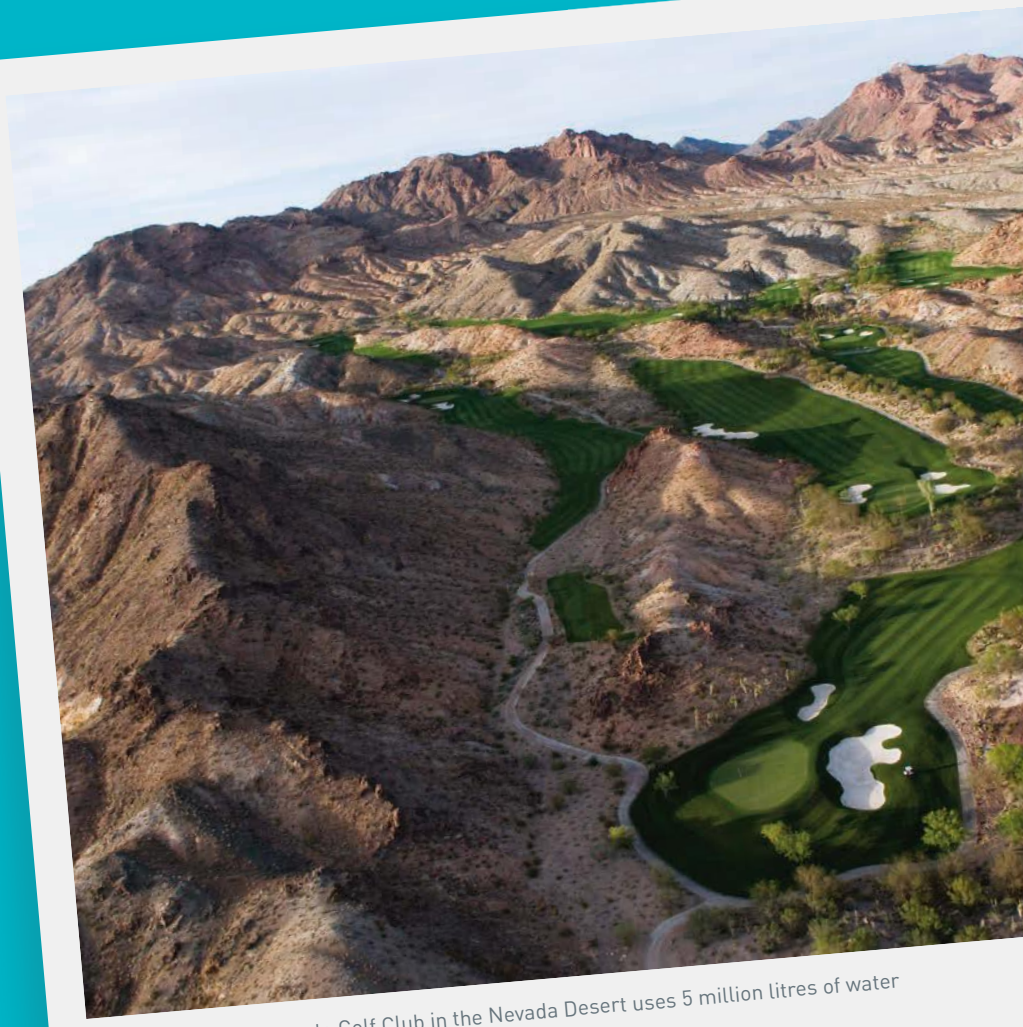
In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Space, Environment, Interconnection, Scale, Sustainability, Change
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools:Spatial technologies, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHAPTER

7



Source 7.1 The Cascata Golf Club in the Nevada Desert uses 5 million litres of water per day to irrigate its fairways and greens.

VALUING AND MANAGING WATER

People value water for many different reasons. It has economic, cultural, spiritual and even aesthetic (appreciated for its beauty) value. As populations grow, the demand for water increases, yet its supply is limited. People all over the world need to examine how they use water, and put in place measures to conserve and manage it. On the other hand, when rainfall is high, communities in low-lying areas close to rivers need to put in place measures to deal with the opposite problem – floods.



WHAT EFFECT DOES THE UNEVEN DISTRIBUTION OF WATER RESOURCES HAVE ON PEOPLE, PLACES AND ENVIRONMENTS?

7.1 SECTION

In this section you will investigate:

- the economic, cultural, spiritual and aesthetic values of water for people, including Aboriginal and Torres Straight Islander Peoples and/or peoples of the Asia region

CHECKPOINT 7.1

WHAT APPROACHES CAN BE USED TO SUSTAINABLY MANAGE WATER RESOURCES AND REDUCE WATER SCARCITY?

7.2 SECTION

In this section you will investigate:

- the nature of water scarcity and ways of overcoming it

CHECKPOINT 7.2



GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Environment:** the effect of human activities on natural and human environments
- **Interconnection:** how people affect the environment such as people's use of water on its quality and availability as a resource
- **Sustainability:** pressures on the Earth's water resources and landscapes

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** political maps, sketch maps, choropleth maps, relief maps
- **Fieldwork:** virtual local area
- **Graphs and statistics:** pie charts, bar graphs
- **Spatial technologies:** GIS
- **Visual representations:** ground photographs, oblique aerial photographs, satellite images, cartoons, annotated diagrams, posters, presentations, infographs

7.1 THE IMPORTANCE OF WATER

WHAT EFFECT DOES THE UNEVEN DISTRIBUTION OF WATER RESOURCES HAVE ON PEOPLE, PLACES AND ENVIRONMENTS?

Since the beginning of human history, we have relied on water. We drink it in order to survive; we wash, cook and clean with it; and we use it to grow our food and produce electricity. In this way, water is arguably our most precious resource. Life on Earth without it would be impossible. One of the challenges facing Australia today is that we use too much of this environmental resource.

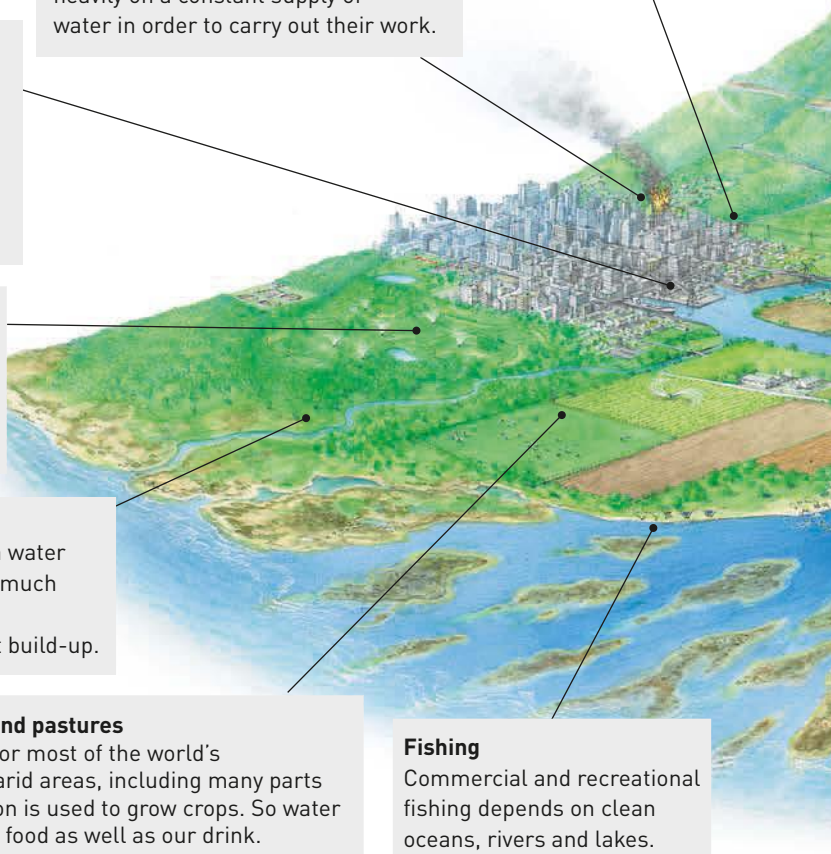
Only 12 per cent of the water consumed in Australia is used in our homes and gardens, whereas 70 per cent is used to irrigate farms. This irrigation provides us with much of the food we eat, so it must be included when we think about how much water each of us personally consumes. When you add this water to the amount used to make other products we use every day, such as shampoo and toothpaste, every Australian is responsible for using over 1 million litres of water per year! Source 7.2 outlines the various ways in which we all use water.

Source 7.2 In Australia we use large amounts of water in many different ways.

Spiritual uses
Water holds a special significance for almost all world religions. It often plays a key part in religious ceremonies.

Firefighting
Firefighters around the world rely heavily on a constant supply of water in order to carry out their work.

Domestic uses
The average Australian household uses over 350 litres of water a day for drinking, preparing food, washing, cleaning, flushing toilets, cleaning cars, and watering lawns and gardens. Toilets and bathrooms account for about 40 per cent of this domestic water use.



Irrigation of parks, gardens and sporting grounds
Many parks, gardens and sporting grounds, including football ovals, rely heavily on water in order to survive. In dry areas, water is often taken from drinking storages to keep them green and healthy.

Environmental needs
As well as being used for human consumption, fresh water is a vital part of the natural environment. Taking too much water from a river can cause many environmental problems, such as weed growth, fish deaths and salt build-up.

Irrigation of crops and pastures
Irrigation accounts for most of the world's water use. In some arid areas, including many parts of Australia, irrigation is used to grow crops. So water provides us with our food as well as our drink.

Fishing
Commercial and recreational fishing depends on clean oceans, rivers and lakes.

REVIEW 7.1.1

Remember and understand

1 What activity uses the most water in Australia? How much of our water does it use?

2 Explain how water can be used to help create electricity.

Apply and analyse

3 Using Source 7.2, categorise each water use shown as either an off-stream use (in which water is removed from its source, either by pumping or diversion) or an in-stream use (in which water remains in place).

4 What other water uses can you think of?

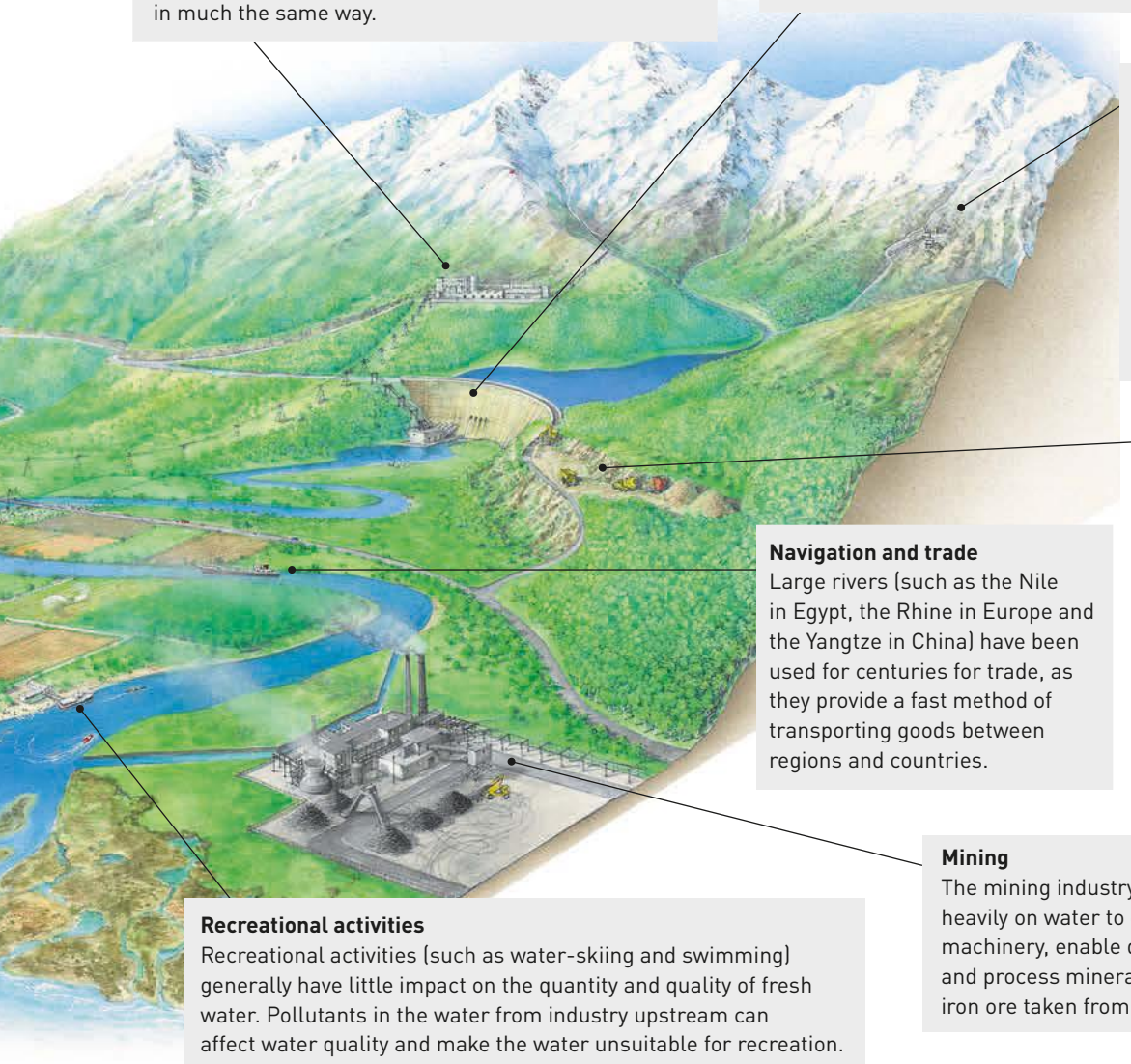
Investigate and create

5 **a** Using Source 7.2, identify two water uses that compete with one another and so cannot easily exist beside one another.

b Invent a solution to the problem you found above. This could be a real-world solution or something that has not even been thought of yet.

Power generation: coal-fired and nuclear power
Virtually all power stations use large quantities of water. Coal-fired power stations heat water to produce steam that turns turbines to create electricity. Water is also used to cool the station. Nuclear power plants operate in much the same way.

Power generation: hydroelectric power
Electricity can be generated from the energy of moving water. Usually, to do this a dam must be constructed across a river and a lake formed behind it. This allows the river's flow to be controlled and released through the dam to produce electricity.



Snow-making
Artificial snow-making is important in countries such as Australia where natural snowfalls can be infrequent. However, many countries with more regular snowfalls now also use snow-making machines in order to improve conditions and attract more tourists.

Construction and industry
The construction industry relies heavily on water in order to make concrete and many building supplies, such as bricks. Many industrial processes use large quantities of water for cooling and cleaning.

Navigation and trade
Large rivers (such as the Nile in Egypt, the Rhine in Europe and the Yangtze in China) have been used for centuries for trade, as they provide a fast method of transporting goods between regions and countries.

Mining
The mining industry relies heavily on water to cool machinery, enable drilling and process minerals and iron ore taken from the ground.

Recreational activities
Recreational activities (such as water-skiing and swimming) generally have little impact on the quantity and quality of fresh water. Pollutants in the water from industry upstream can affect water quality and make the water unsuitable for recreation.

GROWING THE WORLD'S GRAIN

Rice is the world's most important food crop and is the main food source for over half of the world's population. Rice production is heavily dependent on water. A semi-aquatic plant, rice is grown in flooded fields. For this reason, rice-growing communities tend to be located in regions of the world with high rainfall. About 90 per cent of the world's rice is grown in Asia, with India and China being the largest producers of rice. Outside of Asia, the United States and Brazil are the biggest producers of rice.



Source 7.3 Rice seedlings being placed in the rice paddy for planting, Mekong Delta, Vietnam

Rice farming in Vietnam

Vietnam is home to some of the world's richest agricultural regions. It is the fifth biggest producer, the second largest exporter and the seventh largest consumer of rice. In Vietnam, 75 per cent of people's daily calorie needs are met by rice.

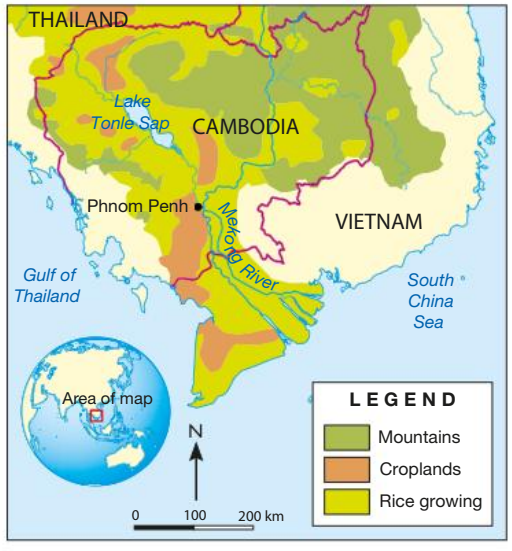
The Mekong Delta is called the 'rice bowl' of Vietnam, with more than half of the country's rice produced there. The delta is formed by sediment (small particles of rock and dirt) deposited by the Mekong River and provides rich soil for farming. The Mekong Delta region is also flood prone, making it perfect for rice production. The rice is grown in flooded fields known as paddies.

Of the 17 million people in the delta region, 80 per cent are employed in rice cultivation. The rice farmers live in houses built on stilts and the roads in the region are located on raised embankments to provide protection from flooding.



Source 7.4 Satellite image of the Mekong Delta in Vietnam. Farming here is dependent on the rich soils and plentiful water of the region.

MEKONG DELTA: RICE-GROWING REGIONS



Source 7.5

Source: Oxford University Press



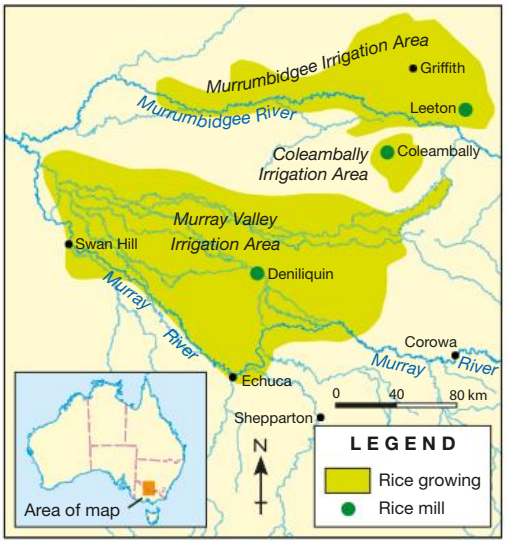
Most of the rice produced in Vietnam and other parts of southern Asia is a variety known as Indica rice. Indica rice is a long grain rice that grows well in hot, tropical climates. In recent times, faster growing rice plants have been developed. These new strains of rice mature in 110 days instead of 160, meaning farmers can grow three crops a year instead of two.

Rice farming in Australia

In Australia, a variety known as Japonica rice is more commonly grown. This variety of rice grows well in the Australian climate. In a dry country such as Australia, rice farmers have to be very efficient in their use of water (see Source 7.7). Australian rice growers use 50 per cent less water than the world average to grow 1 kilogram of rice. To ensure water is not wasted, the soil of Australian rice farms needs to be checked and approved to ensure that it can hold water and not allow it to escape below.

Australia's rice-growing regions include the Murrumbidgee and Murray Valley in south-western New South Wales (see Source 7.6). These regions are suitable for rice cultivation as they have available water, irrigation infrastructure, large areas of flat land, and suitable soils. Storage and milling facilities for rice have also been established in these areas. The rice industry has been a major contributor to the economic and social wellbeing of people in the towns of these regions.

AUSTRALIA: RICE-GROWING REGIONS



Source 7.6

Source: Oxford University Press



Source 7.7 Australian farmers carefully plough their fields to minimise water wastage. They even use lasers to ensure rice fields are as close to level as possible. Raised levees divide large fields into individual bays to allow farmers to carefully control the flow of irrigation water.

REVIEW 7.1.2

Remember and understand

1 What economic value does rice have?

2 How have farmers reduced their water use in rice-growing regions across Australia?

Apply and analyse

3 Compare rice-growing techniques in Australia and Vietnam. How are they similar? How are they different?

Investigate and create

4 a Draw a sketch map of Source 7.4 to show the location of rice paddies in the Mekong Delta. Mark in the South China Sea and rice paddies (most of the green area on the image).

b Using Google Earth, explore the region you have just mapped in more detail and list all the physical or natural features that make this area perfect for rice farming.

COMPETITION FOR WATER SUPPLIES

Fresh water from rivers is used by people in cities, farms and factories. Competition for this precious economic resource has seen the introduction of dams all over the world to store the water flowing down rivers and ensure a constant supply of water to the people nearby. Because people living along the entire length of rivers depend on them for water, competition also exists between upstream and downstream users. The flow and quality of water available to downstream users depends on how the river is used upstream.

CASE STUDY

The Murray River

The Murray River provides an excellent example of what happens when demand for river water threatens to outpace supply. Water from the Murray River has many competing uses, including irrigation, domestic urban water supply, industrial water supply, maintaining the natural environment, recreation, navigation, hydroelectricity and water storage. There are three major water **storage dams** on the Murray River. There are also 10 **weirs** (another type of dam) built across the river to slow the river flow and allow towns to access the water. **Locks** have been built where the water level can be raised and lowered to allow boats to travel from one side of the weir to the other.

A series of pumps and pipes carries some of the water from the Murray River to water users in towns, cities and farms many kilometres from the river (see Source 7.8). One of these pipes carries water from the town of Mannum to Adelaide, 60 kilometres away. The amount of water pumped from the river to Adelaide varies from year to year but can be as high as 90 per cent of Adelaide's water needs in some years.

MURRAY RIVER AND SOUTH AUSTRALIAN WATER PIPELINES



Source 7.8

Source: Oxford University Press



Source 7.9 This image was taken in 1981 when the mouth of the Murray River completely closed, creating changed conditions for wildlife and plants in the region.

The agriculture sector is by far the largest user of water from the Murray River. On average, 3780 gigalitres (3780 billion litres) is diverted each year to irrigate farmland to grow crops and raise livestock. Clearing of native vegetation in the river valley has enabled irrigated crops and pastures to be grown, but also forced salty groundwater to the surface and into the river. Along with pesticides and fertilisers, the salty water causes problems for users downstream. Near the South Australian town of Waikerie a system of pumps intercepts

some of the salty water before it reaches the Murray River. It is carried in pipes to a 400-hectare lake. It is estimated that this scheme prevents more than
100 tonnes of salt a day reaching the river. Most of the water not used for irrigation is diverted to homes and industries throughout South Australia through six major pipelines (see Source 7.8). The average amount of water that flows from the Murray River into the ocean near Adelaide is now just 25 per cent of the total natural flow. This is because around 75 per cent of this water is taken out of the river upstream.



Source 7.10 Oblique aerial photograph of the Murray River at Mannum, South Australia

KEY CONCEPT: SCALE

The changing scales of water management

The water in the Murray River is one of Australia's most precious resources but is very difficult to manage. This is mainly because there is so much competition for the water. The water is used by thousands of farmers to produce food and other products for millions of people. Many towns and cities in three different states use the river to supply residents with water for their homes and businesses.

In the past, many upstream water users have only considered their own water needs when taking water from the river. They have not considered how this would impact on people and places downstream. We now know that this local-scale approach to water use damages the health of the river. Water must be managed at the regional scale, considering the needs of all water users and the environment in the entire river basin. For more information on the key concept of scale, refer to section GT.1 of 'The geographer's toolkit'.

REVIEW 7.1.3

Remember and understand

1 What competition is there for Murray River water?
2 Identify the two major uses of Murray River water.
3 Explain how the competing water uses of boating and water storage in weirs have been catered for along the Murray.
4 What problems have been caused downstream by upstream usage of the Murray River water?

Apply and analyse

5 Explain why it is difficult to manage the water resources of the Murray River.
6 In the left foreground of Source 7.10 you can see a small marina and a residential development. Are these developments at a local or regional scale?
7 Examine Source 7.8.
   a How many pipelines are shown that access water from the river?
   b Use the scale to estimate the distance water travels from Swan Reach to Edithburgh.

Investigate and create

8 Draw a map of Source 7.10. Use a legend to show the following features: the Murray River, irrigated farmland, irrigated golf course and sporting ground, a marina for houseboats and the town of Mannum.
9 Complete a map of your local area showing all the water sources (such as rivers, creeks, dams and reservoirs) and the links to where the water from these sources is used (for example, housing, sports fields, farms and industry).
10 Research the Murray–Darling Basin Authority (MDBA) and report back to the class on a specific aspect that the MDBA is involved in. You may find the educational resources on its website useful.

THE CHALLENGES OF MANAGING WATER



Source 7.11 Sewage spills into the Ganges River in the city of Varanasi.

Water is an essential environmental resource that is important for the health of humans and the health of the environment. Different values are often placed on water; for example, water used for economic purposes can also have great spiritual and cultural importance for a community. Competition for water use needs careful management. It is often not easy to come up with solutions. Water management is difficult for many reasons:

- It is an essential resource needed by every person on the planet.
- It moves through the environment quickly so it is difficult to capture and store.
- Its availability is not constant – it changes over time and in different locations.
- It is a shared resource with many competing uses.

Over the past 50 years the world's population has doubled, and the output from farms and industries has surged to meet increasing demands. The growth in demand and competition for water has put a much greater strain on global water supplies. We need to make good decisions to fairly share the use of water and minimise the impact our water use has on the natural environment.

CASE STUDY

Ganges River, India

The Ganges River begins high in the Himalayan mountains, and travels across India before flowing east into Bangladesh and into the Bay of Bengal. In total, the river is 2525 kilometres long. The Ganges is worshipped by Hindus, who believe bathing and praying in the river purifies them. This sacred river is also used by millions of Indians who live along its banks and depend on it for their daily needs.

In the last 30 years, India's population has grown to nearly 1.2 billion people; one-third of these people live along the banks of the Ganges. Huge increases in the size of cities, factories and agriculture have put enormous pressure on the river. Irrigation canals siphon off large amounts of water to grow food for the country's increasing population. Untreated **waste-water** is dumped into the river from cities and towns that lack proper sewage-treatment facilities. Around 25 per cent of India's population work in manufacturing and



Source 7.12 Tens of thousands of Hindu devotees gather on the banks of the holy Ganges River to bathe and offer prayers during the Karthik Purnima festival in Patna, India.



industry. The waste-water and **effluent** from these industries often contain hazardous chemicals. The Ganges is now one of the most polluted rivers in the world.

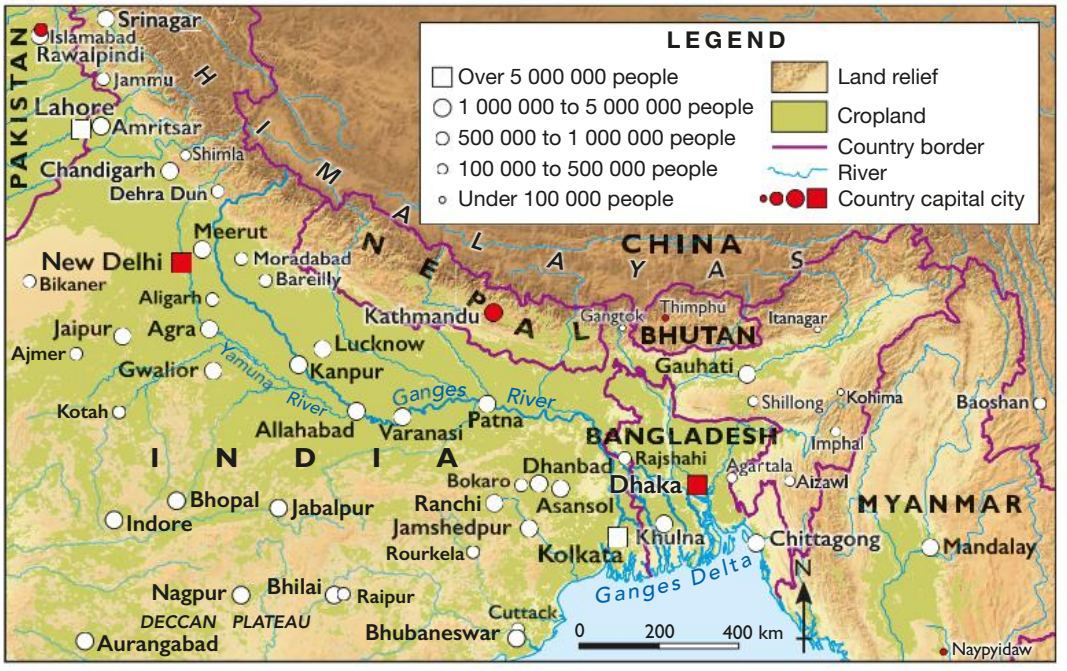
Overuse and lack of management have meant that India's most sacred river is gradually dying. In Varanasi, a city on the banks of the Ganges in north-eastern India, the bacterial count in the water is 3000 times higher than the safe levels established by the World Health Organization. Polluted water is the main cause of skin problems, disabilities and infant deaths, but many Hindus refuse to accept that the Ganges (or Mother Ganga as they call her) is the source of these problems. 'People have so much faith in this water that when they bathe in it or sip it, they believe it is the nectar of God [and] they will go to heaven,' says a scientist at the Central Pollution Control Board in India.

In 2011, Indian officials signed an agreement with the World Bank for a $1 billion loan to finance a government project that aims to stop the flow of untreated waste-water into the Ganges by 2020.

STRANGE BUT TRUE

Six to eight million people die annually from the consequences of disasters and water-related diseases.

COURSE OF GANGES RIVER



Source 7.13

Source: Oxford University Press

REVIEW 7.1.4

Remember and understand

1 Why is water difficult to manage?

2 List three reasons why water resources are under threat.

3 Look carefully at Source 7.12.
   - **a** Why have all of these people gathered at the Ganges?
   - **b** Identify the dangers they face.

Apply and analyse

4 List as many competing uses of the Ganges as you can.

5 Explain why the Ganges is so difficult to manage.

Investigate and create

6 Examine Source 7.13.
   - **a** Explain why the pollution of the Ganges is a much greater problem in Kolkata than in Kanpur in northern India.
   - **b** How do you think the pollution of the Ganges affects the natural environment around the river?
   - **c** With so many people using the heavily polluted Ganges, create a poster to inform visitors to its banks of the health warnings.

WATER AND INDIGENOUS AUSTRALIANS

Water is a vital resource valued by both Indigenous and non-Indigenous Australians. Non-Indigenous Australians generally consider water as a natural resource with great economic and aesthetic value. Indigenous Australians on the other hand generally value water for cultural and spiritual reasons. They regard the rivers and waterholes as an inseparable part of their land. Land and water management is a key part of the culture of Aboriginal and Torres Strait Islander Peoples.

A spiritual connection with water

Before European settlement, most Aboriginal people lived in the well-watered coastal areas and along the rivers of the Murray–Darling Basin. Aboriginal people in the arid areas of Australia studied the habits of wildlife to detect water supplies. They mapped the location of water in their artwork. In these maps, spirals identified the location of pools and wells while wavy lines showed the location of running water (see Source 7.15).



Source 7.14 Aboriginal links to water in the Kimberley region go back thousands of years. These scenes were created by the Worrorra people on a cave ceiling about 8000 years ago. The scene is said to depict a 'great fish chase', showing figures representing both Rock Cod and Dugong and their Wandjina captors.



Source 7.15 In the past, Indigenous Australians communicated the location of water resources through symbols on maps (like this one) and through spoken instructions and stories.

Aboriginal people also passed on their knowledge of water resources through stories. The Worrorra people live in the Prince Regent River region of the Kimberley. Their Dreaming (or Lalai) stories tell of the formation of the Prince Regent River.

The stories tell of how the Wunggurr snake (a creator) dug a path where the Prince Regent River now flows by travelling from far inland to the sea. Other creator beings called Wandjina then took the animal forms of Rock Cod and Melo (a large sea snail), and created Malandum (the Prince Regent River) by swimming upstream along this path. At what is now called King Cascade Falls, Rock Cod was forced to stop abruptly by the Lalai Bowerbird and thrust herself against the soft mud, where she created a step-like cliff. Today, a waterfall flows over these rocks from the stream above where the Bowerbird lives (see Source 7.17).

Indigenous water management

Traditionally, Aboriginal peoples in drier areas of Australia depended on their knowledge of water sources to survive. They accessed water trapped in waterholes, rocks and tree hollows. They watched the flight paths of birds, such as the zebra finch, to help uncover wells and springs. The long roots of eucalypt trees were followed to find underground water, and water was collected from the morning dew on plants. Indigenous Australians would also enlarge rock holes and chip channels through rocks to divert water into specific holes to increase their access to water. To catch fish, dams were built across narrow creeks using rocks or woven branches (see Source 7.16).



Source 7.16 An Aboriginal dam made of woven branches designed to catch fish.

In modern Australian society, Indigenous Australians have been largely left out of the decision-making process when it comes to managing their traditional water sources. In some remote areas of Australia, many traditional water sources have become unreliable or unusable because station owners have given their cattle access to these important areas without consulting the Aboriginal people.

Urlampe in the Northern Territory, 1330 kilometres south-southeast of Darwin, is home to one of Australia's most remote Aboriginal communities. Allan Rankine of the Urlampe Aboriginal Corporation is responsible for managing the water supply for the community. Allan decides what water the community pumps from the bore and how it will be distributed. Traditionally, Aboriginal land and water management plans are clearly defined and everyone understands and respects them.

However, Allan and the traditional owners of the area do not have control over all important water resources in the region. The permanent spring that Allan visited as a child has been polluted by cattle. This once valuable water resource is now undrinkable.

REVIEW 7.1.5

Remember and understand

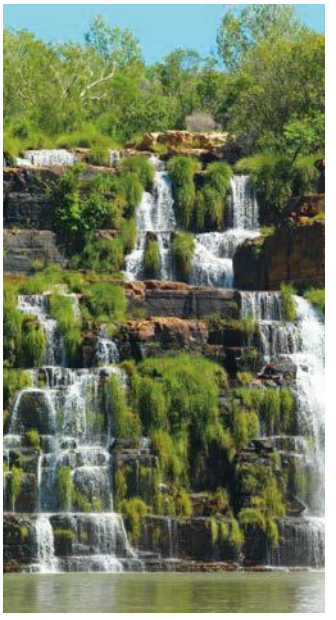
1 Where did most Aboriginal peoples live in Australia before Europeans arrived in 1788?
2 Give examples of traditional and modern Aboriginal water management.
3 How are Indigenous and non-Indigenous views of water resources different?
4 Both Aboriginal peoples and Europeans built dams along the Murray River. What impact did each have?

Apply and analyse

5 Look carefully at Source 7.17.
   a What is the spiritual value of this place to the local Indigenous people?
   b What value might this site have to a tourist?

Investigate and create

6 Look carefully at Source 7.15.
   a Sketch the symbols you think represent water holes and running water.
   b Why were maps such as these important to Aboriginal communities?
   c Why do you think maps like these are still being produced by Indigenous Australians?
7 Use an Internet search to locate a satellite image of Urlampe in the Northern Territory. Use this image to justify why water management is so critical in this region.



Source 7.17 King Cascade on the Prince Regent River is now a popular tourist destination.

7.1

CHECKPOINT

WHAT EFFECT DOES THE UNEVEN DISTRIBUTION OF WATER RESOURCES HAVE ON PEOPLE, PLACES AND ENVIRONMENTS?

- **Investigate the economic, cultural, spiritual and aesthetic values of water for people, including Aboriginal and Torres Straight Islander Peoples and/or peoples of the Asia region**

1 Why are water and the areas surrounding its sources sometimes the cause of conflict? [5 marks]

2 As countries become more developed, their populations move closer to cities. This brings lifestyle changes. For example, people move from farming their own food to shopping for food in supermarkets and eating out. Explain the impact this will have on water needs in the future. [5 marks]

3 Look back through the first section of this chapter and review the 10 photographic images in it. Draw a table in your notebook and categorise the images as economic, cultural, spiritual or aesthetic, including a brief description. [30 marks]

TOTAL MARKS [/40]

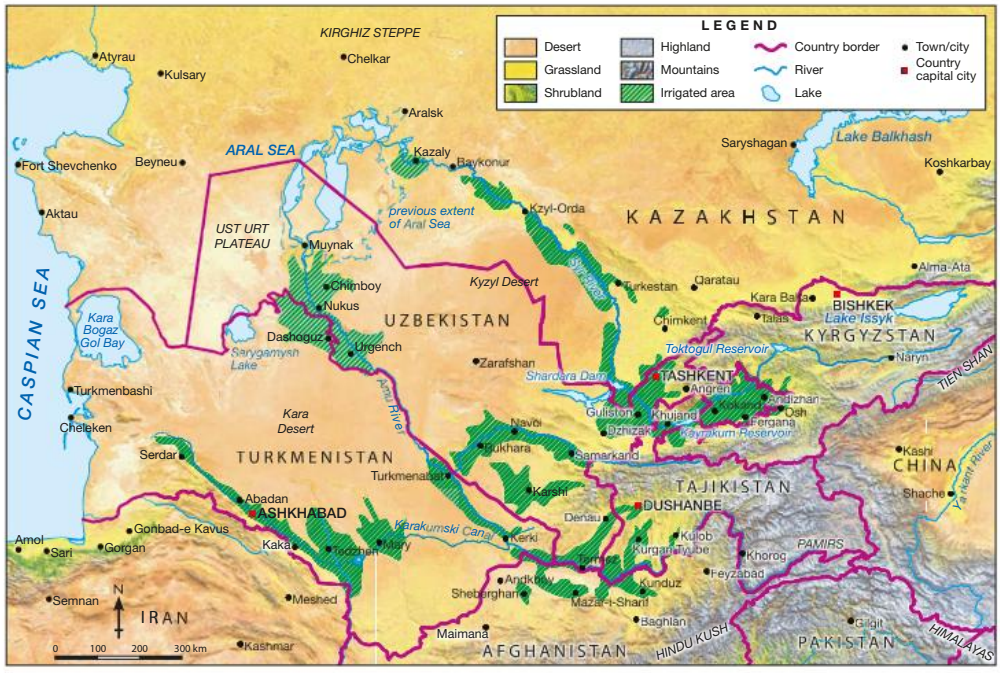
RICH TASK

The Aral Sea

The Aral Sea is located on the border of Kazakhstan and Uzbekistan. In the early 1960s, the two rivers that channelled water to the Aral Sea, the Amu River and the Syr River were diverted to irrigate areas of the surrounding desert to grow rice, melons, cereals and cotton. From 1960 to 1998, the size of the Aral Sea shrank by 60 per cent, and its volume was reduced by 80 per cent. In 1960, the Aral Sea was the fourth largest lake in the world. Today, it is the thirty-first largest. Over the same period of time, the lake has also become five times saltier.

The Kara Desert covers about 70 per cent of the land area in Turkmenistan. It is crossed by the 1375-kilometre Karakumski Canal, the second largest irrigation canal in the world. The canal brought a water supply to the town of Ashkhabad and allowed farming to take place in the desert, particularly cotton growing. Leakages from the canal allowed 50 per cent of the water to escape.

ARAL SEA BASIN: WATER RESOURCES



Source 7.18

Source: Oxford University Press

Acquiring geographical information

1 Look carefully at Source 7.18.
   - **a** What is the name of the longest river that feeds the Aral Sea?
   - **b** Where does this river begin?
   - **c** Into which canal is most of the water from the Amu River diverted?
   - **d** What is this water used for?

Processing geographical information

2 Look carefully at Sources 7.18 and 7.19.
   - **a** What did water as a resource once used for in this region?
   - **b** How has the Karakumski Canal changed this region?

3 The management of the region's water resources is complex because several countries are involved. Name the countries and how they use water.

SKILL DRILL

Interpreting satellite images

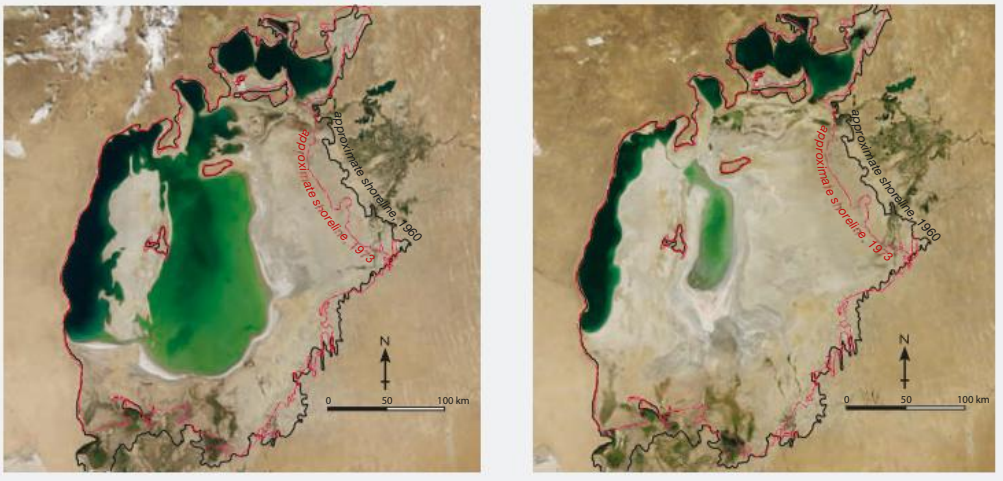
Satellite images help geographers view large areas of the Earth's surface. Special cameras in orbiting satellites 700 kilometres above the ground record variations in the light reflected on the Earth's surface. Satellite images can show different features on the Earth's surface through colour variations on the image. Sometimes this colour variation is natural but it can also be added by computer to highlight specific features. The natural colour satellite images of the Aral Sea in Source 7.19 accurately record the shrinking size of the lake from 2000 to 2011.

Step 1 Understand the size of the area you are looking at in the image. Is it a large-scale image of a small area or an image that covers a large region? Use the scale, if given. If there are two images for comparison, as in Source 7.19, what can be easily identified in both?

Step 2 Try to pick the key features. For example, water courses (rivers and lakes) might be coloured differently to their natural colour to help highlight them. Built-up areas are also good to look for to help you gain an understanding of the human uses of the landscape in the image.

Apply the skill

1 Study Source 7.20.
   - **a** Describe how the Aral Sea has changed between 2000 and 2011.
   - **b** What colour represents deep water on these satellite images?
   - **c** What is the shallowest part of the lake in 2000?
   - **d** What type of land surrounds the Aral Sea in 2000 and 2011?
   - **e** Use the scale to estimate the length of the longest remaining part of the Aral Sea in 2011.



Source 7.19 Satellite images of the Aral Sea in 2000 (left) and 2011 (right)

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Environment, Interconnection, Sustainability
- Inquiry skills: Acquiring geographical information, Processing geographical information
- Tools: Maps, Spatial technologies, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

7.2 MANAGING WATER SCARCITY



WHAT APPROACHES CAN BE USED TO SUSTAINABLY MANAGE WATER RESOURCES AND REDUCE WATER SCARCITY?

Water is most difficult to manage when there is not enough to go around. Water becomes scarce when the demand for clean water exceeds the available supply. It is one of the biggest issues facing Africa, the second driest inhabited continent in the world after Australia. Whereas all Australians have access to clean water, millions of Africans face water shortages. Of the 800 million people who live in Africa, more than 300 million live in water-scarce areas.

The main reasons for water scarcity in Africa are:

- a large and fast-growing population
- large areas with low and variable rainfall
- poor water quality
- lack of water infrastructure, such as pipelines.

Water scarcity contributes to the deaths of many African children. Local water sources may contain harmful bacteria that cause diseases, such as typhoid and dysentery. These diseases are spread by drinking and washing in contaminated water.

STRANGE BUT TRUE

Eighty-five per cent of the world's population lives in the driest half of the planet.

Delivering safe water

The most common solution to water scarcity in African villages is digging a well. A water well is created by digging or boring into the ground in order to reach groundwater in underground aquifers. Clean water from a well stops people catching any water-borne diseases. Providing clean and drinkable water for communities across Africa is a high priority for many of its **developing countries** and international relief agencies, such as World Vision, WaterAid and the United Nations.



Source 7.20 A young girl in Guinea-Bissau enjoys clean water from a new well that has been sponsored by the World Vision aid agency.

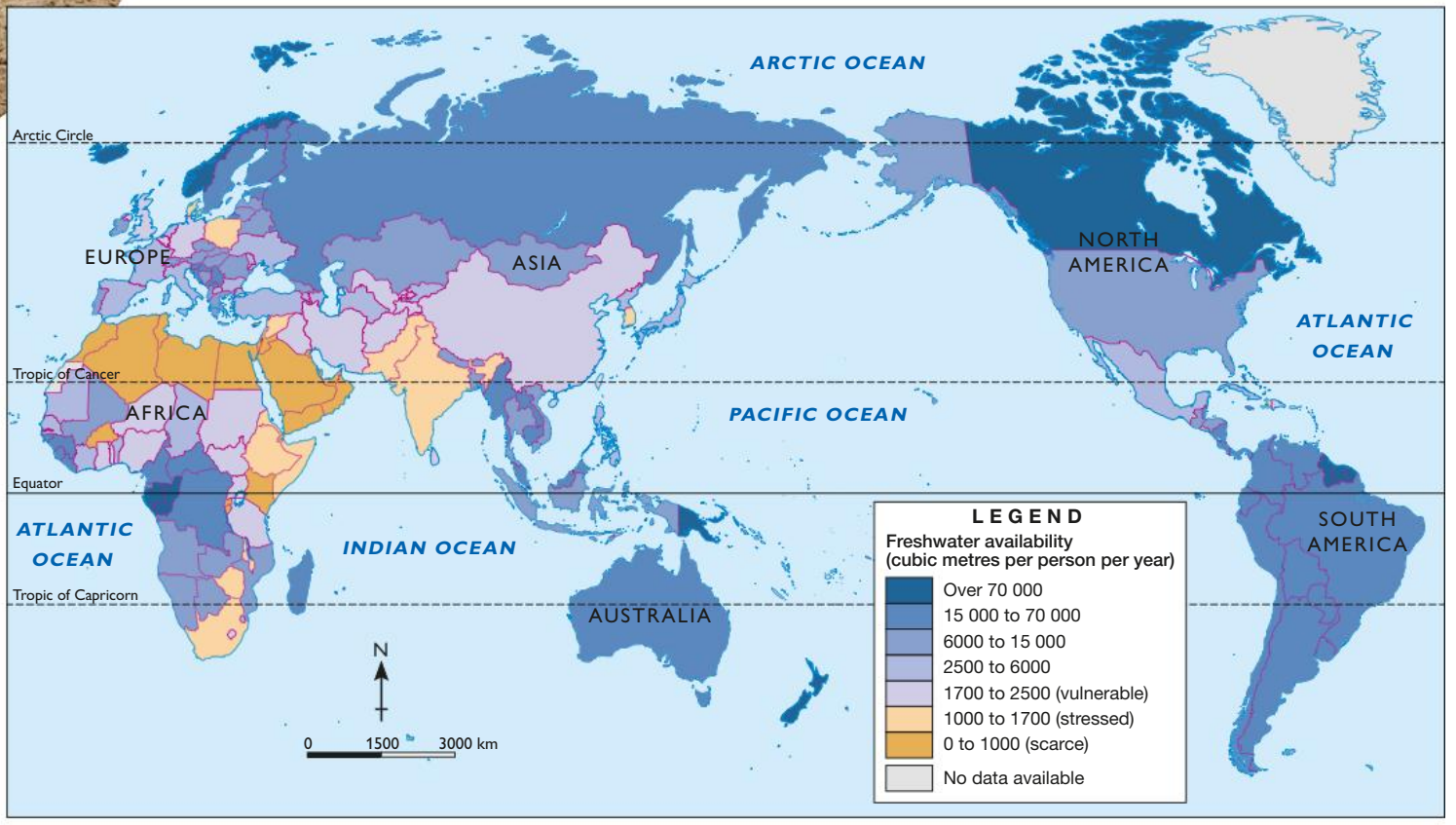


Source 7.21 This woman in Zambia is collecting water from a dried-up river bed half a kilometre from her house. She uses a saucepan to fill the large container, which she will carry on her head or shoulder back to her home.



Source 7.22 A woman fills a water container from a well in the desert in Niger. In most African societies, women are the collectors and managers of the family water supply. African women can spend up to 60 per cent of their day collecting water, especially where water sources are far from the village.

WORLD: FRESH-WATER AVAILABILITY PER PERSON PER YEAR, 2015



Source 7.23

Source: Oxford University Press

REVIEW 7.2.1

Remember and understand

1 Define 'water scarcity'.

2 Explain why water scarcity is such a problem in Africa.

3 What problems does water scarcity cause, especially for women and young children?

Apply and analyse

4 Look carefully at Source 7.23.

- **a** Describe the area of Africa that suffers most from water scarcity.
- **b** Australia is the driest inhabited continent on Earth. Does it have a water scarcity problem? Why or why not?
- **c** Compare fresh-water availability in Australia and New Zealand. Which country has access to more fresh water? Why do you think this might be the case?

Investigate and create

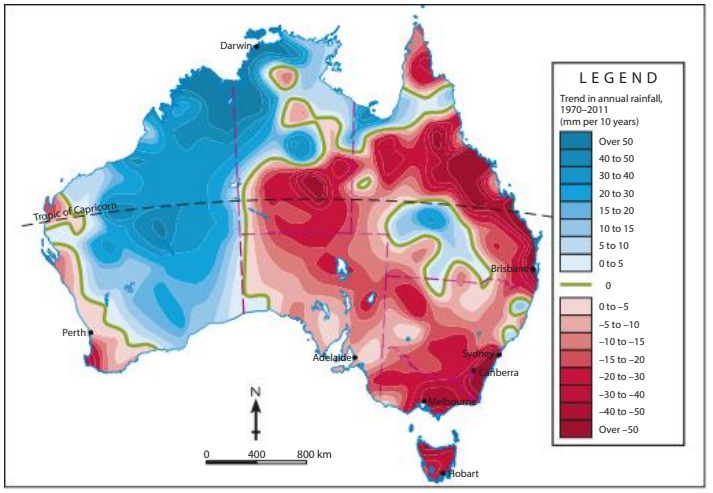
5 Create a poster or PowerPoint presentation highlighting the problems of water scarcity in Africa and how it affects people's lives.

WATER AVAILABILITY AND USE IN AUSTRALIA

Australia has the lowest amount of water in rivers and the smallest areas of permanent wetlands in the north. In addition, water supplies are not evenly distributed. The northern third of the continent is water rich, while vast areas of the interior receive very little rain. Variable rainfall patterns make it quite common for one part of the country to experience prolonged drought.

Population growth and drought have put enormous pressure on water resources in Australia. Dams have been constructed to store water and release it in times of need, and pipelines carry water from areas with water surplus to areas that receive very little rainfall.

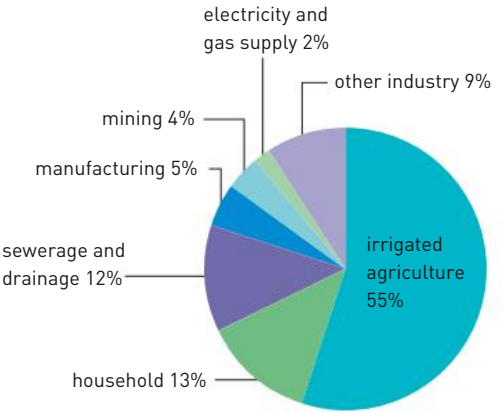
AUSTRALIA: RAINFALL VARIABILITY



Source 7.24

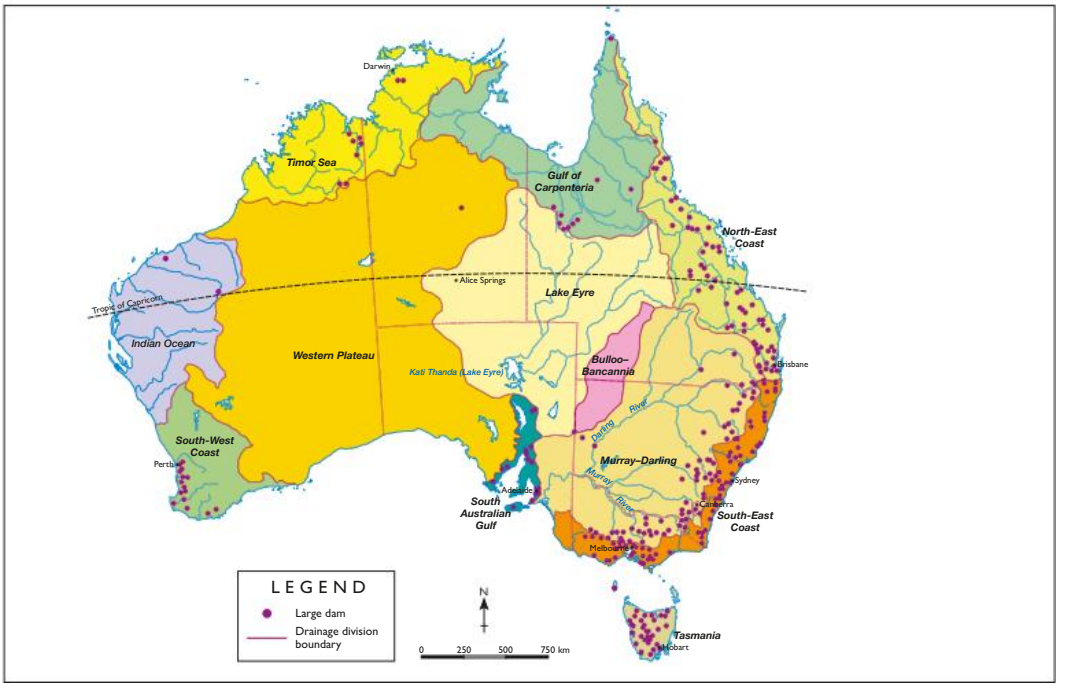
Source: Oxford University Press

AUSTRALIA: FRESH WATER USE



Source 7.25

AUSTRALIA: DRAINAGE DIVISIONS, RIVERS AND WATER STORAGES



Source 7.26

Source: Oxford University Press

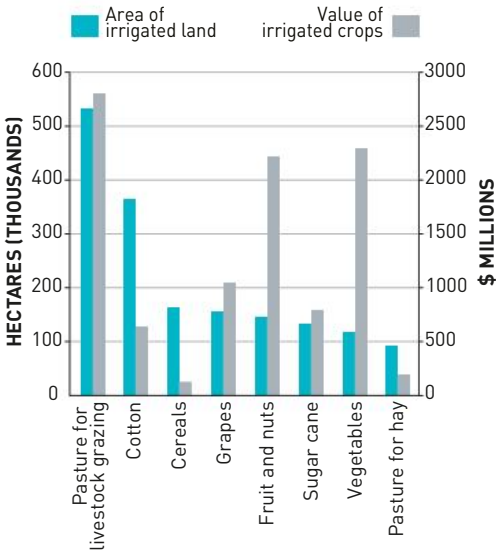
Irrigated land

Farmers change water availability in a region by adding water to crops and pasture through irrigation. Currently, irrigated agriculture uses around 55 per cent of Australia's fresh water every year. Crops such as rice and fruit are particularly large users of irrigation water.



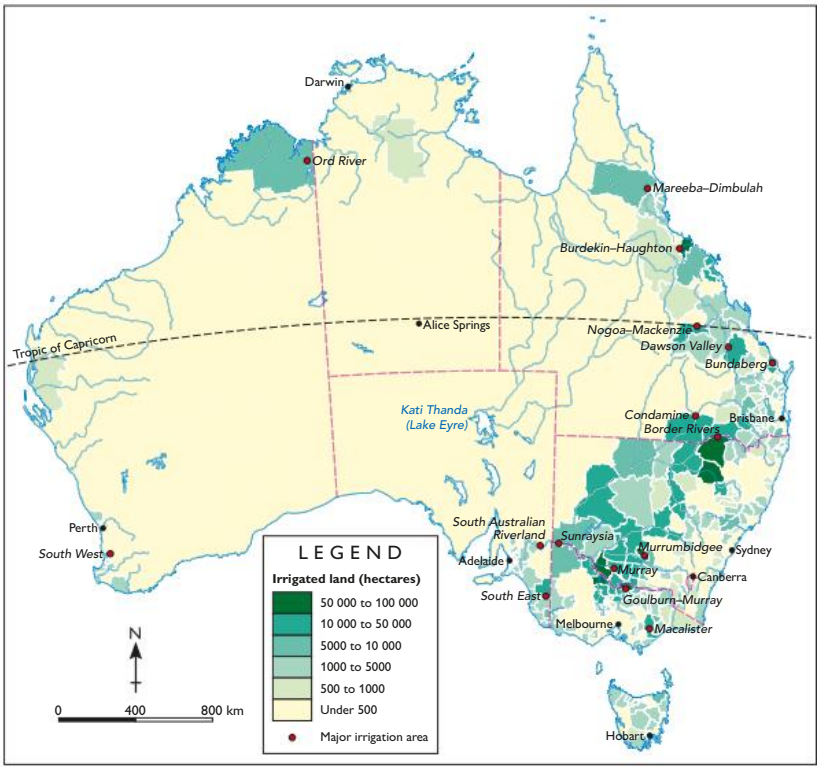
Source 7.27 Irrigation of farms is the greatest use of water in Australia.

AUSTRALIA: IRRIGATED AGRICULTURE (AREA AND VALUE)



Source 7.28

AUSTRALIA: IRRIGATED LAND



Source 7.29

Source: Oxford University Press

REVIEW 7.2.2

Remember and understand

1 What two factors have placed huge pressures on Australia's water supplies?

2 Examine Source 7.26. Which region has no major rivers flowing through it?

Apply and analyse

3 Using Source 7.24, describe the pattern of rainfall across Australia.

4 Examine Source 7.25. What percentage of fresh water is used by the secondary sector?

5 Refer to Sources 7.28 and 7.29.

a Which agriculture activities use the most water?

b As a proportion of land area to value, estimate which crops have the highest and lowest return on investment.

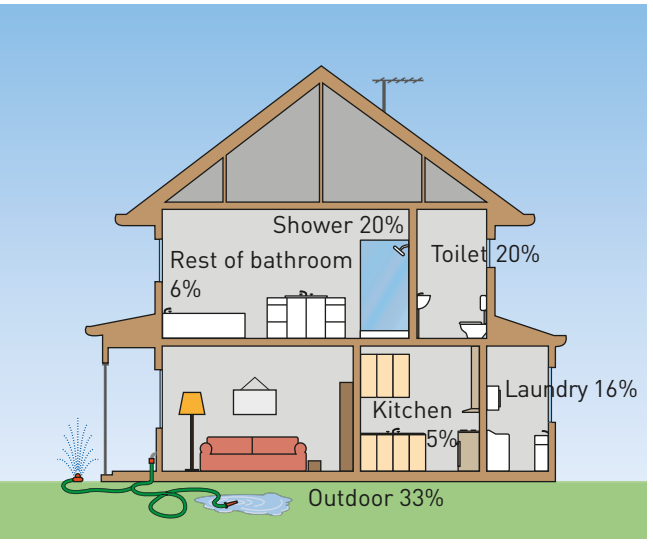
c Give reasons for the location of Australia's irrigated land.

Investigate and create

6 Overhead irrigation (see Source 7.27) wastes the most water. Explain why you believe this to be true.

7 Research other, more efficient ways (wasting less water) of irrigating farms, particularly in the dry Australian climate. Form a viewpoint: should these different methods be enforced by law? Why or why not?

MANAGING WATER AT HOME



Source 7.30 Water use in the home

The easiest way for us to become involved in water management is to understand how we can be more water-wise at home. A resource management plan takes into account the range of uses of the resource, the amount of the resource required and the impact of resource use on the environment. Decisions are then made about what is the best and most sustainable, way to use the resource. Sustainability is an important concept in geography. In order for a resource to be used sustainably there must not be so much used that it affects the ability of the resource to replace itself naturally. Domestic users of water are under more pressure than ever before to manage their water use properly as our water resources become more stressed.

As you have learnt, Australians are among the highest users of water in the world. Nearly half of the domestic water usage occurs in the bathroom. To improve water management in the home we need to select water-saving appliances, capture and recycle water and attempt to use less water. To ensure we have a sustainable supply of water into the future, think about some of the water-saving ideas shown in Source 7.31.

Source 7.31 A range of simple water-saving ideas

Bathroom
Take shorter showers and install new water-efficient showerheads that use no more than 9 litres of water per minute (compared with old-style showerheads that use 20 litres per minute). This can save up to 20 000 litres of water per person per year.

Laundry
Only use the washing machine when you have a full load. Redirect the waste water from the washing machine into a collection bin and use it on the garden, but make sure you use detergents that will not kill your plants.



Kitchen
Don't rinse dishes under a running tap. Ensure the dishwasher is full before turning it on.

Outside
Don't use the hose to clean hard surfaces outside; use a broom. Install a plastic pool cover to reduce water lost to evaporation. Install a rainwater tank to use the water that falls on your roof. It can be used to flush toilets, wash clothes and water the garden. Top up the pool with water from the tank.

Garden
Plant native gardens using local plants that are accustomed to the climate and soil conditions in your area. Use drippers to deliver water directly to the base of the plants where they need it. Avoid sprinklers, which allow water to be blown away and evaporated.

KEY CONCEPT: SUSTAINABILITY

The air shower

Despite living in one of the world's driest places, Australians are among the world's biggest water users. Many scientists believe that our use of water is not sustainable and have looked for ways to increase our water supply or decrease the amount of water we use.

Air shower set to cut water use by 50 per cent

As Australians become increasingly alert to the importance of using water wisely in the home, CSIRO researchers have found a way to use a third less water when you shower – by adding air.

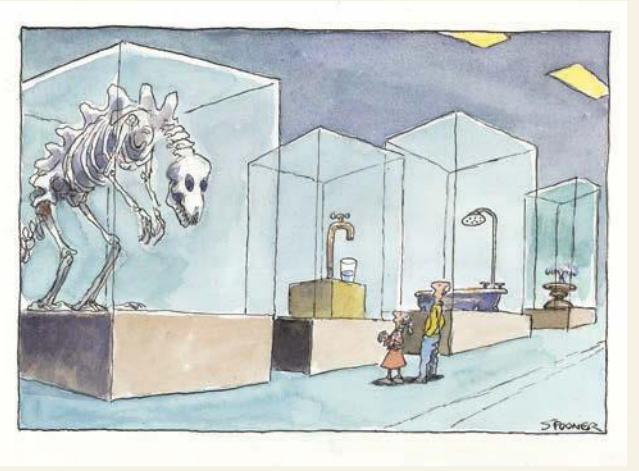
The scientists have developed a simple 'air shower' device which, when fitted into existing showerheads, fills the water droplets with a tiny bubble of air. The result is the shower feels just as wet and just as strong as before, but now uses much less water.

The researchers, from CSIRO Manufacturing Materials Technology in Melbourne, say the device increases the volume of the shower stream while reducing the amount of water used by about 50 per cent.

Given the average Australian household uses about 200 000 litres of water a year, and showers account for nearly a third of this, the 'air shower' could help the average household save about 20 000–30 000 litres a year. If you extend this across the population, that is an annual saving of more than 55 000 Olympic-sized swimming pools ...

Source: CSIRO website

For more information on the key concept of sustainability, refer to section GT.1 of 'The geographer's toolkit'.



Source 7.32 This cartoon was first published in 2007 during a period of severe drought.

REVIEW 7.2.3

Remember and understand

1 What does a management plan need to take into account?
2 Which room in the house uses the most water?
3 What is the easiest way of reducing the amount of water and energy used in the shower?
4 Suggest three ways that water can be gathered and reused around the home.
5 Give two examples of how technology can be used to help save water.

Apply and analyse

6 Look carefully at the news article.
   a What have researchers at CSIRO developed to help save water in the home?
   b What water savings do they hope to make?
   c Apply your understanding of the air shower to develop a new water-saving product idea to clean dishes.
7 Look carefully at Source 7.32.
   a What is the cartoonist suggesting about our management of water in the future?
   b When was the cartoon drawn and what influence might this have had on the cartoonist?

Investigate and create

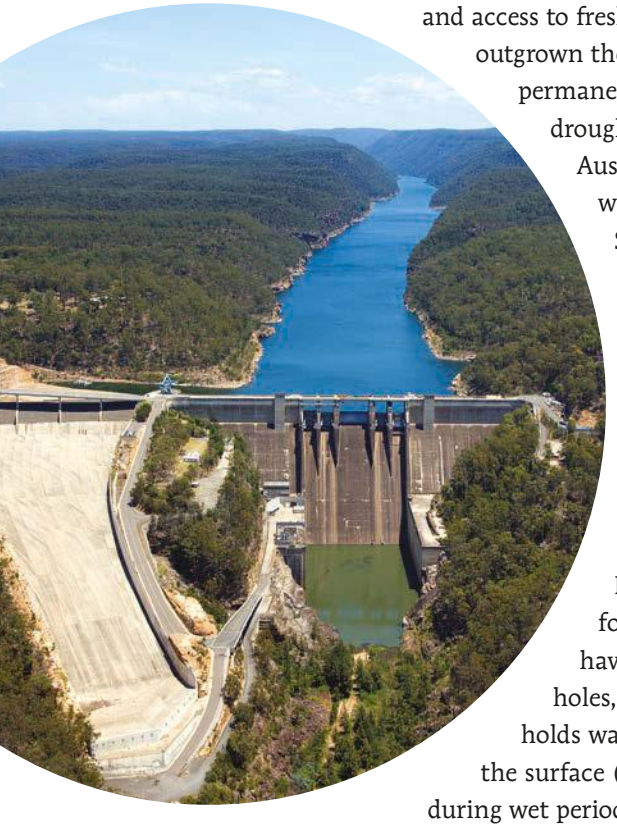
8 Conduct research into the different types of water-saving methods and appliances on the market today. Create your own water-saving reminder for display in one of the rooms of your house or for display in your classroom.

MANAGING WATER IN AUSTRALIA'S BIGGEST CITIES

In order to ensure that reliable supplies of safe water are available for use now and into the future, we all need to use water more sustainably. Careful management of our existing supplies and reductions in our consumption will help to achieve this. We also need to remember that people are not the only living creatures on the planet. The interests of all living organisms need to be considered if the natural environment is to be protected for the future.

Ensuring reliable water supplies in Australian cities

Over 60 per cent of Australia's population lives in one of our five largest cities – Adelaide, Brisbane, Melbourne, Perth and Sydney – all of which are home to more than a million people. The sites of these cities were chosen in large part because of their reliable rainfall and access to fresh water from neighbouring rivers. However, all of these cities have now outgrown their original water supplies. Large dams have been built to provide a permanent water supply for large towns and cities, but population growth and drought have put enormous pressure on these reserves. As a result, many Australian cities are now looking at a number of strategies to reduce their water usage and ensure they have access to reliable supplies into the future. Some of these options are discussed here.



Source 7.33 The Warragamba Dam near Sydney is one of the largest domestic water supply dams in the world. It supplies 80 per cent of Sydney's water.

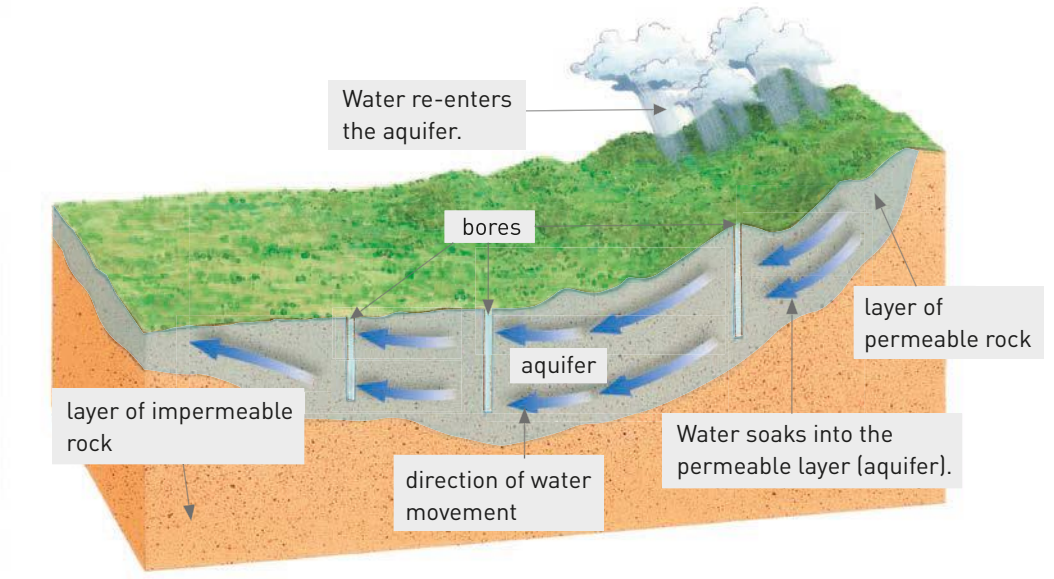
Option 1: Build more dams

Across Australia, governments are thinking about building more dams to create a reliable water supply for our growing population. Dams can also be used to create hydroelectric power when water let through the dam wall turns a turbine to create electricity.

Option 2: Use underground water reserves

Drilling water **bores** is a common method used on Australian farms for supplying water for irrigation and animals. Many Australian cities have started to use this method to add to their fresh-water supplies. Deep holes, called bores, are drilled down into a layer of rock under the ground that holds water. This layer of rock is called an **aquifer**. The water is then pumped to the surface (see Source 7.34). It is also possible to replace the water in the aquifers during wet periods by pumping the water back underground. In this way, aquifers operate as underground dams. In Western Australia, scientists are trialling a method of treating stormwater (rainwater that falls on the hard surfaces of a city, such as roofs and roads) and using it to recharge the aquifers that supply much of Perth's water.

There are large aquifers in many areas of Australia, including beneath Melbourne. Often this water has a high mineral content and must be treated before it can be used for drinking and other household uses. This water could be used for industrial purposes, such as to clean machinery and irrigate crops. This would allow drinking water, currently used for these other purposes, to be added to the city's water supplies. This idea of using lower-quality water for non-domestic purposes has been considered in many Australian cities.



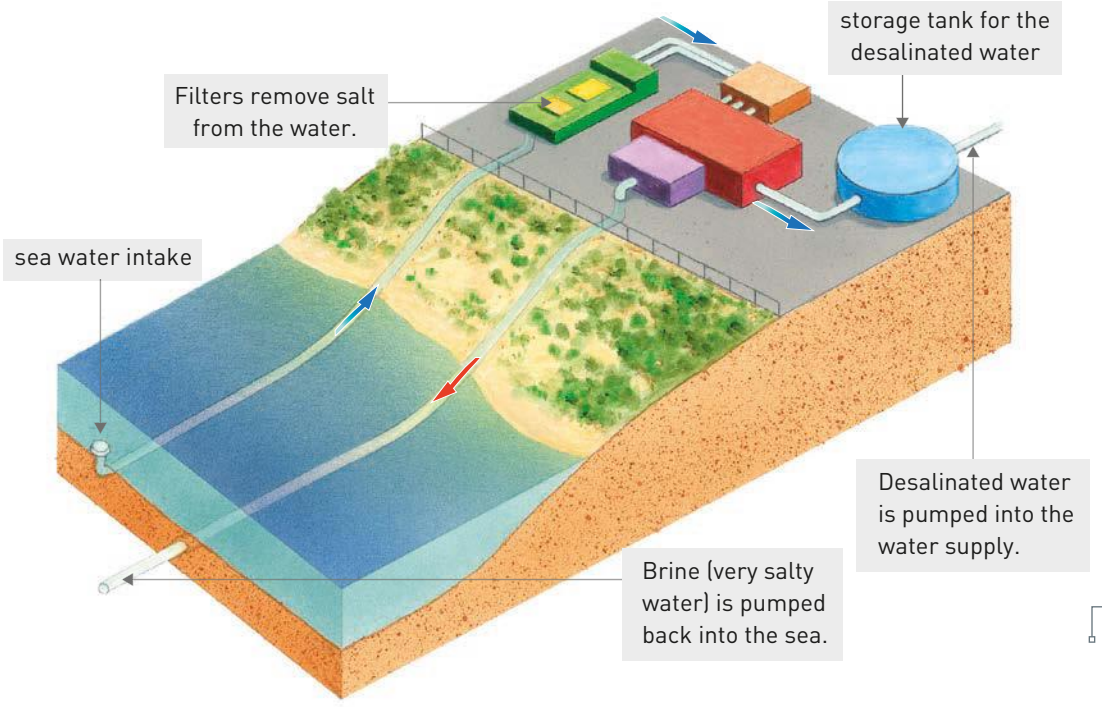
Source 7.34 Water from rainfall soaks into permeable rock. This water-bearing rock is known as an aquifer. The water cannot penetrate the impermeable rock below. Wells (or bores) are drilled into the aquifer to pump water to the surface.

Option 3: Build desalination plants

Desalination plants treat sea water to remove from it the salt and other impurities (see Source 7.35). This process, known as reverse osmosis, turns sea water into fresh water for drinking. As Australia has easy access to a vast supply of sea water, desalination plants are an attractive option for many cities.

There are three main reasons why there are not more of them already:

- Desalination plants cost a lot of money, making the water they produce expensive. The Sydney desalination plant (Kurnell, Cronulla), opened in 2010 at a cost of $1.8 billion. It needs an estimated $192 million annually for maintenance to keep it in a state of 'hibernation' for when it is needed, and almost $6 million to get it up and running if it was needed to be put into action.



Source 7.35 How a desalination plant works

- Desalination plants use a lot of electricity and can damage the environment. It has been estimated that the Sydney desalination plant uses as much electricity as 120 000 households. A new power plant had to be built to run it, adding to the cost.
- Desalination plants can damage the environment. They release highly concentrated salt water (brine) back into the ocean, which can harm marine animals.

Option 4: Build water pipelines

Perhaps the simplest method of ensuring a reliable water supply is to move water from areas that have a surplus. This already happens in most Australian cities. Rainwater is collected in catchments in the hills and forests close to cities and piped to treatment plants and then to water users.



Source 7.36 Huge pipes carry water beneath our city streets. Here, pipes are being laid in Brisbane.

One proposal currently involves piping water not just hundreds of kilometres but thousands. For many years, there has been an idea to pipe water from the Fitzroy River in the Kimberley region in north-western Western Australia to the city of Perth. This pipeline would need to be 3700 kilometres long. The cost of transporting water this far through steel pipes is much greater than other options, such as desalination plants, and so this method is unlikely to be used in the near future. It will also cause environmental problems at the source of the water and would require large amounts of energy to build and operate.

Option 5: Capture and store storm water

Storm water is collected in pipes and gutters and discharged in the sea or rivers. Rainwater tanks capture this fresh water, but cities have not been designed to collect this water on a large scale.

Many major new developments have this option in their plans, ranging from sporting fields, to residential and commercial establishments, ultimately saving money and backed by government schemes. In Adelaide, there is a plan to capture this water through existing pipes and treat it in the current water-treatment facilities. In this way, it could be added relatively easily to the city's drinking water.



Option 6: Recycle and treat waste-water and sewage

Water that leaves our homes is generally unsuitable to be used again. In using the water to clean clothes, dishes and ourselves and to flush toilets, we have polluted the water. This water (known as waste-water or sewage and termed **grey water**) is usually piped to a treatment plant where it is cleaned and purified and then released back into rivers and bays. In some places, such as Singapore and Windhoek in Namibia, this water is added to rainwater and piped back into homes and to other water users.

KEY CONCEPT: SUSTAINABILITY

Toowoomba says 'No' to drinking sewage

In trying to use our resources sustainably, we sometimes have to change our attitudes and behaviours. While many Australians believe that we should use less water or use water from different sources, it can be difficult to convince people to change. In 2006, for example, the people of Toowoomba were faced with a difficult decision about water.

At that time, Toowoomba's three dams had fallen to critical levels. The town council proposed a radical solution. The town would treat its sewage to a high level, store the treated sewage in a dam for three to five years and then add it to the town's fresh-water supplies.

The supporters of the scheme pointed out that this is exactly the system used successfully in parts of California and Singapore, and that the technology exists to treat the sewage to a safe, clean, drinkable level. The opponents of the scheme called it 'drinking poo' and voiced concerns about the town's reputation as a tourist centre and about potential health hazards.

The campaigning was fierce for months before the vote. In the end, 62 per cent of Toowoomba's population voted 'no' to the proposal, leaving the council in the difficult position of having to find other sources of fresh water. For more information on the key concept of sustainability, refer to section GT.1 of 'The geographer's toolkit'.

REVIEW 7.2.4

Remember and understand

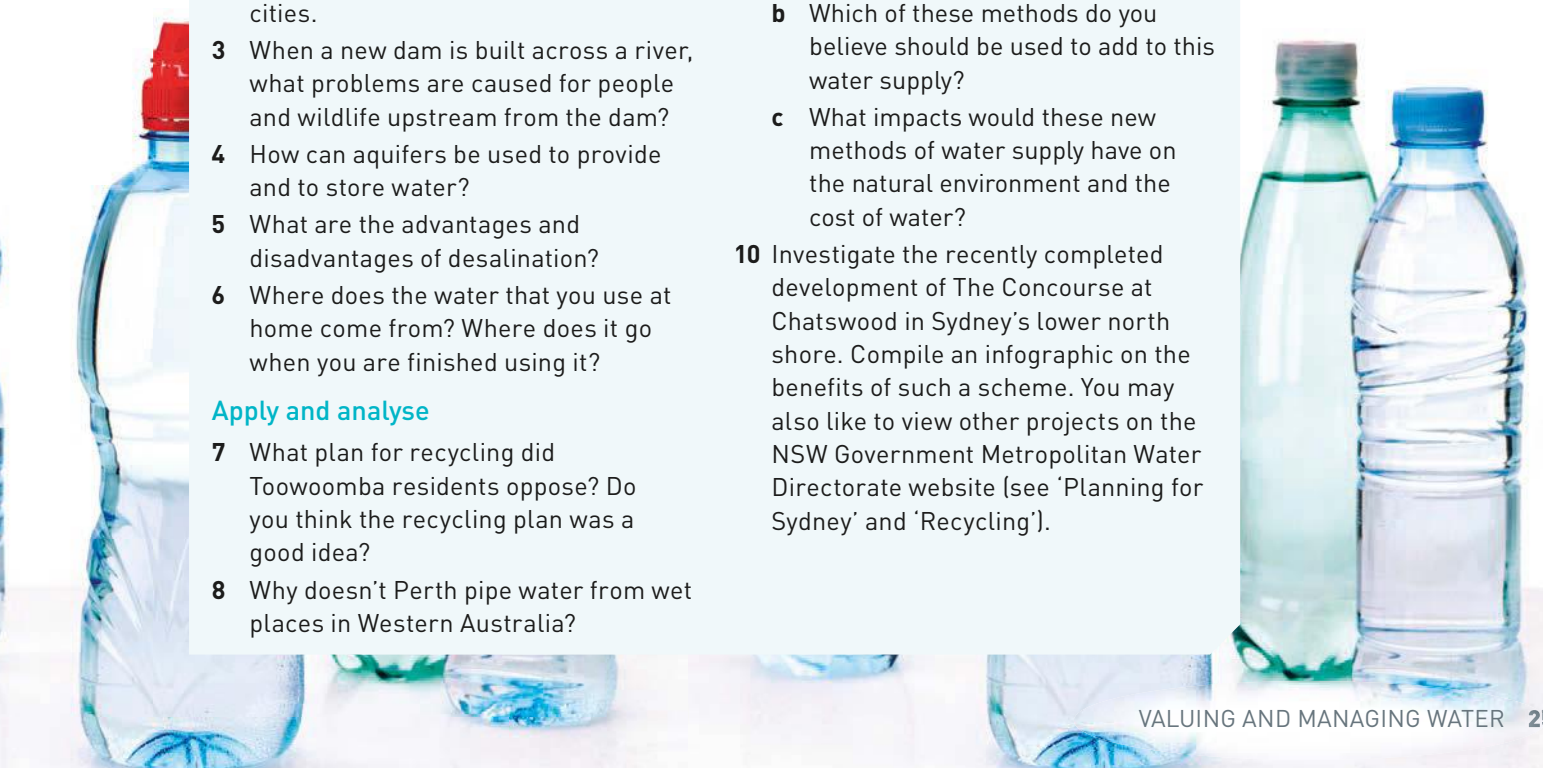
1 In your own words, describe what a sustainable resource is.
2 List five different ways that governments might investigate to find extra water resources for growing cities.
3 When a new dam is built across a river, what problems are caused for people and wildlife upstream from the dam?
4 How can aquifers be used to provide and to store water?
5 What are the advantages and disadvantages of desalination?
6 Where does the water that you use at home come from? Where does it go when you are finished using it?

Apply and analyse

7 What plan for recycling did Toowoomba residents oppose? Do you think the recycling plan was a good idea?
8 Why doesn't Perth pipe water from wet places in Western Australia?

Investigate and create

9 a Research Sydney's (or your local region's) current water supply. Which of the water supply methods described on these pages does it currently use?
  b Which of these methods do you believe should be used to add to this water supply?
  c What impacts would these new methods of water supply have on the natural environment and the cost of water?
10 Investigate the recently completed development of The Concourse at Chatswood in Sydney's lower north shore. Compile an infographic on the benefits of such a scheme. You may also like to view other projects on the NSW Government Metropolitan Water Directorate website (see 'Planning for Sydney' and 'Recycling').



NEW WAYS OF THINKING ABOUT WATER



As global pressure on water resources increases, water experts are beginning to think of water in new ways. New terms for describing types of water and usage have been devised, including virtual water, and blue and green water. This new thinking is designed to promote a better understanding of the ways in which people use water and will help to make water usage more sustainable.

STRANGE BUT TRUE

Producing one cup of coffee takes 140 litres of virtual water.



Virtual water

The amount of water used to produce goods and services is called virtual water. This includes the water used to grow crops or raise animals as well as the water needed in processing these crops and animals into products. Experts use the term 'virtual water' because we cannot actually see how much water went into producing the goods and services we consume every day. For example, 15 000 litres of water are needed to produce just 1 kilogram of beef. This 15 000 litres of water is known as virtual water.

It is often impossible to move real water between water-rich countries and water-poor countries. It is, however, relatively simple to transport virtual water in the form of goods, such as meat and wheat. This helps to support water-poor countries with their water needs.



Blue water and green water

Historically, water suppliers have focused on the capture and supply of blue water (that is, water in storages, such as lakes, rivers and aquifers) over green water (that is, rainwater stored in the soil as soil moisture). Green water is the water that remains in the soil to be used by plants. Farmers in dry regions, such as the interior of Australia, need to understand how to manage both their blue water resources and their green water resources. Installing a rainwater tank to collect and store water for later use is an example of blue water management. Adding a layer of mulch to slow the evaporation of water from the soil is an example of green water management.



Water footprints

The total amount of water you consume each year is known as your **water footprint**. This includes the real water you consume (by drinking, bathing and cleaning) and the virtual water you use through your consumption of goods and services. The total volume of water used by everyone who lives in a country, including the water used to produce exported goods, is the national water footprint.



Source 7.37 One kilogram of rice contains 1500 litres of virtual water, making it one of the world's thirstiest crops.

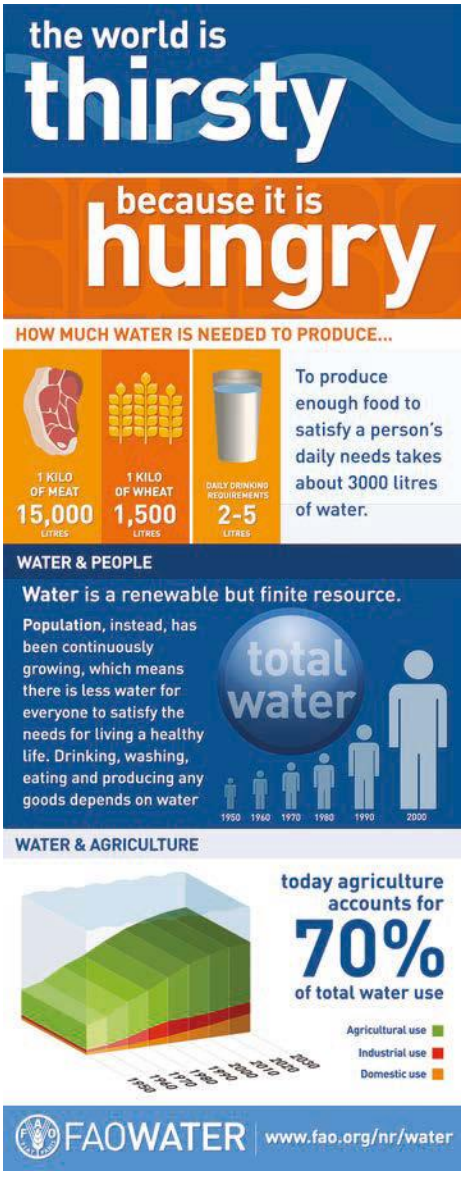
The size of a country's water footprint is largely determined by the country's:

- climate, especially the amount of rainfall and evaporation
- farming methods, especially how efficiently water is used
- production and consumption of crops
- general consumption and production patterns.

Countries where people eat lots of beef and rice and buy many manufactured goods use more water than countries where people eat mainly vegetables and have few personal goods.

Australians are among the world's biggest water users. The Australian Bureau of Statistics estimates that Australia's population will increase to 35.7 million by 2050 and this will place a great strain on an already stressed water-supply network. Experts believe that Australia's capital cities, for example, will need 76 per cent more water by 2050 than is currently supplied.

The good news is that Australians have embraced new water-saving measures. Despite the population of Australia increasing by approximately 19 per cent between 2006 and 2016, the amount of water used by households actually continues to fall. This is due largely to water restrictions in many capital cities and the use of new technologies, such as dual-flush toilets and water-saving showerheads, and the education and awareness of the public.



Source 7.38 A poster from the United Nations that uses the idea of virtual water to communicate a message

REVIEW 7.2.5

Remember and understand

1 Define the term 'virtual water'.

2 Explain the difference between blue water and green water.

3 Why is it important to understand virtual water when working out your water footprint?

4 How can an understanding of virtual water help water-rich countries to decide what to produce and export?

Apply and analyse

5 Source 7.38 states that the world is thirsty because it is hungry.
   - **a** What does this mean?
   - **b** What evidence is presented to support this idea?

6 Look carefully at the image of the Chinese farmer working in his rice fields (Source 7.37).
   - **a** How is he using water as a resource?
   - **b** How is he able to control the flow of water in his fields?
   - **c** Explain how this makes his use of water more sustainable.

Investigate and create

7 Research some of the best water-saving ideas in the world today. Can you invent and design one that will make water shortages a thing of the past? It might be something simple like the water-saving tap (which already exists), or a more complex idea that can be applied to an entire industry.

7.2

CHECKPOINT

WHAT APPROACHES CAN BE USED TO SUSTAINABLY MANAGE WATER RESOURCES AND REDUCE WATER SCARCITY?

- **Investigate the nature of water scarcity and the ways of overcoming it**

1 Describe where in Australia water scarcity is a major issue and why. [5 marks]
2 Although little rain falls in central Australia, explain why it is not a major problem when compared to coastal regions and the south-east. [5 marks]
3 Analyse the reasons why developing countries tend to suffer more from a lack of water. [5 marks]
4 Outline the strategies that Australian cities are using to deal with the increasing pressures of water scarcity. [5 marks]
5 What factors allow Australian cities to carry out these strategies when compared to some other countries, such as Niger? [5 marks]

TOTAL MARKS [/25]

RICH TASKS

Task 1: Water sustainability in your life

Draw a poster to be displayed in your school canteen that makes students aware of the ways in which their food choices impact on water supplies in Australia, e.g. virtual water.

Task 2: The Wodaabe nomads

Communities in extreme environments develop ways of life that allow them to survive and thrive. In the south-eastern part of Niger, in Africa, live the Wodaabe people. They live in a desert region where water is often scarce and feed for their cattle is in short supply. In response to these conditions they have become **nomads** and rarely stay in one place for more than 10 days. They follow the seasonal rains across the desert as rain brings grass for the cattle; this takes them on a route they have followed for hundreds of years.

The seasonal migrations of the Wodaabe take them from the clay plains near Lake Chad to the sandy soils away from the lake. Over the last few decades the lake has become smaller as other communities in the area have used its water for irrigation. This has meant that the Wodaabe's have had to change annual migration routes. The reduction in the size of the lake has enabled more grass to grow on land that was once covered in water, but it has also meant that fresh-water supplies have become less reliable.



Source 7.39 Packing up the homestead to follow the rains

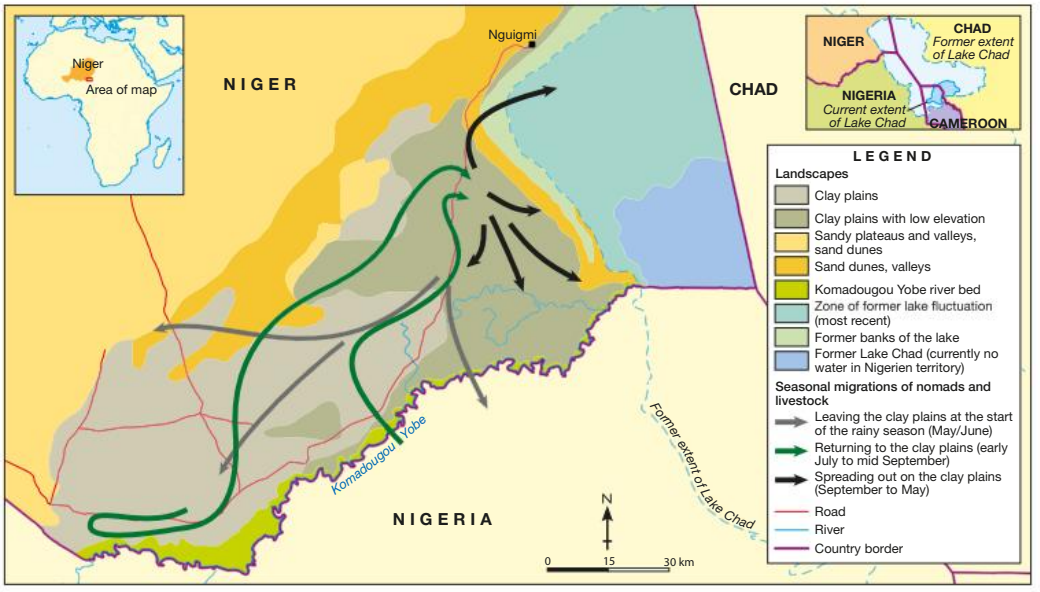


Source 7.40 Young men of the Wodaabe tribe

Source 7.41 Climate data: Nguigmi, Niger

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (mm)	0	0	0	1	5	11	55	100	15	1	0	0
Temperature (°C)	21	24	28	31	33	33	31	30	30	29	25	22

NIGER: NATURAL ENVIRONMENTS AND SEASONAL MIGRATION ROUTES OF THE WODAABE



Source 7.42

Source: Oxford University Press

Acquiring geographical information

1 Define the term 'nomads'.

2 Would you describe the Wodaabe as voluntary migrants? Why or why not?

Processing geographical information

3 Clay plains with low elevation are the best areas for the Wodaabe to graze their cattle in the dry season. Why? Using Source 7.42, describe the location of the clay plains with low elevation.

4 Source 7.39 shows a Wodaabe family packing their belongings to follow the rains. Describe their possessions. How many donkeys would your family need?

Communicating geographical information

5 Construct a climate graph for Nguigmi using the climate data in Source 7.41.

SKILL DRILL

Understanding flow maps

Flow maps show the movement of things from one place to another. Flow maps can be simple or complex. They can show the movement of one group of people around a small area or compare the movement of many different goods around the world. Flow maps use arrows of different colours and sizes that show different things moving around and the numbers of these things. Here are some steps that will help you understand flow maps:

Step 1 Read the title of the map carefully.

Step 2 Look at the legend on the map. This will tell you what the different coloured arrows on the map are showing and provide you extra information, such as the time of year this movement happens.

Step 3 Look for patterns on the map. Are the movements related to changes in the weather, to the time of year, to political or economic factors or all of these things?

Step 4 Try to explain the reasons for the pattern.

Apply the skill

1 Describe the movement of the Wodaabe during May and June.

2 Where do the Wodaabe travel to from July to September?

3 Explain the pattern in Source 7.42 supported by evidence from Source 7.41.

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Space, Environment, Interconnection, Scale, Sustainability
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Graphs and statistics, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHAPTER

8



Source 8.1 Toowoomba in Queensland was hit hard by flash floods in 2011, which were accompanied by record monsoonal rains and tropical cyclones.

INVESTIGATING ATMOSPHERIC AND HYDROLOGICAL HAZARDS

Natural hazards are natural events that have the potential to injure or kill people, and damage property and parts of the environment. They can be grouped according to the processes that cause them. Water hazards, also known as hydrological hazards, are associated with water processes. They include floods, droughts and tsunamis. Weather hazards, or atmospheric hazards, are caused by weather processes. They include tropical cyclones, tornadoes, thunderstorms and snowstorms or blizzards. This chapter highlights floods and cyclones.



WHAT IMPACTS CAN WATER HAVE ON COMMUNITIES?

8.1 SECTION

In this section you will investigate:

- one contemporary atmospheric hazard or hydrological hazard including causes, impacts and responses

(two have been presented in this chapter for you to choose from)

CHECKPOINT 8.1



GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Environment:** the effect of human activities on natural environments
- **Interconnection:** how people are affected by the environment with regard to natural hazards
- **Scale:** responses and actions undertaken by governments, organisations and individuals
- **Change:** the effect of management strategies in reducing the impact of natural and human processes

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** topographic maps, weather maps, thematic maps, choropleth maps
- **Graphs and statistics:** data tables
- **Spatial technologies:** geographic information systems (GIS), satellite images
- **Visual representations:** ground photographs, oblique aerial photographs, annotated diagrams, infographics

8.1 FLOODS: A HYDROLOGICAL HAZARD

WHAT IMPACTS CAN WATER HAVE ON COMMUNITIES?

Natural factors

Put simply, rivers flood because they are forced to carry more water than they can hold. This process is like filling a glass from the tap but leaving the tap dripping into the glass after it's full. Every river, like every glass, can only hold a certain amount of water. This is known as its **carrying capacity**. Heavy rain or a collapsed dam can cause a river to exceed its carrying capacity and force it to burst its banks. As a result, water covers the surrounding land.

The soil carried by the river is spread across the surrounding land. Over millions of years and thousands of floods, the land near the river is slowly built up and, appropriately, is called a floodplain. Billions of people around the world choose to live on these **floodplains** because of the fertile soil, flat land and ready supply of fresh water. The world's floodplains support billions of people, many of whom live with the constant threat of floods.



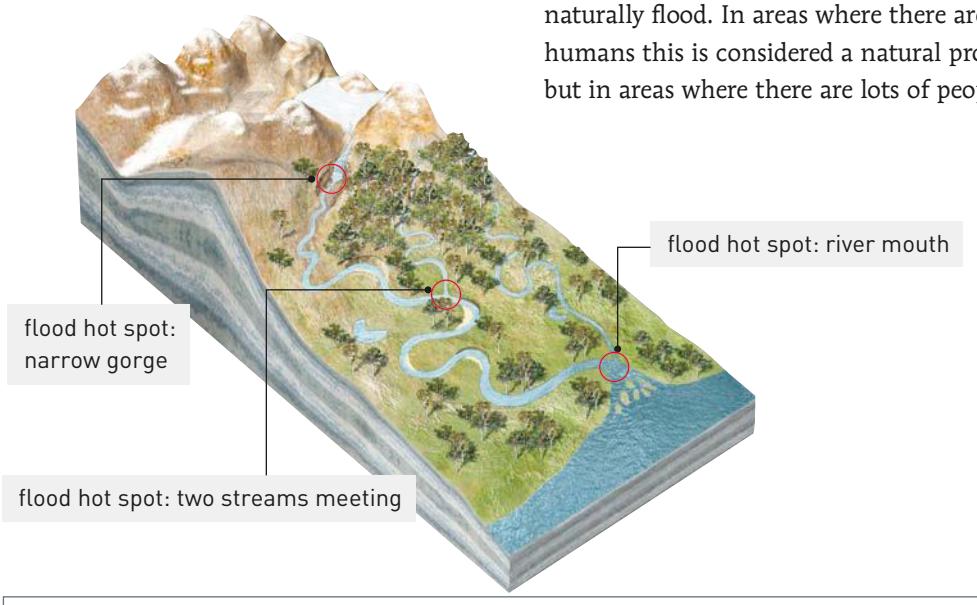
Source 8.2 A flood is a natural event, but becomes a disaster if humans are adversely affected by it.

Human factors

Some human activities make rivers more likely to flood, endangering both natural and human environments. Clearing the natural vegetation, such as trees and plants, growing on the sides of hills may result in more water flowing into rivers instead of being used by these trees and plants. Replacing natural environments (such as forests, grasslands, wetlands and soil) with hard surfaces (such as concrete and roads) also means that water does not soak into the ground; instead, it flows across it. The presence of so many communities, towns and cities also increases the flood risk. Rivers naturally flood. In areas where there are no humans this is considered a natural process, but in areas where there are lots of people,

STRANGE BUT TRUE

Many ancient communities depended on the annual flooding of rivers such as the Tigris and Euphrates (Middle East), the Nile (Egypt) and the Ganges (India).



Source 8.3 Rivers tend to flood in particular places, shown here as hot spots.

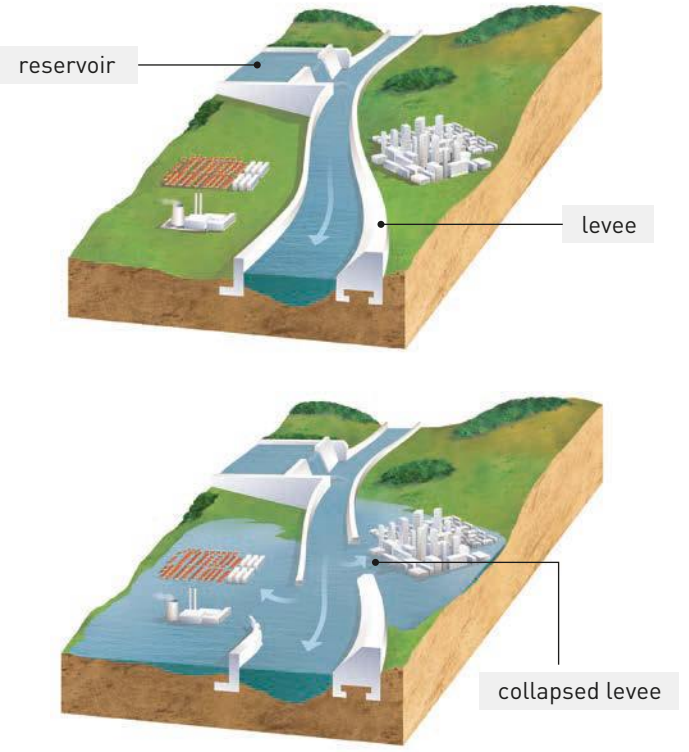
these natural events turn into potential and real disasters.

In some places, large artificial banks known as stopbanks or **levees** have been built to help protect communities from floods. While they help defend the community from small flood, they sometimes make the effects of a large flood much worse. The river runs faster and deeper between the levees and is able to carry more water. During a major flood the water may have nowhere to go if it meets an incoming tide or storm surge at the river mouth. The water then banks up behind the levees and may spill over into surrounding areas.

If the levee collapses from the strain of holding back the floodwaters, this can result in catastrophic flooding as the water floods through a narrow gap with terrifying force. This occurred in the US city of New Orleans in 2005 when Hurricane Katrina brought torrential rain and a storm surge up to 9 metres high. Levees protecting much of the city collapsed and more than 1800 people were killed.



Source 8.5 The first of many giant sandbags is lowered by helicopter to close a hole in a levee following Hurricane Katrina in New Orleans, United States.



Source 8.4 A levee before and after its collapse

REVIEW 8.1.1

Remember and understand

1 What is a floodplain and why do so many people live on them? Do you live on a floodplain?
2 What is a levee and how can it reduce flooding in some areas?
3 List some of the human activities that may contribute to flooding. Select one of these and explain why it may lead to a flood. You may wish to use a sketch in your explanation.

Apply and analyse

4 Explain why floods are more likely at each of the hot spots shown in Source 8.3.
5 Do you think that the attempt to repair the levee in Source 8.5 will be successful? Give some reasons for your answer.
6 Examine a map of Australia online or in your atlas that shows our largest cities and towns. List the Australian cities with more from one million people that are located on flood plains at the mouth of rivers. What is the largest town or city that you can find that is *not* located in one of these hazardous places? What does this tell you about the flood threat in Australia?

Investigate and create

7 Why do levees sometimes make the effects of flooding worse? Design a flood protection system that you believe would work better than a levee. Conduct some more research to assist you in designing your system (for example, the Thames Barrier, United Kingdom, or New Orleans, United States). Sketch your design and label the key features.

FLOODS IN AUSTRALIA

Most towns and cities in Australia are located close to rivers, but some experience more floods than others. This is because of a combination of important geographical factors, particularly rainfall patterns and river geography. As you have already learnt, different places experience different types of rainfall, but there are also different types of rivers. Australia is the world's flattest continent, so generally our inland rivers flow, and flood, slowly. Those that flow from the mountains to the sea, however, tend to flow and flood more quickly and this can be devastating for the people who live beside them.

AUSTRALIA: FLOODS



Source 8.6

Source: Oxford University Press

Inland rivers

The rain that falls on inland Australia flows into one of our many inland river systems. Some of these never reach the sea as they flow into large salt pans, such as Kati Thanda (Lake Eyre). Once every couple of decades or so, enough rain falls in central Australia to fill Kati Thanda, creating Australia's largest lake. The rivers that flood these inland regions move very slowly, giving people time to prepare for them. Farming communities and towns may be isolated for weeks if roads are covered by floodwaters, but few lives are lost in these slow-onset floods.

Some of our inland rivers, however, can be deadly. Much of the rain that falls in inland eastern Australia flows into the Murray–Darling river system and eventually reaches the sea near Adelaide. Some of the rivers in this system can rise quickly with little warning. The deadliest flood in Australia's history occurred when the Murrumbidgee River destroyed the small New South Wales town of Gundagai in June 1852. Swollen by torrential rain, the river rose and washed away all but three of the town's houses. Eighty-nine people lost their lives, and many more were saved from the floodwaters by local Aboriginal men.

In southern New South Wales and northern Victoria, floods may be caused by summer thunderstorms or by a series of cold fronts sweeping in from the south. These fronts, created when warm air is forced above cold air, may bring heavy rain along the southern coast and into much of the southern Murray–Darling Basin.



Source 8.7 The Diamantina River, shown here flowing past Birdsville in western Queensland, carries floodwaters to Kati Thanda (Lake Eyre) several times a decade.



Source 8.8 In early 2011 about one-quarter of Victoria was affected by major flooding. In some inland towns, such as Charlton, the floodwaters took many weeks to recede.

Coastal rivers

Most of Australia's most devastating floods occur on our coastal rivers, particularly along the eastern coast. During summer, tropical cyclones and thunderstorms often dump heavy rain on the eastern slopes of the Great Dividing Range (see Source 8.6). This rain fills the short, fast-flowing rivers in the area to bursting point, causing rapid-onset floods. Towns and farming communities at the foot of the ranges, such as Clermont and Toowoomba, are most in danger.

REVIEW 8.1.2

Remember and understand

1 Why do Australia's inland rivers flow slowly? How does this affect the types of floods that occur?

2 Seven Australian floods have resulted in more than 30 fatalities. Where and when did they occur?

Apply and analyse

3 Which areas of Australia are most at risk from dangerous floods? Why?

4 What questions could you ask to investigate the flood risk in your local area?

5 What do you notice about the temperature of the sea and the risk from tropical cyclones?

6 In what ways does the Great Dividing Range influence the flood risk in eastern Australia?

Investigate and create

7 Fourteen of the 15 most disastrous floods in Australia occurred more than 50 years ago. Do you think this means that we are experiencing fewer floods or are there other explanations for this? Brainstorm the possible explanations.

8 Design and construct a flood model. This can be done with simple items: soil, sand, rocks, a container for a dam, a ruler for a levee, rain from a spray bottle or a flood from a bucket. What works best? What doesn't? Make a video of your experiment and report back to the class.

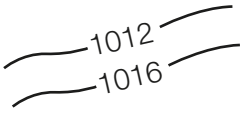
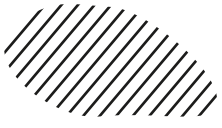
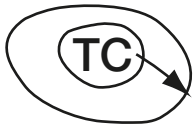
PREPARING FOR FLOODS

Floods are part of the natural cycle of many rivers, so it is almost impossible to prevent them entirely. There are, however, many steps that we can take to lessen the impact of floods on people and places. These can be grouped into three categories. First, we can predict where and when there will be flooding so people have time to prepare. Second, we can ensure that people, homes and communities in flood-prone regions are prepared. Finally, when a flood does strike we can respond quickly and efficiently to save lives and make the affected area safe.



Source 8.9 A thunderstorm rolls into Port Hedland, Western Australia.

Source 8.10 Weather map symbols

Symbol	Name	Explanation
	Isobar	A line connecting places with the same air pressure; the closer together the isobars, the stronger the wind.
	High pressure cell	Air rotates anticlockwise (in southern hemisphere) around a sinking air mass; conditions are warm and dry.
	Low pressure cell	Air rotates clockwise (in southern hemisphere) around a rising air mass; conditions are cool and wet.
	Cold front	A line showing where cold air moves into an area and forces warm air to rise, cool and cause rain; cold fronts move in the direction of the arrowheads.
	Warm front	A line showing where warm air moves into an area, rises and cools; this often produces light rain and showers.
	Trough line	A long area of rising air, often bringing a line of rain and sometimes thunderstorms.
	Rainfall	On some weather maps, shading is used to indicate a region where rain is likely to fall.
	Tropical cyclone	Air rises rapidly and rotates clockwise with a calm centre; conditions are extremely windy and wet, and flooding is likely; cyclones move in the direction of the arrow.

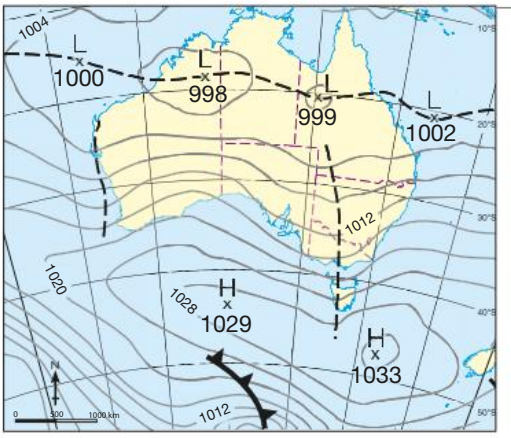
How do we know floods are coming?

Floods in Australia are caused by heavy rain. To predict where and when heavy rain will fall, **meteorologists** use thousands of observations from radar, weather balloons, satellites and other sources. They use their observations to forecast the weather and inform the public about upcoming weather events. This includes issuing flood alerts and warnings.

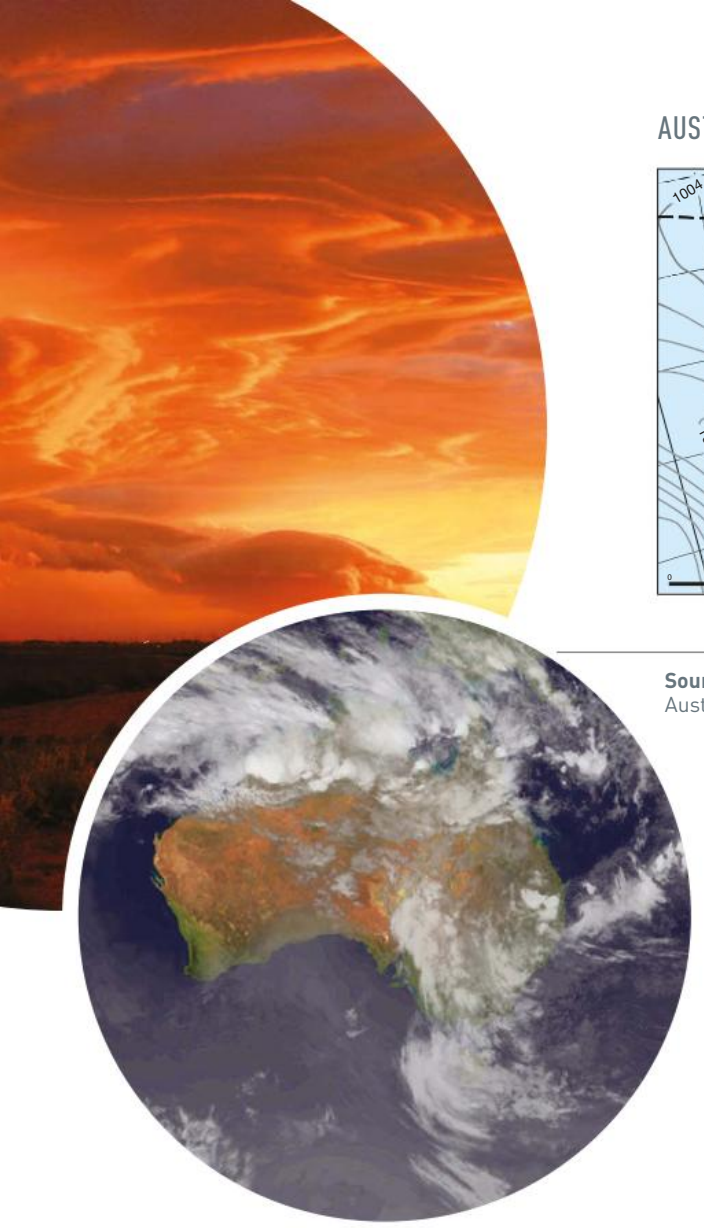
The basic tool of weather prediction is a weather map. Weather maps show what is happening to the air in the atmosphere. Air rises and falls and this movement is measured with a **barometer** as air pressure. Air rises when it is heated and sinks when it is cooled. Because the Earth is spinning, the rising and sinking air also spins. We feel this spinning air as wind. Water droplets in rising air may cool and join together to create rainfall.

Weather maps show the air pressure as a series of lines and help meteorologists make predictions about temperature, wind and rainfall. Although they may appear confusing at first, the symbols on a weather map are codes and, as with all codes, once you know the secret, you can read the message.

AUSTRALIA: WEATHER MAP, 10 JANUARY 2011



Source 8.11
Source: Bureau of Meteorology



Source 8.12 A satellite image of Australia on 10 January 2011



Source 8.13 The Bureau of Meteorology issues flood warnings that are broadcast on television and other media.

REVIEW 8.1.3

Remember and understand

1 What are three things that people can do to lessen the impacts of floods?
2 What is a cold front?
3 Explain how Source 8.11 could be used to lessen the impacts of flooding.
4 North-eastern Victoria experienced heavy rain and major flooding on 10 January 2011. What was the cause of this rain?
5 On 10 January 2011 it was a windy day in Perth. From which direction did the wind blow? Do you think Hobart was windier or calmer than Perth on that day?

Apply and analyse

6 What relationship do you notice between clouds and trough lines when comparing the satellite image (Source 8.12) with the weather map (Source 8.11)?
7 Source 8.11 is a weather map that shows the situation on the day on which devastating floods hit the Lockyer Valley (see later in this chapter). What type of weather can this region of Queensland expect to receive in the next few days?

Investigate and create

8 Conduct a search for a weather map for today (in newspapers, on the Internet or via a mobile app) and predict the weather over the next few days for your local area.

HOW FLOODS AFFECT PEOPLE AND PLACES

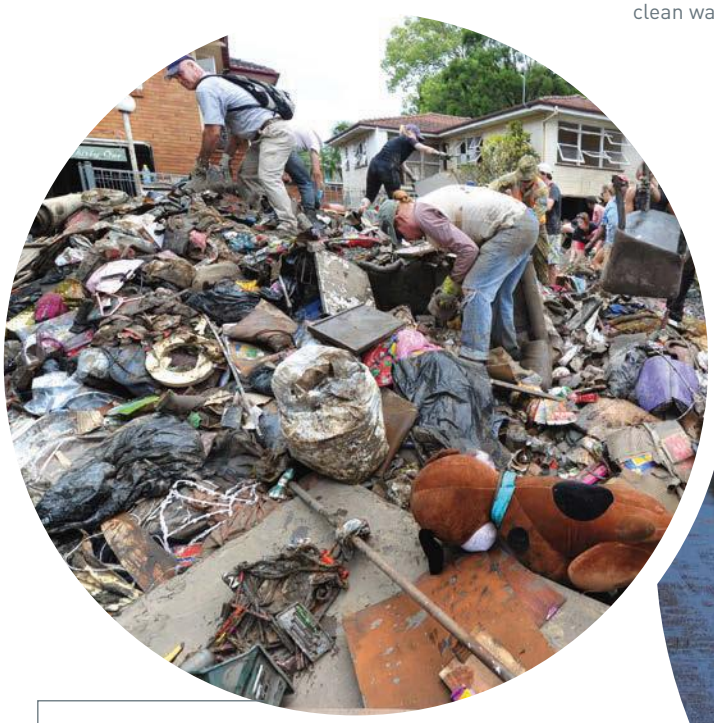
Major floods can have devastating effects on different regions all over the world. In large cities, hard concrete and asphalt surfaces mean that very little water soaks away through the soil. Instead, roads can quickly turn into rivers, with terrifying results.

In farming regions whole crops can be uprooted and washed away, along with much of the rich topsoil. Expensive farming machines and equipment can be damaged or destroyed by floodwaters and livestock can also be lost.

In some countries, floods lead to widespread famine and starvation, with large death tolls. In Pakistan in 2010, nearly 2000 people died from flooding and 17 million people were affected.



Source 8.14 A Pakistani farmer and his family became stranded by floodwaters in 2010 and were left without food and medical supplies. The biggest challenge they faced, however, was a lack of fresh, clean water.



Source 8.15 Volunteers remove flood debris from houses in the Brisbane suburb of Fairfield on 16 January 2011.



Source 8.16 In flat regions, such as western Victoria, floodwaters can make farming impossible for months at a time.





Source 8.17 This beetroot farm in the Lockyer Valley in Queensland had huge quantities of valuable topsoil washed away in 2011.



Source 8.18 These villagers in Pakistan compete for food supplies being dropped by an army helicopter after severe flooding in 2010.



REVIEW 8.1.4

Remember and understand

1 Identify some of the ways in which people's health can be affected during floods.

2 Explain why it costs so much to clean up after floods.

3 Study Source 8.15.
   - **a** Who are the people in the photograph and what are they doing?
   - **b** Where has all the rubbish come from?

Apply and analyse

4 Study Source 8.14.
   - **a** How can the people shown possibly be suffering from a lack of water?
   - **b** How might food aid reach this family?

5 Identify some of the short-term and long-term effects of flooding.

6 Which of the flood effects shown on these pages do you believe will have the most lasting impact? Give some reasons for your answer.

Investigate and create

7 Study Source 8.18. Imagine you have been sent into this region to report on the effects of the flood. Write a report on the effects on the people who live in this area. Present it as a newspaper report or as a script for a television news report.

QUEENSLAND'S 'INLAND TSUNAMI'

The deadliest floods in Australia in more than 70 years struck south-eastern Queensland in January 2011. In late 2010, a combination of record monsoonal rains and a tropical cyclone soaked Queensland's river catchments. July to December 2010 were the wettest six months ever recorded in Australia, and December 2010 the wettest month on record for Queensland.

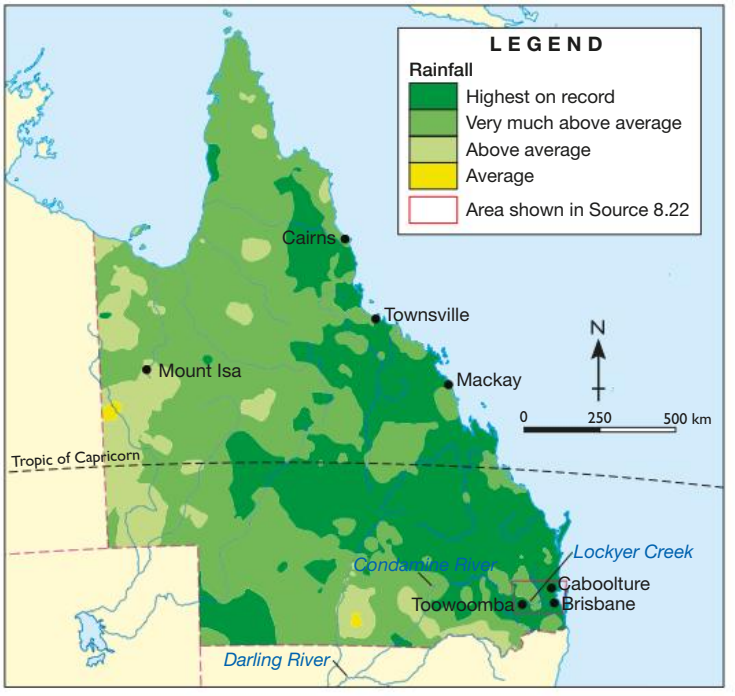
By early January, many Queensland rivers were in flood. Towns had been evacuated, businesses destroyed, schools closed, farms swept away, and roads and railway lines cut. Thousands of homes were flooded, but the worst was to come.

Toowoomba sits 700 metres above sea level on the Great Dividing Range. Rain that falls to the west of Toowoomba flows into the Darling River and begins a long journey of about 3000 kilometres to the sea near Adelaide (see Source 8.20). Rain that falls to the east of Toowoomba flows into the **headwaters** of the Lockyer Creek and reaches the sea at Brisbane.



Source 8.19 The appropriately named Water Street in Toowoomba's central business district became a waterway in minutes.

QUEENSLAND: RAINFALL, OCTOBER TO DECEMBER 2010



Source 8.20

Source: Oxford University Press

On 10 January 2011, a severe thunderstorm dumped more than 60 millimetres of rain on the town in an hour. This caused a flash flood to surge through the town, flooding the town centre and washing away cars and people. Many pedestrians and motorists had to be rescued as roads became rivers. The Queensland Police Commissioner described the flood as an 'inland instant tsunami'.

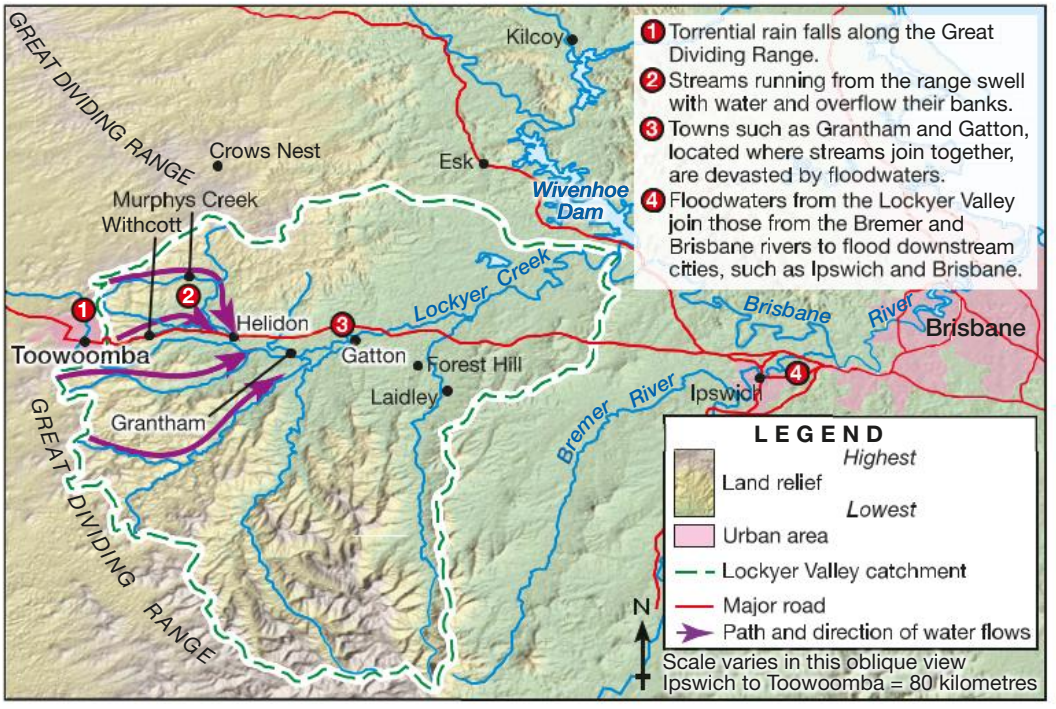
Between the Great Dividing Range and Brisbane sits the Lockyer Valley. As the thunderstorm that affected Toowoomba crossed the valley, it continued to dump torrential rain. When combined with the run-off from Toowoomba, the already swollen creeks could not cope. Moving down the valley with great speed and terrifying force, the floodwaters slammed into the towns of Murphys Creek, Postmans Ridge, Helidon, Grantham and Gatton. A survivor described the flood as 'a wall of water', as creeks rose up to 15 metres above their normal level in a few minutes.

Thirty-five people died in the floods. More than 78 per cent of Queensland (an area bigger than France and Germany combined) was declared a disaster zone, with over 2.5 million people affected. Floodwaters also affected the Bremer and Brisbane rivers with Ipswich and some Brisbane suburbs also flooded. More than one-quarter of Queensland's rail network was destroyed and 9000 kilometres of roads were damaged. The total cost of the floods was estimated to be as high as $20 billion.



Source 8.21
Downstream from the town of Grantham the rail bridge was covered by the debris carried by the floodwaters.

LOCKYER VALLEY FLOOD, JANUARY 2011



Source 8.22

Source: Oxford University Press

REVIEW 8.1.5

Remember and understand

1 Why did the streams and rivers of this region overflow and flood?
2 What is a thunderstorm?
3 Explain how the Great Dividing Range affected the movement of floodwaters from Toowoomba.

Apply and analyse

4 List the causes of this flood under two headings: natural causes and human causes. You may like to refer back to 'Why do rivers flood?' earlier in this chapter to review the human activities that may lead to flooding.
5 On a map of Australia showing flood regions (see Source 8.6), locate the town of Toowoomba. Follow the course of rivers from Toowoomba to the mouth of the Murray. Do you think the flash flood caused flooding at the mouth of the Murray River? Give some reasons for your answer.
6 Describe the rainfall received in Queensland in the last three months of 2010. How did this rain contribute to flooding in January 2011?
7 Examine the map of the Lockyer Valley (Source 8.22). Why is the town of Grantham most at risk from flooding?

Investigate and create

8 The Lockyer Valley is an area of rich farming land. Sometimes called 'Queensland's salad bowl', it is home to many fruit and vegetable growers. What resources in the region attract farmers to the Lockyer Valley? How do you think farmers were affected by the flood? How would this impact on other Australians? Create a flow chart of your answers to these broad questions. You will probably need to add more sections in your flow chart to better illustrate the before, during and after effects of the flood.

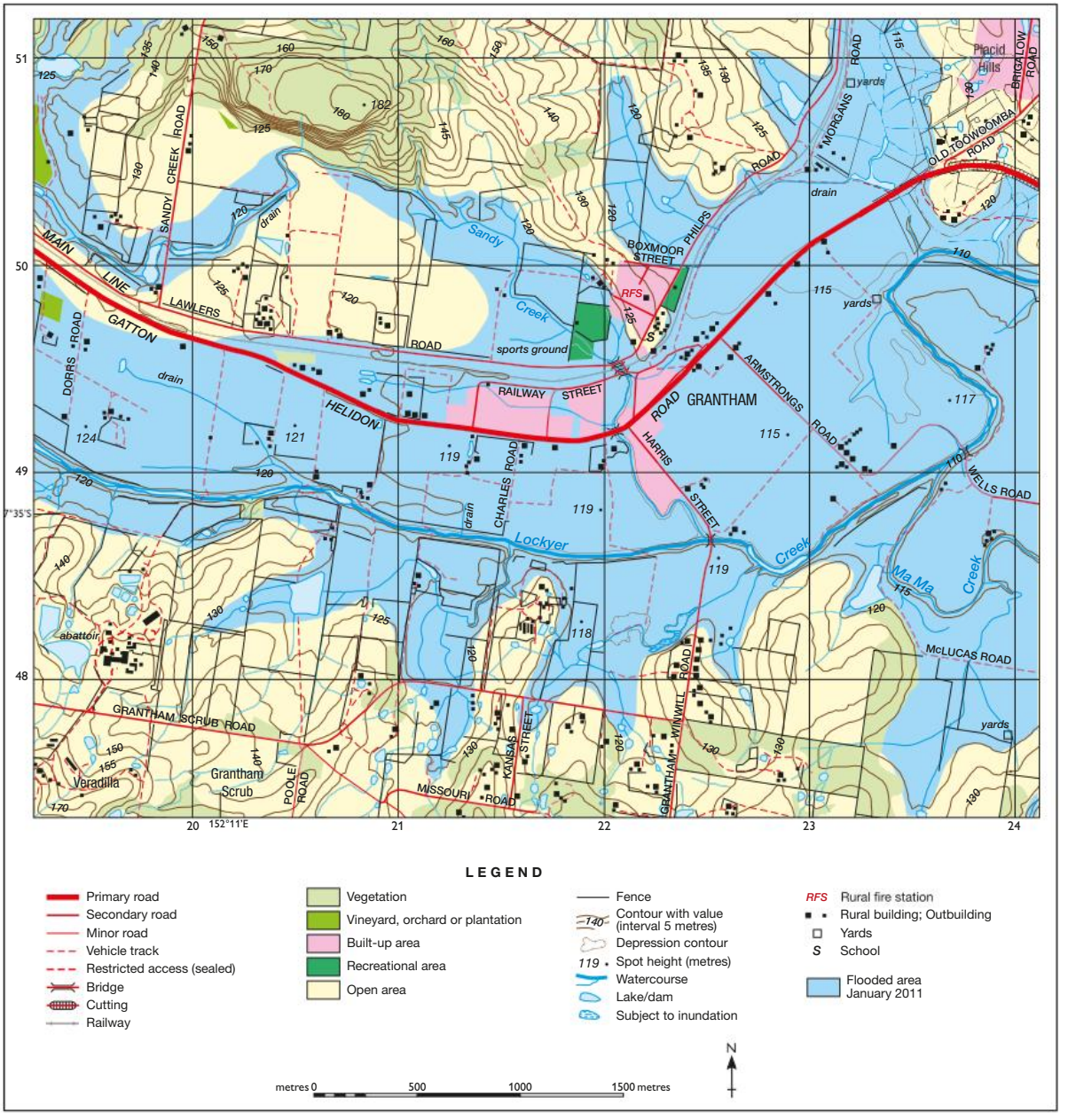
CASE STUDY

GRANTHAM FLOODS, QUEENSLAND

Grantham, a small rural community in the Lockyer Valley, was devastated by the 2011 floods. Local residents described the flood that swept through the town as a wall of water that appeared with little warning. The waters swept from the Lockyer Creek across the neighbouring paddocks and into the town. Experts estimated that the floodwaters were moving at 2 to 3 metres per second and reached a depth of 2 metres within 10 to 15 minutes.

Houses were swept away in the flood and people trying to escape in their cars were also caught. Twelve people died in Grantham as a result of the flood and 130 homes were destroyed or damaged. In the year after the flood some Grantham residents moved away from the area and some built new homes on higher land near the town.

GRANTHAM TOPOGRAPHIC MAP SHOWING 2011 FLOODWATERS



Source 8.23

Source: Oxford University Press

SKILL DRILL

Showing height on maps

Most maps only have two dimensions – width and length. In order to see the third dimension, height, geographers use a topographic map. For more information on topographic maps refer to section GT.2 of 'The geographer's toolkit'. On a topographic map, such as Source 8.23, brown squiggly lines have been added to show the height of the land. These lines join together all places of equal height and are called contour lines.

You can work out the height of the land and, more importantly, the shape of the land by following these steps:

Step 1 Some of the contour lines have a number, such as 120, showing you all of the places on this line are exactly 120 metres above sea level.

Step 2 You can work out the height of the lines without numbers on them by counting down or up from the numbered ones, with the help of the contour interval.

Step 3 Places where the contour lines are close together shows steep land. Places where the contour lines are far apart are flat or gently sloping.

Apply the skill

1 How high above sea level is the school?
2 In which direction does Lockyer Creek flow on this map?
3 Is Grantham built on flat land or hilly land?

SKILL DRILL

Locating places on topographic maps

The grid placed on a topographic map allows you to locate places very accurately. Each line on the grid is given a two-digit number. The lines that run vertically are called **eastings** (because the numbers increase as you move east). The lines that run horizontally are called **northings** (because the numbers increase northwards). For a detailed example of how to locate places refer to section GT.2 of 'The geographer's toolkit'.

To locate specific points on topographic maps, geographers use a **six-figure grid reference** (GR). For example, the abattoir near Grantham is located at GR195483. The method used to work out this grid reference is:

Step 1 Put your finger on the bottom left-hand corner of the square in which the feature you want to identify is located. The two-digit number of this easting line will give you the first two digits in the area reference.

Step 2 Estimate the number of tenths that your feature is located between this easting line and the one to the right of it. For example, if it is halfway between the lines it will be five tenths. This number (5 in this case) is the third number in the GR.

Step 3 Again, from the bottom left-hand corner of the square follow the northing line to the side of the map to find out the second two digits in the area reference.

Step 4 Estimate the number of tenths that your feature is located between this northing line on the bottom and the one on the top. This number is the last number in the GR.

Apply the skill

1 Complete the following table.

Map feature	Six-figure grid reference
Abattoir	195483
	222498
Building at the sports ground	
Intersection of _____	197457

REVIEW 8.1.6

Remember and understand

1 What type of map is Source 8.23? Explain what it shows.

Apply and analyse

2 The rail bridge shown in Source 8.23 is located at GR 221495. On which creek is this bridge located? In which direction is this creek flowing?
3 Using Source 8.3, decide on which of the three flood hot spots Grantham is located.
4 Following the flood in 2011, many Grantham residents built new homes in the town around GR 240510. Why is this area less likely to flood than the town of Grantham?

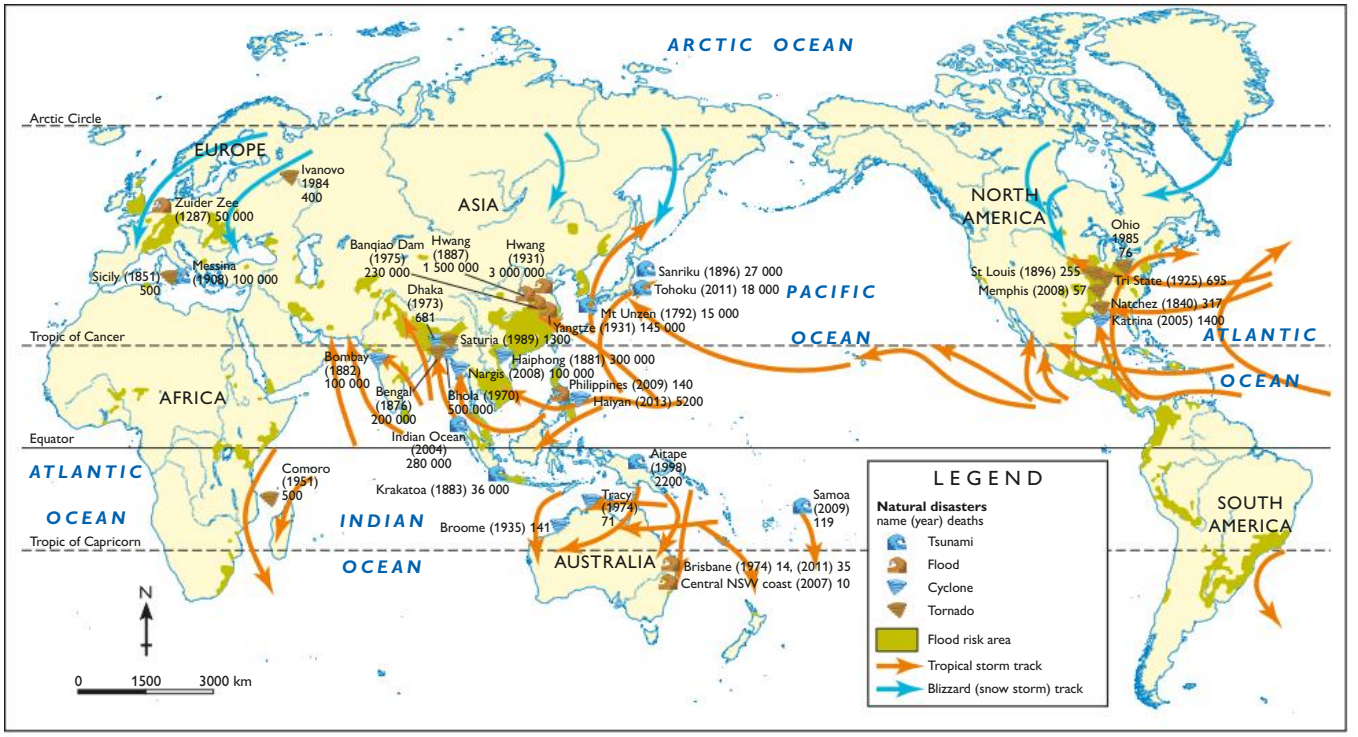
Investigate and create

5 Research the best design structures to limit flooding. Create a flood mitigation (reduction) plan for the Grantham area. Justify your decisions.

TROPICAL CYCLONES: AN ATMOSPHERIC HAZARD

Tropical cyclones are the world's largest storms and often generate destructive winds and severe rain events. They only form over oceans with water temperatures greater than 26.5 degrees Celsius, mainly between latitudes 20°N and 20°S (see Source 8.24). Tropical cyclones are known as hurricanes in the Americas and typhoons in Asia.

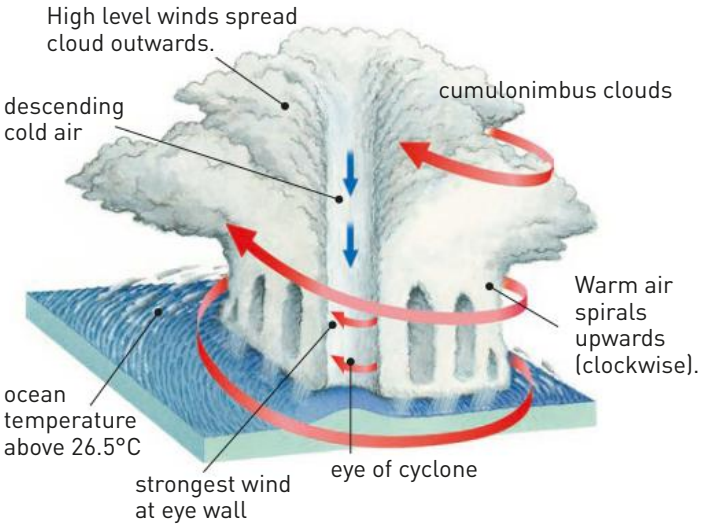
WORLD: WATER AND WEATHER HAZARDS AND DISASTERS



Source 8.24

Source: Oxford University Press

TROPICAL CYCLONE: SOUTHERN HEMISPHERE



Source 8.25



A tropical cyclone is formed when the warm ocean heats the air above it, causing the air to rise. Cool dense air races across the ocean surface to replace the rising air. The Earth's rotation spins the rising air, creating a whirlpool of wind with a vacuum in the centre. This is known as the 'eye' of the tropical cyclone (see Source 8.25). The eye diameter is typically 40 kilometres, but can range from less than 10 kilometres to over 40 kilometres.

Cyclone danger and impacts

Cyclones can be very dangerous because they produce strong, destructive winds and heavy rainfall with flooding on or near the coast. Some of these effects can also be felt further inland.

Winds

Cyclones can have wind gusts exceeding 280 kilometres per hour in the most severe cases (see Source 8.26). These very destructive winds contribute to property damage and turn airborne debris into potentially lethal missiles. In the eye of the cyclone, the wind will drop and may even look as if it is clearing up. But this will soon be replaced by more destructive winds from another direction. The accompanying low pressure system will produce high swell and waves, which are dangerous for vessels out at sea and those moored in harbours, and can badly erode foreshores.

STRANGE BUT TRUE

Cyclones in Australia are named by the Bureau of Meteorology from a predetermined list of alternating boy and girl names. If a particular cyclone is severe, then its name will not be used again (for example, Cyclone Yasi, 2011).

Source 8.26 Cyclone categories

Category	Windgusts	Typical effects
1	Less than 125 km/h	Negligible house damage. Damage to some crops, trees and caravans. Small craft may drag moorings.
2	126 km/h to 169 km/h	Minor house damage. Significant damage to signs, trees, caravans. Heavy damage to crops. Risk of power failure. Small craft may break moorings.
3	170 km/h to 224 km/h	Some roof and structural damage. Some caravan destruction. Power failure likely.
4	225 km/h to 279 km/h	Significant roof loss and structural damage. Caravans destroyed and blown away. Dangerous airborne debris. Widespread power failure.
5	More than 280 km/h	Extremely dangerous with widespread destruction.

Source: Bureau of Meteorology (BOM)



Rain

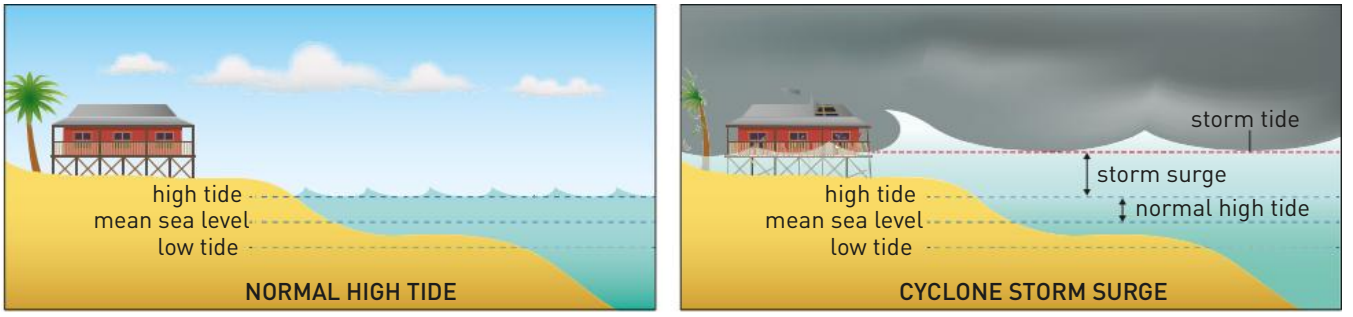
Heavy rainfall that comes with a tropical cyclone can produce widespread flooding. This can result in further damage to buildings and death by drowning. Flooding after a cyclone weakens or passes can occur a long way from the tropical coast. When a cyclone is downgraded to a severe storm it may continue to move inland or further south.



Source 8.27 Tropical Cyclone Yasi, one of the most powerful cyclones in Australia's history, crossed the north Queensland coast near Mission Beach on 31 January 2011. Yasi caused severe damage to buildings and crops, as well as widespread flooding.

Storm surges and tides

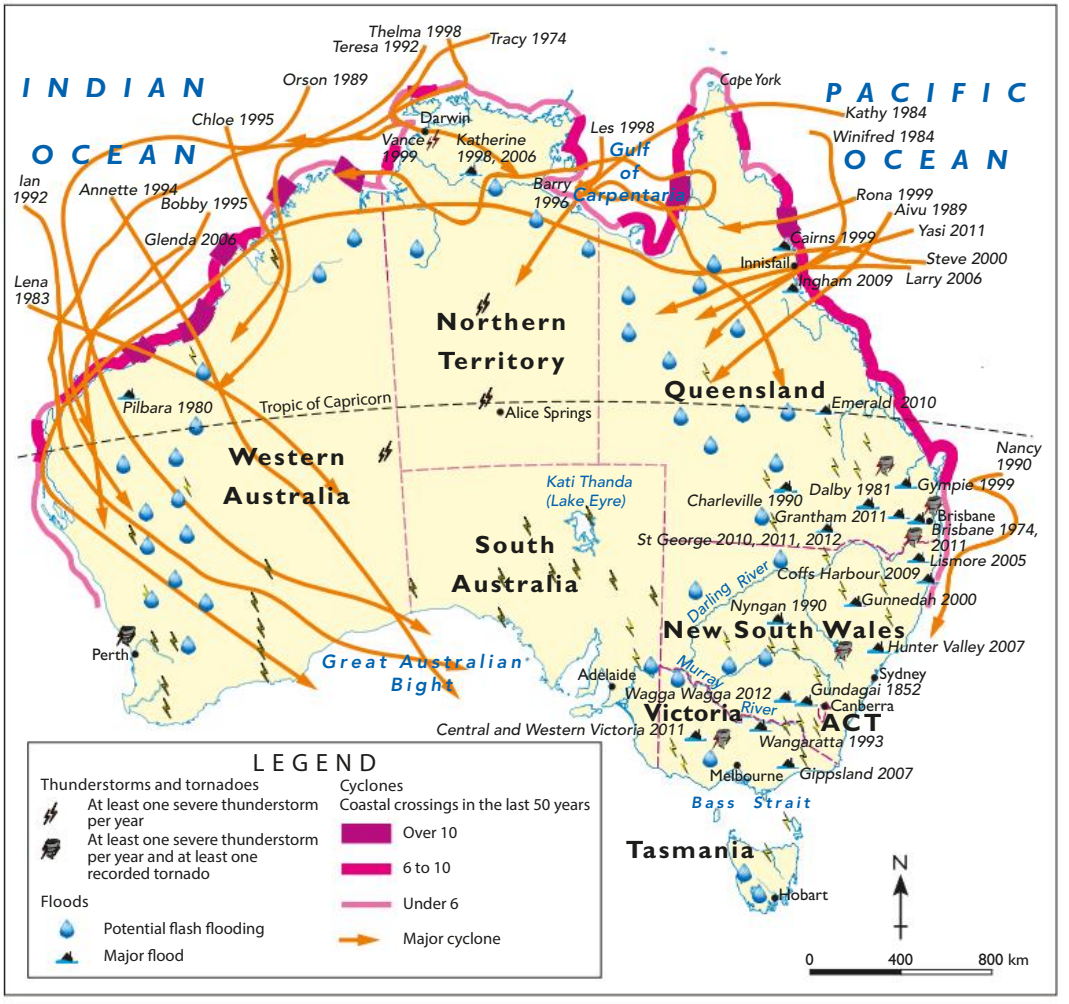
Sometimes, the most destructive event associated with tropical cyclones that make landfall are storm surges. A storm surge is created when an intense low pressure system reduces the downward pressure on the water surface, effectively 'sucking up' the water. This raised body of water can be 60 to 80 kilometres across and 2 to 5 metres higher than the normal tide level (see Source 8.28). When surges occur at the same time as a high tide (or, worse yet, a spring or king tide at full moon), then flooding can be extensive, particularly along low-lying coastal areas.



Source 8.28 A comparison of sea levels during normal high tide and a storm surge

Source: http://www.bom.gov.au/cyclone/about/

AUSTRALIA: WATER AND WEATHER HAZARDS AND DISASTERS



Source 8.29

Source: Oxford University Press

Source 8.30 The top 10 worst cyclones in history

Rank	Name of cyclone and area of largest loss	Year	Ocean area	Deaths
1	Great Bhola Cyclone, Bangladesh	1970	Bay of Bengal	300 000–500 000
2	Hooghly River Cyclone, India and Bangladesh	1737	Bay of Bengal	300 000
3	Haiphong Typhoon, Vietnam	1881	West Pacific	300 000
4	Coringa, India	1839	Bay of Bengal	300 000
5	Backerganj Cyclone, Bangladesh	1584	Bay of Bengal	200 000
6	Great Backerganj Cyclone, Bangladesh	1876	Bay of Bengal	200 000
7	Chittagong, Bangladesh	1897	Bay of Bengal	175 000
8	Super Typhoon Nina, China	1975	West Pacific	171 000
9	Cyclone 02B, Bangladesh	1991	Bay of Bengal	138 866
10	Cyclone Nargis, Myanmar	2008	Bay of Bengal	138 366

REVIEW 8.1.7

Remember and understand

1 Refer to Source 8.24 to describe the global pattern of water and weather hazards.
2 What set of environmental conditions is needed before cyclones may develop?
3 Outline the most common weather phenomenon associated with cyclones.
4 Explain where cyclones most commonly occur in Australia (see Source 8.29).

Apply and analyse

5 Examine the list of the top 10 worst cyclones in history (Source 8.30).
- **a** How is the data ranked?
- **b** Which region of the world has the highest proportion of the worst cyclones?
- **c** With some research, analyse the factors that contribute to such high deaths in this region.

Investigate and create

6 Conduct research into one of the Australian cyclones labelled in Source 8.29. Create a fact file similar to the one below.

Name of cyclone:	
Date	
Location	
Severity / category	
Deaths	
Cost	
Impact	
Other information	
Images	

CASE STUDY

TYPHOON HAIYAN (YOLANDA)

In early November 2013, the central Philippines was hit by one of the largest and most powerful typhoons ever recorded. With wind speeds of 315 kilometres per hour and a storm surge of up to 5 metres, the typhoon tracked westwards across the Philippines, devastating cities, villages and rural communities. More than 6000 people were killed, over a million homes destroyed or damaged, as were many roads, bridges, power stations and water supply systems. Throughout the region more than 16 million people were affected.



Source 8.31 Coastal communities, particularly those on small islands and low-lying peninsulas, were devastated by the storm surge. This small coastal town in Samar province was completely destroyed.



Source 8.32 Survivors desperately needed fresh water and food supplies after the typhoon passed. For many isolated communities, such as the small city of Tanauan, the only way to deliver these and other urgent supplies was by military helicopter.

TACLOBAN: 23 FEBRUARY 2012

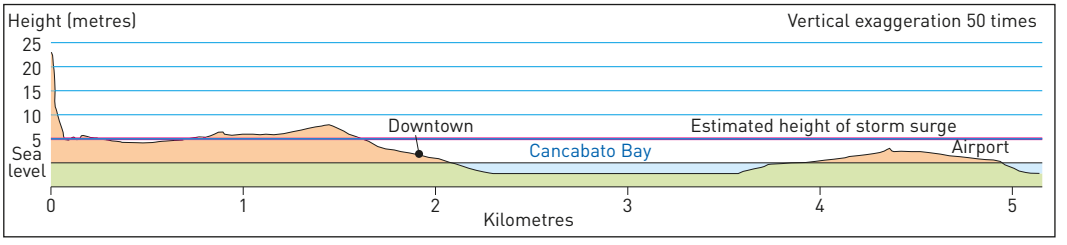


TACLOBAN: 10 NOVEMBER 2013



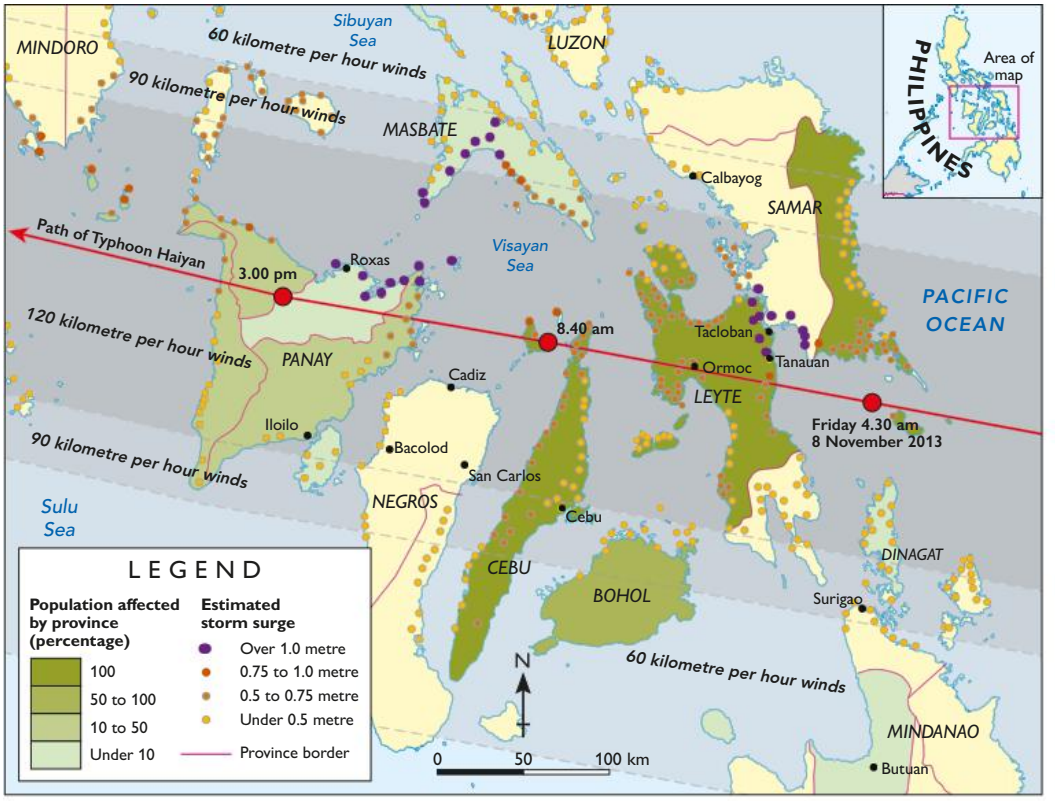
Source 8.33 Tacloban, a city of more than 200 000 people, is located on the eastern island of Leyte. The destruction was so severe that the mayor declared a 'state of calamity'.

TACLOBAN: CROSS-SECTION



Source 8.34

PHILIPPINES: TYPHOON HAIYAN STORM TRACK



Source 8.35

Source: Oxford University Press

REVIEW 8.1.8

Remember and understand

1 What type of photograph is Source 8.32? Why are almost all of the initial images of the disaster of this type?

2 Outline the ways people may have been affected by the disaster.

Apply and analyse

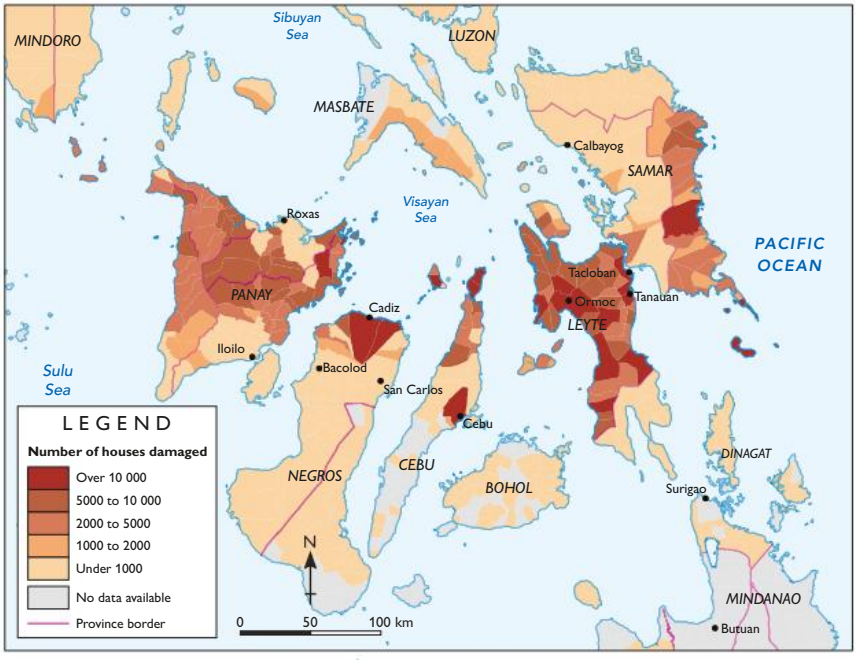
3 Explain why there were so many deaths from the disaster.

4 Describe the difference in the before and after shots of Source 8.33.

Investigate and create

5 Airdrops were the only way to get urgent supplies to many people. Research and design a 'care package' to help save lives in emergency situations. Note: a care package is roughly the size of a school bag and needs to last for one week.

PHILIPPINES: HOUSES DAMAGED BY TYPHOON HAIYAN



Source 8.36

Source: Oxford University Press

8.1

CHECKPOINT

WHAT IMPACTS CAN WATER HAVE ON COMMUNITIES?

- **Investigate one contemporary atmospheric hazard or hydrological hazard including causes, impacts and responses**

1 List the types of hazards that can be caused by water. [5 marks]
2 Outline the potential impacts caused by one of your hazards listed above. [10 marks]
3 Analyse what responses a community might need when recovering from a natural disaster. [10 marks]

TOTAL MARKS [/25]

RICH TASK

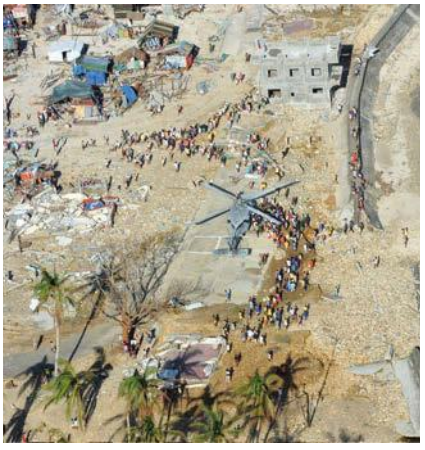
Response to Typhoon Haiyan

There was a massive aid response after Typhoon Haiyan. Many countries around the world sent relief to the Philippines in the form of emergency food and water, military vehicles and personnel, communication and medical experts, and rebuilding and trade skills.

Overseas governments were not the only ones giving immediate help. The World Health Organization (WHO), the United Nations (UN) and more than 50 non-government organisations (NGOs) and other agencies offered their support. This support was backed by donations from the general public.

The relief effort had to be heavily coordinated to make it timely and effective. This was done by the UN Emergency Relief Coordinator. Within days of the disaster, the UN declared a system-wide Level 3 (L3) response – L3 marks the highest level of humanitarian crisis. In responding to the needs of the many millions of people affected, the Haiyan response became the first large-scale relief effort for a sudden-onset disaster. It set a new standard for improved collective action in humanitarian emergencies.

The L3 declaration also made available US$25 million in funding through the UN Central Emergency Response Fund, and the Strategic Response Plan brought in US$468 million of the requested US$776 million, including projects from more than 50 UN agencies and NGOs. An additional contribution of US$375 million was recorded, with a far larger amount not formally registered.



Source 8.37 Philippine citizens gather around a US Navy helicopter as it delivers relief supplies on 17 November 2013.



Source 8.38 Red Cross helping to rebuild stronger homes

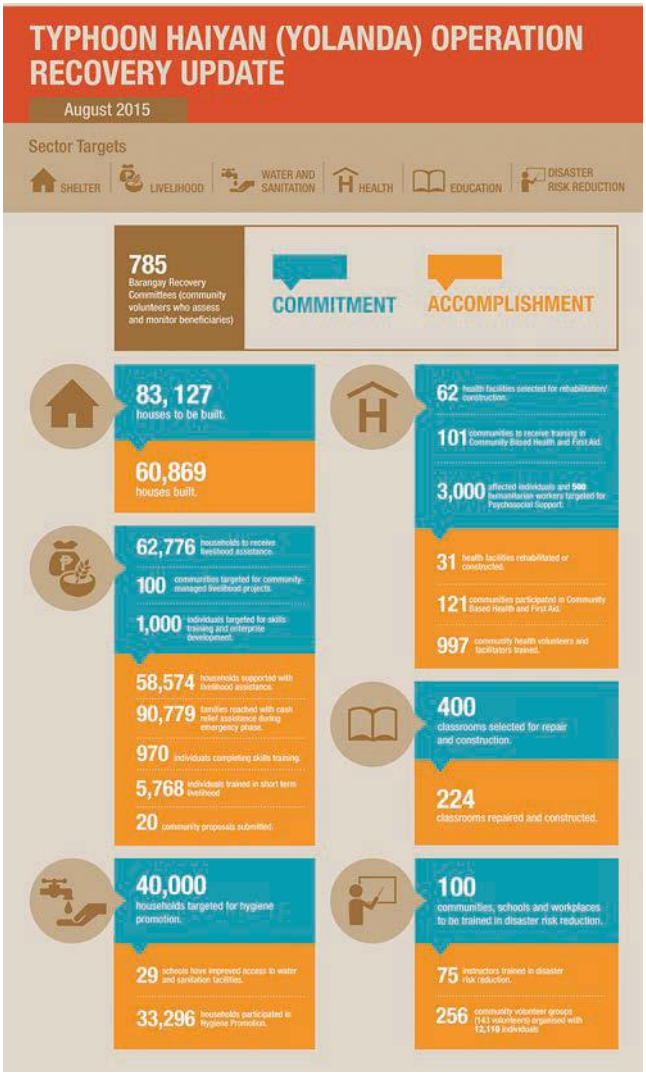


Source 8.39 Red Cross distributes aid supplies.

Rebuilding efforts

The emergency aid delivered in the first few days and weeks is vitally important. However, the rebuilding efforts in the months, even years, after the destruction are also crucial. Getting people back into work and to school, and restoring their daily routines, is essential for the recovery efforts to be successful in the long term.
A year after the typhoon, thousands of people across the Philippines moved into safer, more storm-resistant homes. Red Cross has helped 100 000 people to rebuild their homes by providing iron roofing and cash grants for building supplies. The organisation also trained more than 1900 carpenters in design principles for weatherproof shelters.

The recovery process is still ongoing in the Philippines since Typhoon Haiyan struck in 2013.



Source 8.40 Where are they up to?

Source: International Federation of Red Cross and Red Crescent Societies (IFRC)

Acquiring geographical information

1 List all the different groups of people involved in the clean-up efforts.

2 Why do you think it was important that the UN became involved?

Processing geographical information

3 Explain why a fast emergency response from international agencies was crucial.

4 Using Source 8.40, in which categories has there been the greatest success? Where is the greatest need for continued assistance?

Communicating geographical information

5 Conduct research to update the information in this chapter to show where the response and rebuilding efforts in the Philippines are at. Write a report to the UN outlining your concerns for the year ahead.

6 You are a reporter for *World News Australia* and have been chosen to follow the developments, impacts and clean-up efforts following Typhoon Haiyan. Present your findings as a visual representation – this could be an infographic, poster, poem, PowerPoint, website, app or iBook. Your representation must cover the following key elements: causes, impacts and responses.

7 Remember to include images and diagrams to help convey your information.

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Place, Space, Environment, Interconnection, Scale, Sustainability
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Graphs and statistics, Spatial technologies, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.



4 INTERCONNECTIONS

CONNECTING PEOPLE AND PLACES

CHAPTER 9

THE EFFECTS OF GLOBAL CONNECTIONS

CHAPTER 10



***MSC Pamela* arriving in Port Botany.** This container ship was built in South Korea in 2005, is registered in Panama, and travels between Europe and Australia transporting all kinds of goods for people to use and consume. The ship is connected by satellite tracking to the global shipping network. *MSC Pamela* is an example of how people and organisations are connected across the world through transport, trade, and information and communication technologies.

CHAPTER

9



Source 9.1 The Grand Bazaar in Istanbul, Turkey, is the world's most visited tourist destination.

CONNECTING PEOPLE AND PLACES

The way people and places are connected has changed over time. In recent years, cheap airfares have allowed more people than ever before to travel to far-off destinations, such as the Grand Bazaar in Istanbul, Turkey, which has more than 91 million tourists visit each year. Tourists are now able to instantly post their photographs online on social media to show family and friends in real time what they are experiencing. Every place on Earth is connected more than ever before.



HOW ARE PEOPLE AND PLACES CONNECTED TO OTHER PLACES?

9.1 SECTION

In this section you will investigate:

- the influences on and effects of people's travel and recreational, cultural or leisure connections with different places for the future

CHECKPOINT 9.1

WHAT ROLE DOES TECHNOLOGY PLAY IN CONNECTING PEOPLE TO PEOPLE, GOODS, SERVICES AND INFORMATION IN OTHER PLACES?

9.2 SECTION

In this section you will investigate:

- the way transportation and information and communication technologies are used to connect people to services, information and people in other places

CHECKPOINT 9.2

GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Interconnection:** how people are affected by the environment; how people affect the environment
- **Place:** factors influencing people's perceptions of places; the special significant place has to some people; the effect of global trade, transport, information and communication technologies on places across the world
- **Space:** how location influences the ways people organise places

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps:** thematic maps, political maps, choropleth maps
- **Graphs and statistics:** tables, pie graphs
- **Visual representations:** photographs, aerial oblique photographs



9.1 PERSONAL CONNECTIONS TO PLACES

HOW ARE PEOPLE AND PLACES CONNECTED TO OTHER PLACES?

Everyone has places that mean something special to them. You can probably think of a place right now that has a particular significance for you. This is what places are – parts of the Earth's surface that are identified and given meaning by people. A place can be as small as your bedroom or as large as a continent. It can be a constructed feature such as a building, or a naturally existing feature such as a freshwater lake.

The key concept of place is essential to geographers. By dividing the Earth's surface into a series of identifiable places, geographers can better understand the natural processes and human activities that shape and change our world.

People may be attached to different places for different reasons, and places can mean completely different things to different people. The tourists in Source 9.2, for example, might perceive this place as an opportunity to see something unique and to photograph it. The bus driver who brought them here and the owner of the resort where they are staying may see it quite differently – as somewhere that provides them with employment and an income. For the Indigenous people of the region, the Anangu, this place has a very different meaning. Different parts of the landscape contain stories of their origin and creation. For the Anangu, these are sacred sites they must care for and protect.







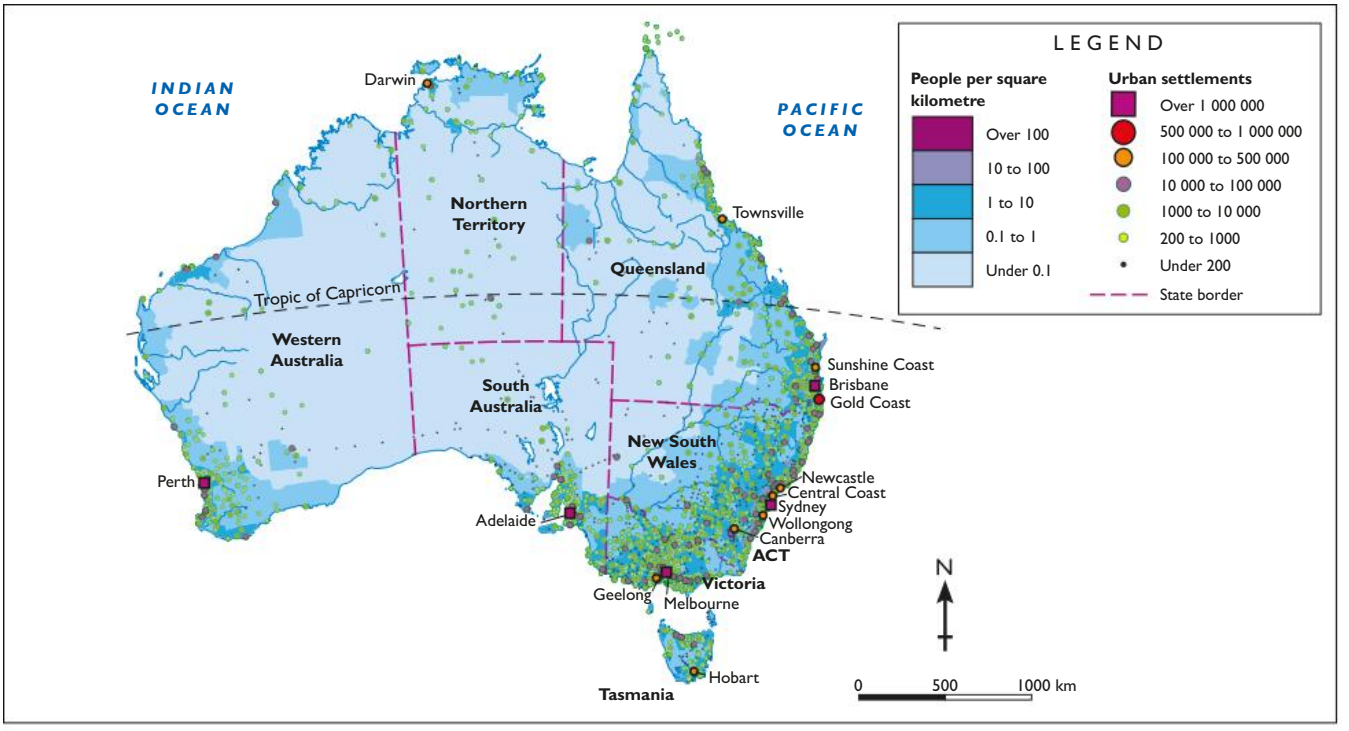
Source 9.2 Uluru is a place that has been identified and given meaning. Like all places it has both tangible (able to be touched) and intangible (not able to be touched) characteristics. The rock, the plants and the soil are all tangible, while the scenic beauty, cultural significance and economic value are intangible.

What are spaces?

Space refers to the way in which features are arranged on the Earth's surface. The key concept of space helps geographers to explain the way things are arranged by applying the elements of location, organisation and **spatial distribution** – the shapes and patterns in which things are arranged on the Earth's surface.

Geographers often use maps to explore and explain the arrangement of the Earth's physical and human features. Maps allow us to see patterns and try to explain why these patterns occur. Source 9.3, for example, shows the distribution of Australia's population. It shows us that Australians tend to live near the coast in large cities, particularly in eastern Australia. A geographer studying this map would note the pattern. They may also ask questions about it, and perhaps ask about the line of small towns between Adelaide and Perth. Why are the towns arranged in this way? How are they connected? These kinds of questions are applying the concept of space.

AUSTRALIA: POPULATION DENSITY AND DISTRIBUTION



Source 9.3

Source: Oxford University Press

Interconnections between places

We all create places of our own by defining them and giving them meaning, and all of these places are interconnected. Geographers use different ways to understand and explain these interconnections.

No place exists in isolation. Not even a rock in a mountain riverbed or a single tree is isolated. Every place is interconnected with another. The place where you live is connected to a neighbourhood, the road outside the school connects it with different suburbs, and entire continents are connected to each other in many ways, too.

Some of the interconnections between places are the result of natural processes. The rock in the riverbed mentioned above, for example, may be connected not only to the other surrounding rocks but also to other areas entirely. Fast-flowing rivers wear down rocks into tiny pieces and then carry these pieces to the coast, where they are shaped into new features such as sand dunes and sandbars. This process links together the mountains and the coast.

Other interconnections are the result of human activities such as trade, transport and communication. These move people, goods, services and ideas between places, linking them together.

There are various ways that geographers explain how and why we connect to place, and these will be examined next.

REVIEW 9.1.1

Remember and understand

1 Write a definition of the term 'place' in your own words.

2 Think of a place that you know well. Describe your personal connections to it.

Apply and analyse

3 Examine Source 9.3.

a Describe the spatial distribution of Australian cities that contain more than 100 000 people.

b Why are maps often used to show the concept of space in geography?

Investigate and create

4 Give an example of a place in your community that is used for more than one purpose. Create a mind map to show the different interconnecting ways in which it is used. Try to think of as many people as possible that might use the place, the different ways they might use it, and what their perceptions of the place might be.



Source 9.4 To a visiting tourist, the Bungle Bungles Range might just be another pretty landscape. To the traditional owners, the Kija peoples, it is perceived very differently.

DIFFERENT WAYS WE CONNECT TO PLACE

Geographers are interested in how people are connected to different places, and how each of these different places is interconnected. They also interpret people's perception of places. Perception refers to the way in which we regard, understand or interpret things, including places.

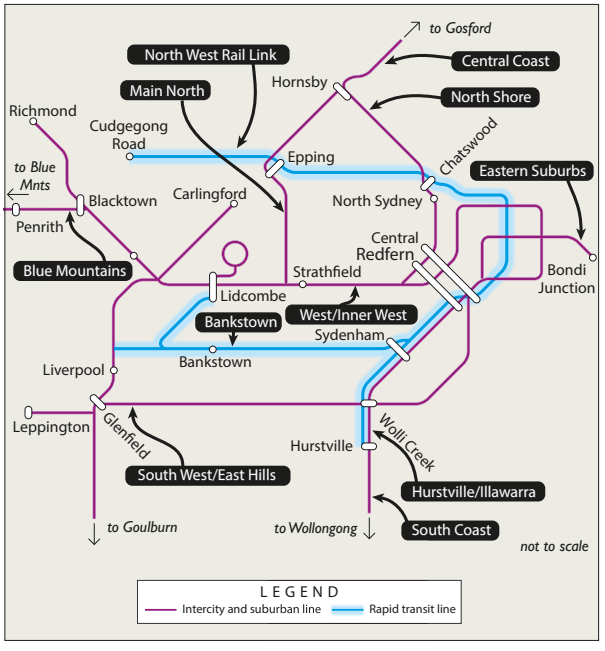
Geographers use different models, tools and strategies to understand and explain some of the ways people perceive place. Here, we will examine three of these methods:

- asking questions
- using a geographical model
- applying a set of geographical criteria.

Asking questions

As you know, geographers ask lots of questions, and this is certainly the case when it comes to examining the key concept of place. Because we connect to places in many different ways, geographers need to ask a range of questions in order to understand and explain these interconnections.

For example, a geographer visiting the rock formation of the Bungle Bungle Range in Western Australia might investigate why the rocks are such a distinctive and unusual shape. They would look for clues and ask questions. Why are there stripes in the rocks? What outside forces might have caused them? How are the rocks connected to the surrounding landscape?



Source 9.5 This image shows how lines of a public transport network act like spokes, connecting places to the central hub. A place can have more than one hub, and many spokes.

As the concept of place involves many different aspects (in addition to physical appearance), a geographer would then go on to ask a range of other questions about the area's cultural, spiritual and economic aspects. Do people live in the area? If so, how long have they lived here? Do other people come to visit? Is the place used for spiritual or religious purposes?

Asking such questions often reveals that people view the same place very differently. One place may be nothing more than pretty scenery to a passer-by, while to someone else it could be a sacred site or even burial ground. This difference in perception can lead to very different opinions about what might be a suitable way to treat or use a place.

Using a geographical model

Geographical models are used by geographers to explain patterns and analyse their significance. The networks that connect people and places together can be very complex and confusing. Geographers often simplify complex networks by using a range of models such as a **hub and spoke** model. A 'hub and spoke' model is a way of representing connections in a way that can be more easily understood. They look and function a bit like a bicycle wheel, where the hub is the centre of the 'wheel', and each spoke is connected to it.

Complex connections between places like the suburbs of a city can be viewed using a hub and spoke model, where the city centre is the hub, and the roads and public transport connections that bring people to it are the spokes.

A hub and spoke model is also useful when explaining the interconnections of the complex networks we access every day, such as transport and communication networks. These networks allow people to connect with each other and provide access to vital services such as schools, hospitals, shopping centres and other community facilities. While most established Australian communities have well-developed networks, not everyone finds them easy to access. People with disabilities, for example, may find it difficult to use some forms of public transport and this can limit their connectedness with their local community.



Source 9.6 Chadstone is a shopping and entertainment hub in Melbourne's south-east. It is the largest shopping centre in the country and receives about 20 million visitors a year. It is linked to other parts of Melbourne by an extensive network of road and public transport 'spokes'.

Applying a set of geographical criteria

There are many different reasons why people feel connected to particular places. Geographers try to understand these reasons by grouping them into similar categories according to a set of criteria. By doing this, they can start to identify patterns in the data they collect and draw conclusions based on these patterns. For example, you might feel connected to a particular street because you wrote your initials in wet cement there when you were a kid. Another person might feel connected to that street because their church is located there. A third person might also feel connected to the street because they work in a shop there. Although all three people feel a certain connection to this place, they each perceive it in a different way because of the different experiences they had there and the meaning they attach to them.

By classifying these reasons, or sorting them into groups, geographers can better understand important interconnections to place. Most reasons for a feeling of connection to place can be grouped under the following four criteria or values:

- *spiritual* – related to a person's beliefs
- *economic* – related to employment and income
- *cultural* – related to the shared characteristics of a group of people
- *historical* – related to past experiences and events.

REVIEW 9.1.2

Remember and understand

1 List two methods geographers use to explain how people connect to place.

2 Examine Source 9.6 and write down how a 'hub and spoke' model could be used to describe it. It may help to first identify the hub and what facilities it provides, and then describe the spokes when thinking about your answer.

Apply and analyse

3 Write a short paragraph about a place that is important to you. Can you identify the main reasons why you perceive it as being important?

4 What are some of the important hubs in your local community? Select two or three hubs and write a paragraph on each, explaining how they service and support different members of the community.

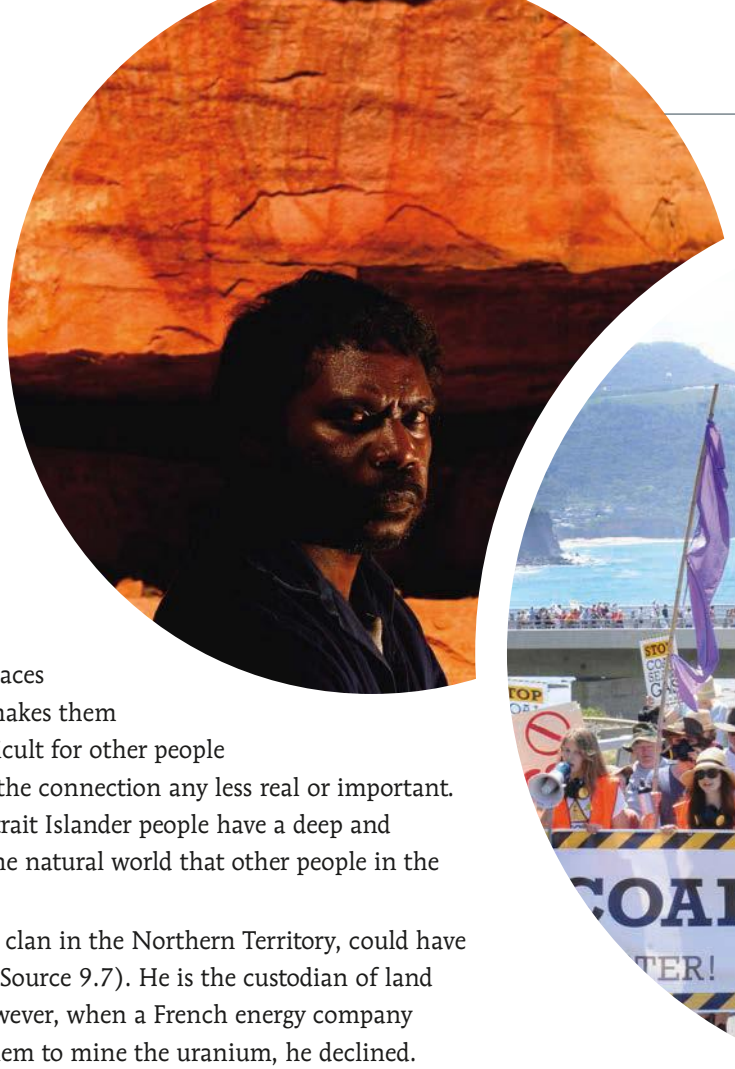
5 Examine Source 9.4. Brainstorm reasons why people might have different opinions about appropriate ways of using or developing important sites such as the Bungle Bungle Range. Create a table in your notebook to classify these reasons under the following four criteria: economic, cultural, historical or spiritual.

6 Examine Source 9.5. Why is a network such as this one important for a community? In what ways does it connect people and places?

Investigate and create

7 Choose a city you have read about or visited and explain the different ways in which people there are interconnected. Think about the reasons people visit, what the transport system and road network are like, and any historical factors.

CONNECTIONS TO PLACE



As discussed, the different ways in which people connect to place can be categorised according to four main criteria – spiritual factors, economic factors, cultural factors and historical factors.

Spiritual factors

Many people feel connected to particular places because of their beliefs or the way a place makes them feel. Sometimes this connection can be difficult for other people to fully understand but this does not make the connection any less real or important. For example, many Aboriginal and Torres Strait Islander people have a deep and complex spiritual connection to places in the natural world that other people in the wider community do not have.

Jeffrey Lee, the sole survivor of the Djok clan in the Northern Territory, could have become one of Australia's richest men (see Source 9.7). He is the custodian of land that contains vast deposits of uranium. However, when a French energy company offered him millions in royalties to allow them to mine the uranium, he declined.

Instead, he offered the land to the Federal Government so that it would be included as part of Kakadu National Park, and therefore protected from mining.

'Money don't mean nothing to me. Country is very important to me,' he told newspaper reporters. Mr Lee believes that it is his responsibility to look after the land and that digging into the ground would disturb the spirits that live within it. 'There are sacred sites, there are burial sites and there are other special places out there which are my responsibility to look after. I'm not interested in white people offering me this or that … it doesn't mean a thing. I'm not interested in money. I've got a job; I can buy tucker; I can go fishing and hunting. That's all that matters to me.'

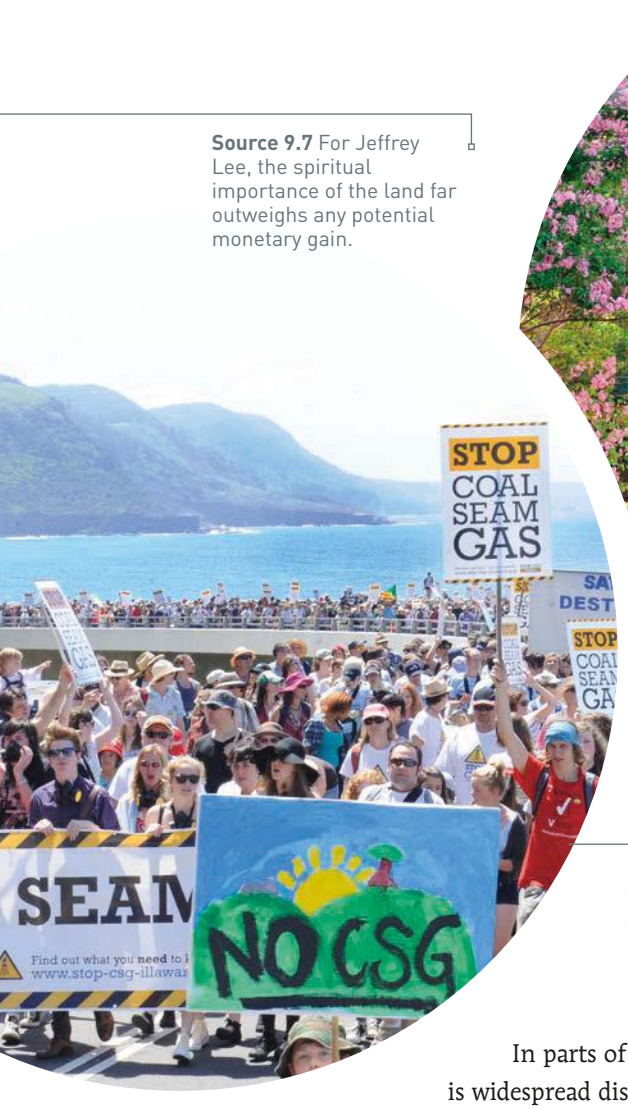


Economic factors

Many people feel a connection to particular places because these places provide them with employment or a source of income. In the previous example of the proposed uranium mine in the Northern Territory, the French mineral company was interested in connecting to this place because of economic opportunities. In the same way, a farmer will feel connected to the place in which he or she farms and a tourism operator will feel connected to the place that tourists come to visit.

In countries where personal wealth is viewed as a desirable goal, economic connection to place may take precedence over less tangible reasons for connection, such as spiritual or historical factors. Different reasons for connecting to place can cause disagreement, protest and even conflict between individuals and groups.

Source 9.7 For Jeffrey Lee, the spiritual importance of the land far outweighs any potential monetary gain.



Source 9.8 A 2011 protest in Newcastle against the mining of gas in New South Wales. This shows how some people's economic connection to this place can differ from other people's connection to it.



Source 9.9 Chinatown in Sydney is one of many Chinatowns around the world that have sprung up in areas dominated by Chinese immigrants.

In parts of Queensland and New South Wales, for example, there is widespread disagreement about mining gas from the rocks beneath farming areas (see Source 9.8). Many farmers believe that the process used to extract the gas degrades their land and water, but mining companies point out that the gas is needed by many people for heating and cooking. Many protests have been held to try and influence state and federal governments to more closely control or stop the mining of this gas (see Source 9.8).



Cultural factors

Connections to place can also be strongly influenced by a range of cultural factors. This can include the perceived historic value of a place, and how that is meaningful for people in the present, the past and even into the future. The notion of cultural heritage can be an important motivating factor for connection to place.

People with similar interests, backgrounds and heritage often connect with each other to form communities. Immigrants to a new country, for example, tend to live close to other recent arrivals from the same country. This allows them to connect more easily to people with the same language and culture and, therefore, to fit more easily into their new community.

This happens all around the world and creates areas of ethnic concentration. In New York, for example, there are neighbourhoods known as Little Italy, Chinatown, Little Manila, Le Petit Senegal, Jamaica, Koreatown and Spanish Harlem. The residents of these places may feel connected to the area in which they live because of their cultural connections (see Source 9.9).

CASE STUDY

Vietnamese in Cabramatta, Sydney

The Sydney suburb of Cabramatta is an example of ethnic concentration in Australia. Many of the residents were born overseas, with nine out of 10 Cabramatta residents speaking more than one language. While there have been several waves of migrants from Europe and Asia in this area over the last century, it is the Vietnamese who dominate.

As a result of the Vietnam War in the 1960s and 1970s, millions of Vietnamese fled the country to find refuge elsewhere.

Many Vietnamese refugees crammed into small boats to escape and became known as 'boat people'. More than 112 000 Vietnamese came to Australia in the 20 years after 1975, and Sydney is now home to more than 67 000 people who were born in Vietnam.

Many Vietnamese refugees also settled in the suburbs of Springvale and Richmond in Melbourne. Cabramatta originally became a popular place for Vietnamese people because a migrant hostel was located there and cheap housing was available. In Cabramatta, new arrivals from Vietnam joined a large and growing migrant population from many other places.



Source 9.10 Cabramatta in Sydney is home to Chinese, Cambodian, Thai, Lao and Vietnamese communities. Vietnamese people make up 27.7 per cent of the population.

Historical factors

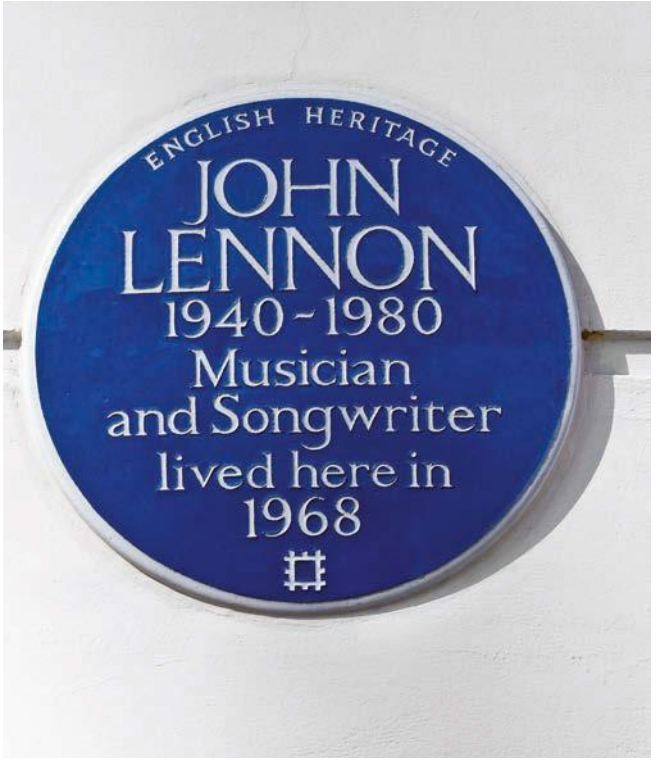
Events that happened in the past can also result in people forming special connections to particular places. These may be recent events or events from hundreds of years ago, but they can form powerful links between people and places. For many people, the places they visited on holidays as children remain special places well into their adulthood because of the memories these places hold.

On a wider scale, important historical events can give particular places a special meaning. These events could include a war or battle such as Gallipoli, a terrorist attack such as the Bali bombings (see Source 9.11), or the birthplace or burial place of a famous person. In some towns and cities, places of historical significance might be marked with a statue or other commemorative marker. In London, for example, many places that are connected with historical events and people are marked with blue memorial plaques (see Source 9.12).

The strong connection some people feel with a place for historical reasons can explain why many people feel strongly about the demolition of old buildings or the development of a site for a new apartment block. It also helps to explain why people may have a special connection to battle sites or disaster sites thousands of kilometres away or to the wharf where they first arrived in Australia as a refugee.



Source 9.11 Many Australians feel a special connection to Bali in Indonesia because of the 2002 terrorist attacks that killed 202 people – 88 of them Australians on vacation.



Source 9.12 Blue plaques in London mark places where people may feel a historical connection because of an event that occurred or a person who lived at that place.

REVIEW 9.1.3

Remember and understand

1 Why might people sometimes find it difficult to understand another person's spiritual connection to a particular place?
2 Why do people with similar cultural backgrounds often live close to each other?
3 Explain why some farmers in Queensland and New South Wales protest about gas mining in the places where they live.

Apply and analyse

4 Re-read the information relating to Jeffrey Lee.
   a Describe the connection he has to the place where he lives.
   b Why does he have this connection?
   c Is this the same way you feel about the land? Why or why not?
   d Account for the similarities and differences between his connection to the land and yours.

Investigate and create

5 Many people feel a connection to places where important events occurred in the past. Find out why many Australians have a special connection to Gallipoli in Turkey, Kokoda in Papua New Guinea or to Kuta in Bali.

CONNECTING TO PEOPLE

No man is an island,
Entire of itself,
Every man is a piece of the continent,
A part of the main.

The English poet John Donne wrote these words in 1624. In these lines he expresses the idea that every person is connected to someone else. This is as true today as it was nearly 400 years ago. The more we learn about our amazing planet and the people who live here, the more we come to realise that everyone and everything is connected to everyone and everything else.

We are connected to people and places all around the world in many ways. This includes being connected by the food we eat, the clothes we wear, the goods in our homes, the sport we play, the music we listen to and the movies we watch.

We are also the most mobile generation in history, travelling for work and for leisure more often and more quickly. As well as these physical and cultural connections, there are the rapidly growing digital connections that break down barriers such as language and distance that once separated people and places.

Global citizens

Each of us is an example of the connected world in which we live. This is true even when we are just sitting at our desk at school – we don't have to physically travel to be connected with other places in the world.

Some people, however, are true global citizens and are linked in many different ways to places all around the world. Cadel Evans, the famous Australian cyclist, is one example of a person who is interconnected globally on many levels (see Source 9.13). Perhaps best known as the first Australian to win the Tour de France cycling race, Evans was once asked how it felt to be an Australian whose sport has taken him around the world. He replied, 'Chiara's [his wife] Italian, we're living in Switzerland and I'm Australian riding for an American registered team sponsored by a Swiss company.' He could also have added that he and his wife have adopted an Ethiopian child and that his teammates are from 10 different countries.



Source 9.13 Australia's Cadel Evans (right) wins a stage in the 2011 Tour de France. He is followed to the line by cyclists from Spain, Kazakhstan, Colombia, Belgium and Norway. The race was televised in 190 countries and watched by an estimated 3.5 billion people around the world.

The life and career of Cadel Evans is a clear example of the many ways we can be connected with many different places.

KEY CONCEPT: INTERCONNECTION

How submarine cables connect the world through communication

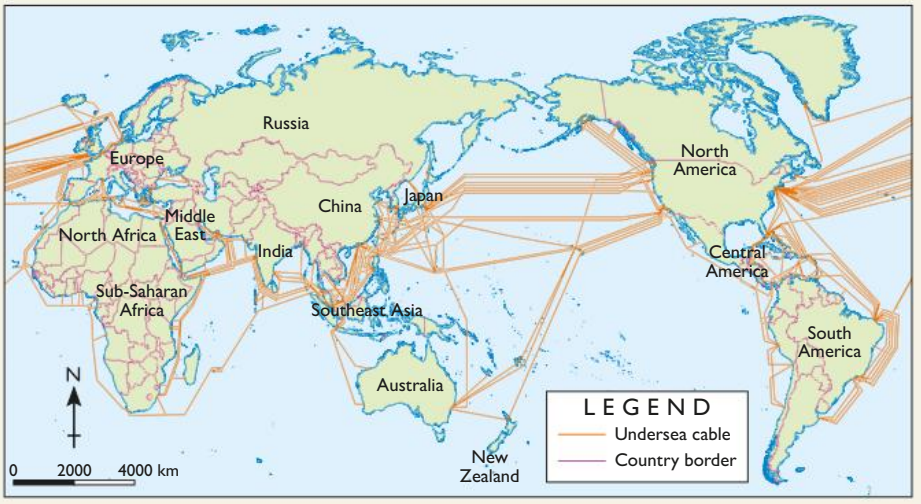
In the past, most countries used their own resources to feed and clothe their own populations. Today, however, all nations increasingly rely on each other to supply goods and services to their populations. We are more connected to the rest of the world than we have ever been before. This increasing interconnection between countries is referred to as **globalisation**.

Globalisation has increased rapidly over the last 50 to 60 years. In 2008, for example, the same amount of trade took place in one day as in a whole year in the 1940s. This increase is largely due to rapid improvements in information and communications technology (ICT) such as the Internet. Virtually all of the world's Internet connections are made through submarine cables on the ocean floors that link together the world's land masses. In total, there are about 885 000 kilometres of submarine cables around the world and the latest cables carry signals 12 000 kilometres across the Atlantic Ocean in 0.00072 seconds. The latest submarine cables are about the thickness of a garden hose but contain enough bandwidth for 20 million Internet users.

For more information on the key concept of interconnection refer to section GT.1 of 'The geographer's toolkit'.



WORLD: NETWORK OF SUBMARINE TELECOMMUNICATION CABLES



Source 9.14

Source: Oxford University Press

REVIEW 9.1.4

Remember and understand

1 How do the lines of John Donne's poem relate to the principle of interconnection? Do you think this poem is relevant to today's world? Why or why not?

2 In what ways do submarine cables connect different places around the world?

Apply and analyse

3 Write a list of some of the ways in which you are linked to other countries.
   - **a** Share your links with your classmates and build up a class list of these links.
   - **b** Show these links on a world map. You may need to develop a legend to show different types of links.
   - **c** Describe the pattern shown on your class map.

4 Examine Source 9.14.
   - **a** Identify the regions and countries that are the most connected by submarine cables.
   - **b** Which places are important hubs for submarine cables?

Investigate and create

5 Rewrite the lines from John Donne's poem in your own words as a tweet. How many people would his poem have reached when it was published in 1624? How many people could the Twitter version reach? Describe how both the poem and the tweet are examples of interconnection.

THE GEOGRAPHY OF YOU

You are a global citizen, and the things you use and consume come from different places all over the world. The decisions you make about the things you buy link you to people and places both near and far. This connection means that your decisions can impact on these people and places in both positive and negative ways. These two pages contain a series of activities that will make you more aware of the ways in which you are connected to producers of products and services from all around the world – and how they are connected to you.





SKILL DRILL

Collecting, recording and representing primary data

During any geographical inquiry, geographers will ask questions, collect a range of data and information, record their findings and represent them so they can be interpreted more easily. By following a process of geographical inquiry like this, geographers can be sure that the conclusions they reach will be accurate, useful and reliable.

Geographers often collect their own data by interviewing people, carrying out research, conducting surveys, taking photographs, or drawing field sketches. This kind of information is known as primary data. They record this primary data carefully before representing it in different ways (for example, as diagrams, tables, charts, graphs, maps or a combination of these).

Collecting, recording and representing your own primary data is a great way to practise your skills as a geographer. Follow these steps to collect, record and represent a range of primary data about the clothes you wear, the possessions you own and the ways you connect to other people – in other words, the geography of you!

Step 1 Construct a key inquiry question to begin your investigation, for example, 'Where do my clothes come from?' Select 20 different clothing items from your wardrobe and record where each item was made. Try to select a range of clothing made from a variety of fabrics. The tags on your clothing will often include some information about where the item was made.

Step 2 Collect and record the information for your inquiry by creating a table or spreadsheet and entering your results into it.

Step 3 Choose the best way to represent your findings. Choose a format that clearly communicates the information. You may choose to represent this data as a table, a graph pie chart, bar graph or line graph), an infographic or a map a spatial distribution map or a choropleth map) – or even a combination of these things.







Source 9.15 Do you know where the things you use and wear come from?



Apply the skill

Complete one or more of the following tasks to better understand the effects of your purchasing habits and Internet use and how your choices connect you to the rest of the world.

1 **Exploring the origin of your clothing**
Follow the steps outlined on the previous page to explore the origin of 20 items of your clothing. Collect the countries of origin for any of the 10 items you have researched, record the data and represent it in a suitable format of your choice.

2 **Exploring the origin of your possessions**
Select 10 items you use every day (such as a pen, a computer, a DVD) and examine them carefully to see if they contain some information about where they were made. You could also try an Internet search engine to research each item further, but you may need the name of the manufacturer and a model name or number. Collect the countries of origin for any of the 10 items you have researched, record the data and represent it in a suitable format of your choice.



Source 9.16 A worker shows a label on a piece of newly made clothing at the Bantai textile factory in Dhaka, Bangladesh.

3 **Exploring your communication links**
Monitor your Internet and smartphone use for a week, recording the names and locations of people you communicate with via email, SMS, Facebook, Twitter, Instagram and online games. Enter the results into a table or spreadsheet.





REVIEW 9.1.5

Remember and understand

1 Describe in your own words what you understand primary data to be. Give three examples of primary data.

Apply and analyse

2 If you were looking to conduct a geographical investigation into how your local area has changed in the last 10 years, list three different types of primary data you could collect to assist you in your investigation and describe the reasons why you chose these types of primary data.

3 Examine your wardrobe and make a list of the brands that you usually wear. Research whether or not these brands use factories in Bangladesh. Create a table to record your results.

4 Do you think your purchasing choices have a direct impact on the people who work in factory sweatshops? List your thoughts, discuss them with a partner and report back to the class.

Investigate and create

5 Conduct your own research into the Rana Plaza disaster and how it brought worldwide attention to the issue of sweatshop conditions in Bangladesh. Investigate the conditions faced by workers in the sweatshops, and find out what is being done to address the problems with safety and working conditions. Write a half-page report outlining what you find.

CONNECTING PLACES AND PEOPLE



Where we choose to spend our holidays says a lot about what we value in a place. Where do you want to go? What do you want to see and do? The most common reasons that people travel are to visit family, spend time with friends, escape a colder climate, discover a new culture, sightsee or take part in a recreational activity such as skiing or hiking. Consider the landmarks and modes of transport in Source 9.17, and try to identify the places they belong to.

Source 9.17 So many wonderful things to see and do. It is exciting to think about travelling the world. Who knows, in your lifetime you may even travel into space!

Where do people travel?

Just as we have connections to places at home, we share connections with people and places away from home. The majority of international travel takes place within travellers' own regions – four out of five worldwide arrivals originate from the same region. This is certainly true for both visitors to Australia and destinations for Australian travellers, with New Zealand ranking first in both instances (see Sources 9.18 and 9.19). Our interconnections with New Zealand are very strong because we share a common British heritage, the English language, a love of sport, trade links and a similar education system among many other things. Australia and New Zealand also offer each other immediate emergency assistance in times of trouble; for example, following the Christchurch earthquake.

Source 9.18 The top 10 source countries for visitors to Australia in 2014–15 and the percentage change over the previous 10 years

Origin of visitors to Australia	Total number of visitors, 2014–15 (thousands)	Trend change 2004–05 to 2014–15 (per cent)
New Zealand	1268.0	18.0
China	933.7	254.4
United Kingdom	666.0	–5.3
United States	577.2	30.8
Singapore	375.1	50.8
Malaysia	331.5	102.5
Japan	322.8	–53.8
India	220.4	292.5
South Korea	214.9	–10.3
Hong Kong	207.1	40.6

Source: ABS

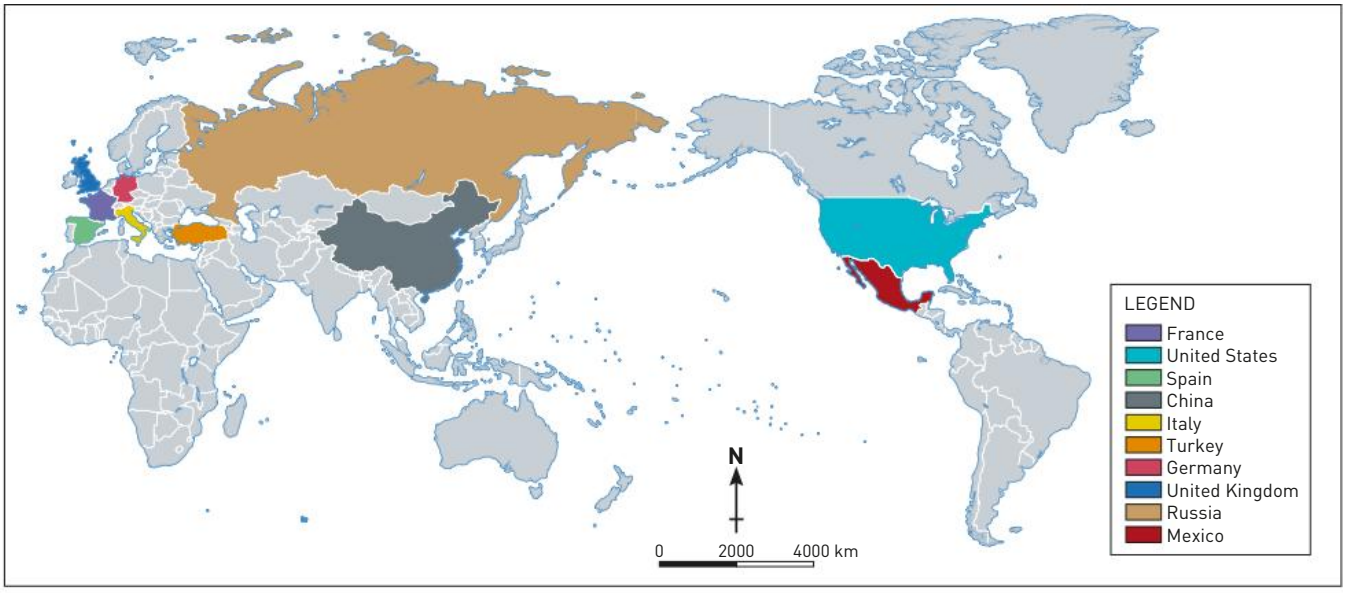
Source 9.19 The top 10 destinations for Australian travellers in 2014–15 and the percentage change over the previous 10 years

Destination for Australian travellers	Total number of travellers, 2014–15 (thousands)	Trend change 2004–05 to 2014–15 (per cent)
New Zealand	1237.5	48.7
Indonesia	1118.7	223.0
United States	980.8	147.5
United Kingdom	552.6	37.4
Thailand	549.5	194.0
China	413.2	92.6
Singapore	361.7	112.7
Fiji	335.5	76.3
India	280.7	228.5
Japan	268.3	177.3

Source: ABS



WORLD: TOP TOURISM DESTINATIONS, 2014



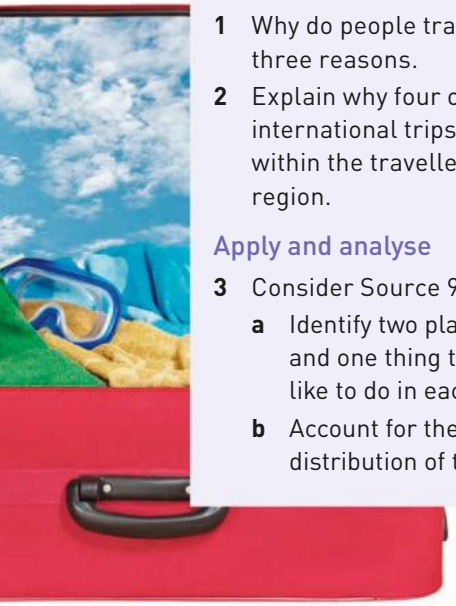
Source 9.20

Source: United Nations World Tourism Organization (UNWTO)

New Zealand remained the most popular destination in 2014, with Australians making 1.2 million journeys there. Of the top 10 destination countries, departures to India recorded the strongest growth over the 10-year period, with a change of 228.5 per cent. This was followed by departures to Indonesia (223 per cent) and Thailand (194 per cent).

We can discover interconnections between other nations by looking at world tourism. Traditionally, the greatest number of travellers were from Europe, but with rising levels of disposable income in many countries, international travellers from Asia, the Middle East, Africa and Latin America are becoming more common. China has been the fastest growing source of travellers in recent years. Chinese travellers spent an incredible US$165 billion abroad in 2014, which represented an exceptional 27 per cent increase over the previous year.

REVIEW 9.1.6



Remember and understand

1 Why do people travel? Give three reasons.

2 Explain why four out of five international trips take place within the traveller's own region.

Apply and analyse

3 Consider Source 9.20.

- **a** Identify two places to visit and one thing that you would like to do in each country.
- **b** Account for the spatial distribution of the world's top 10 tourism destinations in 2014.

Investigate and create

4 Create a pictogram to display your responses to the questions below.

- **a** Explain in as few words as possible your earliest awareness of these places: Australia, America, Europe, Africa and Asia. It may be the place you were born, or a distinctive animal, person, event, food, movie or book that you associate with the place.
- **b** What is the longest time you have lived in one place and where was it?
- **c** What is the shortest time you have lived in one pace and where was it?
- **d** Create a brief list of all of the places where you have lived.
- **e** How many addresses have you had?
- **f** What is your furthest point travelled: north, south, east or west?

DIFFERENT TYPES OF TOURISM



Source 9.21 Times Square in New York City is among the most popular destinations in the world for recreational tourists because of the many attractions there.

It is estimated that tourists spend approximately A$1 trillion (A$1000 billion) annually. This revenue makes a valuable contribution to the economies of most countries around the world.

The United Nations World Tourism Organization (UNWTO) now estimates that the total number of tourists travelling each year will reach 1.8 billion by 2030. Asian countries such as India, Malaysia and Indonesia are expected to see the most rapid increase in tourist numbers over this time.

Tourists travel for many different reasons. Some simply want to relax on a beach, while others are keen to experience the culture, language and history of the places they visit. In order to understand the decisions different types of tourists make, and analyse the impacts that their decisions have on the environment, geographers tend to classify tourists into a number of groups. In this section, we will examine four of the most popular types of tourism and investigate the impacts that each is having on environments around the world.

Recreational tourism

Recreational tourism is perhaps the most well-known and popular type of tourism. Recreational tourists travel to have a good time, to relax, and to enjoy the attractions and activities on offer in the places they are visiting. Many recreational tourists spend their time relaxing on the beach, eating in restaurants, shopping or attending shows. Each year, around 39 million tourists flock to New York City to enjoy all of the recreational activities on offer there (see Source 9.21).

Historical tourism



Historical tourists are generally interested learning more about important events that may have taken place in the past, by visiting the places where they happened. They visit important buildings, view artefacts and monuments and sometimes listen to stories from local experts. The Great Pyramid in Egypt, Stonehenge in England and Machu Picchu in Peru (see Source 9.22) are all popular destinations for historical tourists.

Wilderness tourism

Wilderness tourists enjoy the challenge of visiting wild places such as the Amazon rainforest, Antarctica or the Himalayas. For these travellers, the lure of remote lands, rugged landscapes and even challenging weather conditions is much more

Source 9.22 Machu Picchu in Peru attracts visitors because of its historical significance. Up to 2000 people visit every day.



Source 9.23 Climbers on Mount Everest wait for their turn to reach the summit. Climbers must wait up to two hours to reach the top of the mountain.



Source 9.24 In Central Africa, ecotourism brings about $20 million a year to the region – much of this is used to preserve the habitat of mountain gorillas.

attractive than a cosy hotel and a bit of sightseeing. The chance to visit places that relatively few others have and be exposed to the people and cultures of these remote places makes wilderness tourism an attractive option for many, despite the potential risks involved.

Ecotourism



Ecotourists typically travel to natural areas that are relatively undisturbed, and possibly fragile, to learn more about these special places in a socially responsible manner. Ecotourists try to minimise their impact and avoid damaging the environment in which they travel. They may even aim to improve the wellbeing of the land and those that live there. Some ecotourism raises funds for conservation (see Source 9.24) or to directly benefit the local communities in the places visited by tourists.

REVIEW 9.1.7

Remember and understand

1 How many tourists travel to a different country each year?

2 Identify the countries that are expected to see the most rapid growth in the number of tourists over the next 10 to 15 years.

Apply and analyse

3 As a class, brainstorm examples of experiences and destinations under each of the four tourism types. Which one did your class know the most about? Which did they know the least about? Why do you think this is the case?

4 Think about your last experience as a tourist.
- **a** Classify your experiences into one of the four tourism types discussed on these pages.
- **b** Write a list of all the ways your last holiday had an impact on the places you visited.
- **c** Classify these into the positives and negatives.
- **d** Identify the places where the impact was felt.

5 Which of the four types of tourism outlined do you think is the most popular among the world's tourists? Give some reasons for your answer.

Investigate and create

6 One method to reduce the impacts of tourism is to give tourists a code of behaviour that outlines a number of rules and guidelines to follow.
- **a** As a class, discuss the kinds of rules and guidelines that would reduce the impact of tourism on mountain gorillas such as those shown in Source 9.24.
- **b** In pairs or small groups, design a brochure that you could give to tourists to educate them about the code of behaviour your class has come up with.

IMPACTS OF RECREATIONAL TOURISM

Travelling for recreation is massively popular. There are many destinations that people choose to visit for recreation, so the impacts vary widely. Some places become extremely popular as tourist destinations, and the concentrated number of visitors can have significant impacts on both the natural and built environments there. For example, a beachfront that once attracted people for its sunshine and clean sandy beaches can all too quickly become overcrowded, and polluted if it is not carefully managed and cared for.

Cancun, Mexico

Many areas that were once wilderness have been changed to provide the things that tourists need and want such as hotels, airports, swimming pools and roads. On the Yucatan Peninsula in Mexico, for example, lies the tourist town of Cancun (see Source 9.25). Blessed with a spectacular coastline and warm temperatures, it attracts about two million visitors a year. Before it became a tourist destination, Cancun was a barrier island enclosing a massive shallow lagoon, the Nichupte Lagoon, an important nesting site for sea turtles and seabirds.





Source 9.25 Tourist development in Cancun, Mexico

The lagoon was fringed by mangroves, which acted as a nursery for fish and other marine animals (see Source 9.26). As more tourists began to visit, causeways were built at both ends of the island to join it to the mainland. The causeways restricted how much fresh water was able to flow into the lagoon, changing the conditions of the ecosystem. In addition, sections of the lagoon were filled in, and 60 000 hectares of rainforest and mangroves were removed to make way for the development of hotels and resorts.

Native plants that once protected the coast and prevented erosion were replaced with non-native plants. There are far fewer fish and shellfish due both to the loss of their habitat and overfishing to feed the tourists. Large areas of coral reef are now dead or damaged as a result of snorkelling and scuba diving. Boats and jet skis create pollution, while boat anchors can drag along the seabed, damaging coral and stirring up sediment, all of which have negative impacts on marine life.

The increased numbers of tourists and residents (who work in hotels and restaurants and run tour companies) have also resulted in waste management problems. The lagoon has become polluted with sewage, petroleum products, heavy metals and chemicals from stormwater run-off and the boating marinas in the lagoon.

CANCUN, MEXICO: TOURIST AREA



Source 9.26

Source: Oxford University Press



Source 9.27 While tourists enjoy luxury accommodation in purpose-built resorts, living standards are very different for many of Cancun's workers and their children.

In addition to these negative environmental consequences, there are also negative social consequences. The rapid development in Cancun has put pressure on local resources, meaning the prices of food, energy, raw materials and land have risen. There is also increasing pressure to use agricultural land for the booming tourism industry.

When tourist infrastructure for Cancun was built, little provision was made for the additional residents needed to work in the industry. As a result, there are many slums that surround the area. People living in the slums have poor living conditions and lack drinking water, waste management and other services.

Although the industry provides employment, tourism workers are often poorly paid. This leads to inequalities between resident workers and tourists. Some workers feel resentment towards tourists and are forced into other illegal means of earning an income, such as selling drugs or prostitution.

REVIEW 9.1.8

Remember and understand

1 Explain why many tourists visit Cancun.

2 Describe how tourism has benefited the local people.

Apply and analyse

3 Investigate the natural environment of Cancun.

- **a** Describe the current environment. Use Source 9.25 to help you.
- **b** Using Source 9.26 for information, describe how tourist development has changed this environment.
- **c** Describe how the activities and behaviours of tourists have affected the Cancun region. Refer to particular places and activities in your answer.

4 Cancun has been described as 'a victim of its own popularity'. What does this mean? Do you agree with this statement?

5 Examine Source 9.27. What does this picture reveal about living conditions in the workers' villages?

Investigate and create

6 Imagine that a new tourist development has been proposed for a stretch of coastline in Queensland that has a similar natural environment to Cancun. Describe in a paragraph what lessons the developers of this new resort could take from the experiences at Cancun in order to reduce impacts on natural and built environments. Support your answer with specific examples.



IMPACTS OF WILDERNESS TOURISM

Many tourists are drawn to wilderness areas to experience natural sights and events. Well-known examples of wilderness tourist destinations include Uluru in Central Australia, the Grand Canyon in the USA, and the Serengeti in Africa. Wilderness tourists, and the facilities built for them, can bring great change to natural environments.

Tourism in Antarctica

Antarctica is the world's last great wilderness and a land of extremes. Located at the most southerly point of the Earth's surface, it is the highest, coldest, driest, windiest and most isolated continent. This makes it one of the least visited places on Earth. Antarctica receives only 26 000 tourists a year compared to Australia's 5.8 million visitors.

Most visitors to Antarctica travel on cruise ships from South America and visit a few sites on the Antarctic Peninsula. They come to marvel at the unique wildlife, the pristine condition of the natural environment and the stunning scenery. Nearly 40 per cent of these tourists are from the United States. Australian tourists make up only 8 per cent.

People usually visit Antarctica for only short periods but their visits mostly take place at that same small number of sites. This leads to a long-term cumulative impact – that is, the effects build up over time. Tourists also tend to visit the places with the most wildlife, which has the potential to disrupt the animals' normal way of life. The fragile environment means tourism in Antarctica has to be carefully controlled and managed. It is particularly difficult to manage environmental problems, however, because there is no government, police force or park rangers to manage impacts and control behaviours.



Source 9.28
Passengers from a cruise ship photograph a pair of emperor penguins in Antarctica.

Potential impacts

Impacts of wilderness tourism may include:

- disturbance of wildlife, especially as most tourists are taken to penguin and seal colonies by small boats from large cruise ships
- oil spills, rubbish and waste from cruise ships
- difficulty in rescuing people involved in medical or other emergencies
- the introduction of foreign species to Antarctic waters from water carried as ballast on cruise ships
- tourists damaging plant life, such as trampling slow-growing beds of moss.

Protection

Tourism in Antarctica is self-regulated by the International Association of Antarctic Tour Operators (IAATO). The association has strict guidelines for its members and their ships, such as limiting the size of ships allowed into Antarctic waters. The numbers of people who can land at sites are also limited. The association is seen as being successful in managing tourism in the area; after all, if damage to Antarctica occurs, the attractiveness to tourists will be lost. Membership of IAATO, however, is not compulsory, and there is still the possibility of businesses that don't belong to the association bringing in larger ships carrying more

people and causing more damage. This has not happened so far but, if it did, nothing could be done to prevent it because there are no international laws governing the area.

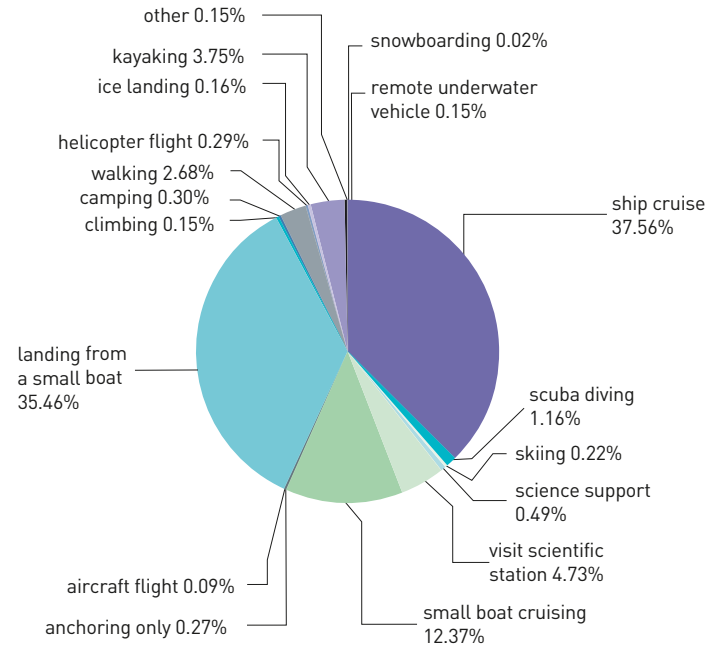
The future of Antarctic tourism

While virtually all tourists currently access Antarctica by boat, this may be about to change. The Australian Government has spent $46 million to put a regular air service in place between Hobart and Casey Station in Antarctica. This has meant the construction of a reliable runway on a 700-metre-thick glacier. Airbus A319 planes have been modified with long-range fuel tanks added so that a return flight to Hobart can be made without refuelling. This minimises the chances of a fuel spill in the pristine environment.

The service will be for scientists and researchers working from the Australian bases in the summer months and will reduce the current 3-week sea journey to a 4½ hour flight. This will allow more scientists to visit Antarctica.

While tourist flights from Australia currently do not land in Antarctica, the technology used to construct this runway may be employed by tour operators in the future. It is important to remember, however, that Antarctica remains a challenging environment to visit and this will always keep the number of tourists relatively low.

TOURIST ACTIVITIES IN ANTARCTICA



Source 9.29



Source 9.30 The passengers and crew of the first flight from Hobart to Antarctica in 2008 gather beside the runway. In the centre of the front row is Peter Garrett, Australia's environment minister at the time.

REVIEW 9.1.9

Remember and understand

1 Describe why so few tourists visit Antarctica.
2 Would you like to visit Antarctica? Give some reasons for your answer.

Apply and analyse

3 Examine Source 9.29.
   - **a** What are the two most popular activities in Antarctica?
   - **b** Describe the potential environmental impacts of these activities.
   - **c** What percentage of tourists take a flight in an aircraft?
   - **d** Why might this percentage increase in the future?

4 Discuss some of the potential and real environmental impacts of aeroplane flights to Antarctica.

Investigate and create

5 Design a poster that will be displayed in the rooms of a cruise ship that will sail to Antarctica. Your poster should outline a code of behaviour for tourists who will travel on the ship, to educate and guide them on how to reduce their environmental impact. Because not all passengers will speak the same language, you will need to use pictures and symbols rather than words on your poster.

THE EFFECTS OF TOURISM IN THE FUTURE



Tourism is an industry that is constantly changing. Geographers who research tourism and leisure have identified the following trends that will shape the ways in which people and places are impacted by tourism in the future.

Trend 1: More people travelling more often



Tourist numbers are expected to continue to increase. By 2030, the number of international travellers will reach 1.8 billion per year if current trends continue. As some places become too crowded, tourists are expected to look for new destinations to offer them the experiences they want. This gives new places the opportunity to benefit from the resulting tourism, which provides a significant boost to their economies. However, it also makes them vulnerable to negative impacts on the environment and their culture.

Source 9.31 Namibia is predicted to be the 'next big thing' in African safari tourism because traditional areas in South Africa, Kenya and Tanzania become too 'busy' for many travellers.

In many places where profits are put ahead of minimising impacts, tourism has brought environmental degradation and a loss of traditional ways of life. As many communities in developing countries rush to attract tourists, many geographers are concerned that the lessons from places such as Cancun, Angkor Wat and Giza will be forgotten.

Trend 2: Increased awareness of environmental issues

More travellers are becoming concerned about their impact on the places they are visiting. Many are choosing their destinations partly because of environmental qualities such as conservation. Mass tourism to large resorts such as those at Cancun still dominate in some countries. However, ecotourism and nature-based tourism are growing two to three times more quickly than tourism as a whole. There are many popular destinations for conservation-aware tourists, including parts of Australia and Africa, which has stunning landscape and the chance to see wildlife in its natural environment.

The Internet has allowed people to learn more about destinations before they travel and this trend is expected to continue. Places that are becoming degraded are becoming less popular as tourists pass on their negative experiences through travel websites. This may result in greater efforts in these places to repair environmental damage and for future developments to be more environmentally friendly.

Trend 3: Travellers want 'real' experiences

There has been a significant growth in the number of people who are looking for authentic places and experiences rather than artificial ones that have been created specifically for tourists. One of the fastest growing types of travel experiences is known as adventure tourism. This includes the 'adrenaline junkies' who want extreme experiences such as mountaineering, white-water rafting and



rock-climbing as well as those who want gentler physical experiences such as hiking and biking.

For many tourists, the experiences they have are becoming more important than the places they visit. Many are looking to interact with local people and to experience their culture away from the packages offered by large hotels and tour companies. Adventure tourism allows them to move out of mass tourism and have an individual experience. Where this has occurred it seems to impact people and places much less than mass tourism and can lead to a better understanding of cultures and environments.

Other trends

Many tourists are becoming aware of the impacts of their travel on people and places they visit. As a result, many of them have started looking for opportunities to reduce these impacts. In response to this growing awareness, many destinations are developing ecotourism options. These tend to be nature-based, educational and designed to have a minimal impact on the environment. Ecotourism is now one of the fastest growing tourism sectors.

In addition to these trends described above, many others have been observed.

- Trips are becoming shorter but tourists are spending more.
- Twice as many people now book their travel on the Internet than use a travel agent.
- Growth in the number of tourists from Asia is larger than from any other region.
- There is a surge in 'niche' tourism: small numbers of people travelling for unusual reasons. This includes medical tourism, when people travel to another country for surgery and other medical procedures. Already worth up to $60 billion a year, medical tourism is growing by 20 per cent a year.
- There is also an increased demand for 'accessible tourism' for the 10 per cent of the population with a disability (see Source 9.32).



Source 9.32 Tourism catering for disabled people is a growing industry.

REVIEW 9.1.10

Remember and understand

1 How has the Internet changed travel and tourism?

2 What is adventure tourism?

Apply and analyse

3 Make a list of those factors and trends that may result in tourism having a greater impact on the environment in the future. Make another list of those factors and trends that suggest that tourism will impact less on the environment. Which of these two outcomes do you consider most likely? Give some reasons for your answer.

4 Examine Source 9.31.

a Why do you think these tourists have visited this place?

b How has this visit impacted on the natural environment?

c How will these impacts increase if the number of tourists to Namibia greatly increases?

Evaluate and create

5 Imagine that it is 2050 and that you are a reporter for an online newspaper. Write an article describing the ways in which tourism has changed in the last 30 or so years. You could describe a typical 2050 holiday and include an advertisement for a typical 2050 destination.

9.1

CHECKPOINT

HOW ARE PEOPLE AND PLACES CONNECTED TO OTHER PLACES?

- **Investigate the influences on and effects of people's travel and recreational, cultural or leisure connections with different places for the future**

1 Explain why geographers are interested in the concept of interconnectedness. [5 marks]

2 Describe the three methods a geographer can use to understand people's sense of place. [6 marks]

3 List the four criteria by which people can have their feelings of attachment to place evaluated. [4 marks]

4 Identify how geographical barriers such as mountain ranges, deserts, oceans and rivers can influence people's degree of movement and interconnectedness. [10 marks]

5 Describe how the Eurotunnel has influenced the degree of interconnectedness between Great Britain and Europe in terms of people and goods. [5 marks]

6 Describe the four main types of tourism. [4 marks]

7 Wilderness tourism is becoming more popular as tourists look for an authentic holiday. Outline some of the issues of having more tourists go to wilderness areas more often in terms of environmental sustainability. [10 marks]

8 Tourism is having a negative impact on the sites we wish to see; we are killing our key global tourist attractions with love. Discuss. [6 marks]

TOTAL MARKS [/50]

RICH TASK

Tourism at Gallipoli

On 25 April 1915, Australian and New Zealand troops fighting in World War I landed on the Gallipoli Peninsula. The battle lasted about eight months and claimed the lives of around 8000 Australians. It is seen by many as a milestone event in our nation's history. Thousands of Australians visit Gallipoli every year to pay their respects to the soldiers who fought there and to see this famous place for themselves.

While a few busloads of visitors arrive at Anzac Cove on an average day, on Anzac Day, the anniversary of the landing, tourist numbers increase dramatically. This gained popularity in 1990 when then Prime Minister Bob Hawke attended the dawn service and declared that 'Gallipoli is, in one sense, a part of Australia'. Anzac Day dawn services at Anzac Cove and Lone Pine now attract up to 10 000 people, most of whom sleep on the ground the night before the service.

To cope with visitor demands during this busy time, bus movements on the narrow winding roads are restricted, temporary grandstands are erected and a special group of Australian volunteers clean up rubbish once the visitors depart.

While many Australians see a visit to Gallipoli on Anzac Day as their right, others believe that the sheer number of visitors degrades the environment and demeans the memory of those who fought there. Some guidebooks are now recommending that tourists not visit on Anzac Day but go on other, less busy days instead. There are some who hold the view that perhaps Australians shouldn't be going there at all, or at least should be better informed about the Gallipoli Campaign.

Visiting Gallipoli on Anzac Day has become, among other things, a geographical issue. This is because the landscape itself is fragile, and the size of Anzac Cove, some feel, cannot support the number of visitors that descend on the Cove at once on Anzac Day. It is also an issue because people have different points of view. This is often the case in geography and comes about, in part, because people have different reasons for connecting to places.

Communicating geographical information

1 Research the environmental impact that visitors are having at Gallipoli, and the ways in which local authorities are



Source 9.33 Tourists attending the Anzac Day service at Lone Pine cemetery, Gallipoli

responding. Present your findings in a short written report.

2 Design a code of behaviour for visitors attending Anzac Day services at Gallipoli to help them minimise their impact on the environment.

3 Write a few paragraphs or a short speech about attending Anzac Day services at Gallipoli, framing your viewpoint from a single perspective (historical, economic, cultural or spiritual). For example, you might write your piece from the economic perspective of a tour bus operator to Gallipoli.

SKILL DRILL

Interpreting qualitative data about geographical issues and events

Geographers need to consider different points of view, and the reasons behind these different viewpoints, when evaluating a geographical issue or event. They may use qualitative or quantitative data when doing this.

When presented with qualitative data such as news pieces, blogs, or research articles, geographers will examine the opinions in these sources, evaluate the sources and the motivation behind them, and analyse the issue or event using this information.

Follow the steps on the next page when interpreting qualitative data related to a geographical issue or event.

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Interconnections, Space, Place
- Inquiry skill: Communicating geographical information
- Tools: Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

Step 1 Identify the issue you wish to investigate.

Step 2 Gather the relevant sources of qualitative data.

Step 3 Carefully read each source. Highlight or take note of the following:

- What do you know about the person who expressed this opinion?
- What possible bias may this person have about this issue?
- What is their opinion on this issue?
- What evidence or information do they use to support their opinion?
- Why did they write or publish the piece? For example, were they paid to write it?
- Who is the target audience?
- What result do you think the writer wants? For example, do they want to sway public opinion or change a current practice?
- Is the source reliable?

Step 4 Using your answers to the questions above, examine the motivation behind the piece. Is the person approaching the issue from a historical, economic, cultural or social perspective?

Step 5 Analyse the issue by comparing the different points of view provided in each source. You can ask questions like these to help you do this:

- What are the main points raised about the issue?
- Is there anything that the writers agree on?
- What are the main points on which they disagree?
- How does their perspective (historical, economic, cultural or social) influence their opinion?

Apply the skill

Following the steps provided, examine each of the four following sources, which express different points of view about visiting Gallipoli on Anzac Day.

1 Do you think Virginia Maxwell (see Source 9.34) is writing from a historical, economic, cultural or spiritual perspective? Why do you think this? List your reasons.

2 Describe the issues surrounding visiting Gallipoli in your own words. Use the key concepts of environment and place in your description.

3 Compare the pieces written by Shelley (Source 9.37) and Erin (see Source 9.39) in their blogs.

a How do you think a discussion between Erin and Shelley might go if they were to meet? Write a short dialogue based on the conversation they might have about their views on Gallipoli.

b With a partner, present your dialogue in a role-play for the class. Be prepared to stay in character and answer questions from your classmates about your feelings on Anzac Day.

4 Why do you think people can have such different points of view about geographical issues? Identify another place you think people might have different viewpoints about and list the possible reasons for this. You could research somewhere like Cronulla Beach in Sydney, for example, or the Franklin River in Tasmania if you are stuck for a place to write about.

Source 9.34

> It's important to remember that this site is just as significant and important for the Turkish people as for the Australians, the New Zealanders and the British. Visitors who come at other times than on Anzac Day get a much better chance to do some quiet reflection, get the full historical context from the tour guides and get the Turkish perspective on the battle as well. This is something that you won't get on a crowded overnight package trip from Istanbul, which is how most people end up seeing the site. It's also easier to find accommodation at other times, and avoids damage to the park, which is fragile.
>
> Virginia Maxwell, co-author of the *Lonely Planet: Turkey* guide



Source 9.35 For many tourists, a visit to Gallipoli at a quiet time allows them to connect more closely with this place.

Source 9.36

Instead of commemorating the heroism of Australian soldiers who landed on that fatal shore in 1915, the conference in October concluded that Australians should reframe the landing as an unmitigated disaster and apologise to the Turkish Government for invading their country.

'The landing was nothing but an unjustified invasion of foreign soil like the British invasion of Aboriginal land in 1788,' says John Lack of the University of Melbourne. 'And we should put the two coves together – Sydney Cove and Anzac Cove – because both invasions were just as bad as each other and cost a lot of lives.'...

John McQuilton of Wollongong University says Australians should look at the story of Gallipoli from the Turkish angle to see how they feel about it, a view that has been neglected for too long. The Turks lost 86 000 soldiers compared with Australia's 8709. 'It is now time to embrace our old enemy Turkey,' he says. ....

McQuilton says Australians should stop going to Gallipoli and claiming rights over Turkish soil for their commemorative activities. 'This land belongs to Turkey and the reason they are building so many memorials of their own is they want it back,' he says.

'Charge of the rewrite brigade,' by Jonathan King

http://www.battleforaustralia.org/battaust/AustInvasion/References/Stanley_on_Gallipoli.html

Source 9.37

We will never forget. The journey that we were privileged to experience on the Gallipoli peninsula was incredible! A journey of both heart-gripping and breathtaking emotions as well as a surreal pilgrimage; a tiny glimpse of what the Anzacs went through on the 25th April, 1915. ...

We embarked on a 5-day tour with Top Deck, discovering a quick peek of Istanbul and Gallipoli. ... it's fair to say that we left our hearts on the shores of the Gallipoli National Park, with the many remaining there. Men of bravery, men of obedience, and men, who courageously and heroically left family, loved ones and their country behind.

... if you ever do get a chance to go to Gallipoli, especially over Anzac day, I would highly recommend it, as it really is (as cliché as it sounds) a life-changing experience.

It was an honour and an eye-opening adventure to be able to stand in the place where thousands had been laid to rest. What a memory to carry. We all walked out of the experience, knowing that we will never think of Anzac day the same. Lest we forget.

Shelley, attended the Anzac Day service, Gallipoli, 2013

http://thesharechair.blogspot.com.au/2013/05/Anzac-day-gallipoli-lest-we-forget.html



Source 9.38 A View of soldiers attacking during the final days of the Gallipoli Campaign in 1915

Source 9.39

I have had this rant to all of my mates who go to Gallipoli for Anzac Day.

It is a problem when Anzac Day starts to resemble the Big Day Out. There are the bogans draped in the Aussie flags who have been up all night. There are the stages, the microphones, the cameras, the celebrities, the spotlights, the lead up that could confuse the upcoming rendition of the 'Last Post' with an upcoming rock band. There are the people who have fought online and forked out hundreds for tickets. And now, there will even be ballots.

Erin, in her blog 'Lessons for the 20s something wanderer'

http://lessonsforthe20somethingwanderer.blogspot.com.au/2013/04/lesson-28-why-im-not-at-gallipoli.html#!/2013/04/lesson- 28-why-im-not-at-gallipoli.html

9.2 TECHNOLOGY ACTIVATES INTERCONNECTIONS

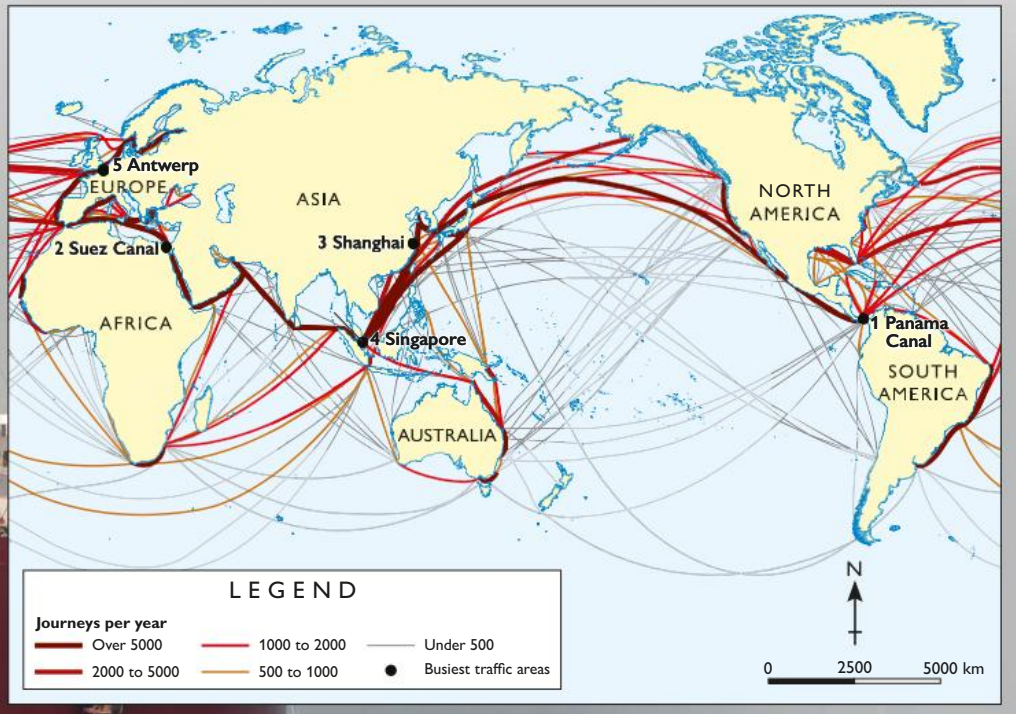
WHAT ROLE DOES TECHNOLOGY PLAY IN CONNECTING PEOPLE TO PEOPLE, GOODS, SERVICES AND INFORMATION IN OTHER PLACES?

Transport technology

Innovation in transportation has played an important role in human history, allowing people to easily move beyond their birthplace. It has made the world feel smaller and more interconnected. Containerisation, refrigeration, the design of long-haul aircraft such as the A380, very fast trains and the development of the supertanker have each contributed to make the movement of people, goods and services easier. As a result, there has been an explosion in the movement of people, goods and services across the globe. This movement has been activated by technology developing a series of links, or interconnections, between and within countries.

We have become increasingly dependent on fast, reliable and cheap transport that gives us year-round access to all kinds of goods and services. When your grandparents were your age they probably ate food grown and processed in their local area. Most of their clothes were made locally, and they most likely bought things they needed from local shops. Today, we can still be eating peaches in June, transported in from California, and that new pair of jeans can be shipped directly to your door. Our homes contain many items made in other countries and we tend to shop globally. Trade between nations is currently valued at about US$18 trillion a year, and international trade links people and places around the world. To make these connections there are approximately 6000 planes in the air right now; 17 000 cargo ships crossing the world's seas and oceans; 2 million kilometres of pipeline transporting gases, oil and water; and more than 1 million kilometres of railway track.

WORLD: SHIPPING TRAFFIC



Source 9.40

Source: Oxford University Press

Source 9.41 Technology innovations that have activated transport links or interconnections across the globe



Containerisation: Simple, standard-sized metal boxes are packed with cargo and stacked onto ships that can carry 8000 of them at a time.



Aircraft design: The Airbus A380 is the world's largest passenger airliner. It can carry over 800 passengers, has a range of 15 700 kilometres and a cruising speed of 900 kilometres per hour.

TECHNOLOGY INNOVATIONS



Refrigeration: Containers with cooling and freezing carry perishable products, keeping them fresher longer.



Oil supertankers: T1 class of supertankers are the largest ships in the world. They are 380 metres long and can carry more than 500 million litres of oil. The more a vessel can carry, the cheaper the costs of transport.



Very fast trains: This high-speed form of transport can move people at 340 kilometres per hour.

Information technology

The Internet allows people to connect with other people in different places more quickly and conveniently than ever before. Today, we use the Internet for a range of activities and purposes that link us to many places all over the world. Your after-school activities are probably connecting you to places all over the world without you even realising it. In the space of half an hour sitting at the computer, you might have logged into Facebook, connecting with friends who live in the same area, others who live interstate or some who live in another country. You might listen to some British or American songs on YouTube while you do your homework. Or you might use an on-demand Internet streaming service such as Netflix to watch a movie or an international sports game. The Internet allows you to make all these connections to different places without physically leaving your desk.

Communication technology

We use the Internet to play games, shop, plan activities, find directions, read, research, complete homework and, more than ever before, to communicate with each other.

Using the Internet for emails remains the most popular activity, with 98 per cent of people online having sent an email in the last 12 months. The Internet has, in many ways, become the most dominant form of social interaction on the planet.

- There are more than 3.2 billion Internet users in the world and 4.3 billion email accounts.
- There are over more than million active Twitter users sending 500 million tweets a day.
- There are 200 million Snapchat users.
- There are 400 million active Instagram users.
- There are more than 1.4 billion Facebook accounts. This is greater than the total world population 200 years ago.
- Every minute a further 400 hours of video content is added to YouTube.
- There are more than 3.5 billion Google searches made every day and 1.2 trillion searches per year.
- About 205 billion emails are sent every day.

STRANGE BUT TRUE

In 1984, Motorola released the first truly mobile phone, the DynaTAC 8000x. Nicknamed 'the brick', it weighed 784 grams, cost US$3995 and had a battery life of 8 hours.



Source 9.42 This map of the world was created not by drawing borders, but by marking the connections between 10 million Facebook friends.

Access to news and information

Developments in information and communications technologies (ICT) have meant that people can now access a wide range of global news and information services quickly and easily. You can get American basketball scores in real-time, for example, or you can see photos from a collection at Paris fashion week on the same day it is shown. This information might be trivial, such as finding out what everyone was wearing at last night's music awards, or it might be something that could potentially save a life.

During bushfire season many people are alerted to the threat via social media, not by traditional news forms (see Source 9.43). Following Twitter allowed people to get real-time updates from others who were tweeting from areas nearby the flames, information that traditional news services did not have access to. You may be able to think of other examples where Twitter or other social media have broken stories before traditional news providers.

Access to services in other places

Do you watch your favourite programs on free-to-air TV or do you prefer to live-stream or download? Do you prefer shop for clothes online or do you go and try things on in store before you buy?

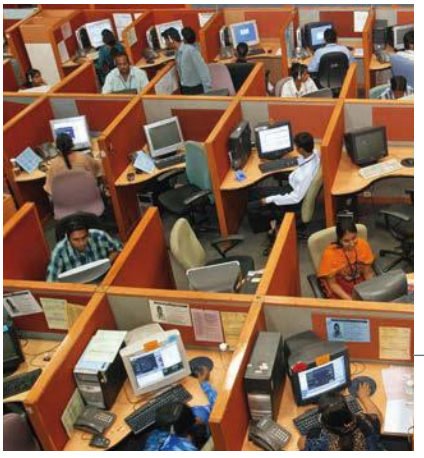
Entertainment and shopping are two areas of your life where information technology connects you to other places on a regular basis. You probably take it for granted that you can download new music the same day it is released in the United States. In the past, you would have had to wait for CDs to arrive in shops here. You can also shop online, and often purchase things more cheaply than if you were buying them in a physical store. Almost $1 trillion a year changes hands through e-commerce, and half of all Australians have shopped online in the last 3 months. Access to services and goods in other places is an aspect of globalisation that many of us now enjoy as a matter of course.



Source 9.43 Instagram post alerting other road users of the imminent bushfire danger

CASE STUDY

Offshore call centres



When people call up to complain about mobile phone service, book an airline ticket or pay a bill, chances are they speak to someone in the Philippines or India rather than in Australia. Many Australian companies have moved their call centres to these other countries to take advantage of the lower wages. The call centre industry, which currently employs more than one million Filipinos and Indians, is expected to grow quickly as Internet speeds increase and new companies take advantage of the cost savings.

Source 9.44 Developments in technology and increased Internet speeds mean that it is possible for overseas companies to use call centres in India or the Philippines.

REVIEW 9.2.1

Remember and understand

1. Identify three innovations in transport technology that have allowed the increased movement of people, goods and services across the globe.
2. In what ways do you think an online news service might be more useful than a traditional television or print-based news service?
3. Name three ways that the Internet provides interconnections between people in different places.
4. Describe how offshore call centres are an example of interconnection.

Apply and analyse

5. Compare the Facebook map shown in Source 9.42 to an atlas map of the world.
   - **a** Name six countries with many very active Facebook users.
   - **b** Name four countries where there appears to be relatively little Facebook usage. Suggest three reasons for this.
   - **c** Describe the pattern of Facebook usage in Australia.
6. In what ways does online shopping affect:
   - **a** the consumer?
   - **b** the environment?
   - **c** local shopkeepers?
   - **d** postal and delivery service providers?

Investigate and create

7. Investigate the best form of transport for trade between countries in the Asia–Pacific region. Create a table that shows the advantages and disadvantages of road, rail, shipping and air transport.

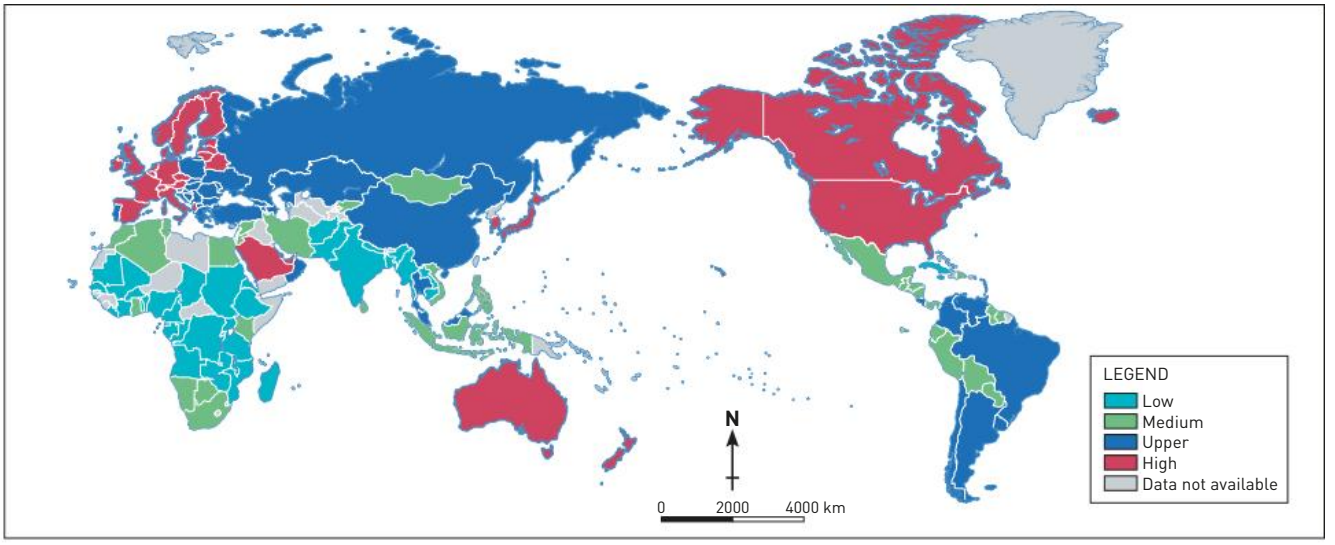
DIGITAL ACCESS AROUND THE WORLD

The digital divide

During your lifetime, the Internet and other digital technologies have become the most powerful tools of connection the world has ever known. In many places it now seems easier to be connected to other people and places than not to be. However, this high level of connection is not experienced equally by everyone. In some places there are more computers and mobile phones than there are people, while in other places these devices are still uncommon. These differences are known as the **digital divide**.

Organisations such as the International Telecommunications Union rank each country based on its digital access (see Source 9.45). The countries shaded red enjoy the highest access. Those shaded light blue have the lowest access. Digital divides are found within, as well as between, countries and result from differences in the quality of the available network as well as basic connectivity.

WORLD: LEVELS OF DIGITAL ACCESS



Source 9.45

Source: Oxford University Press



Digital access in developing nations

While access to communication technologies is greatest in developed nations, the rest of the world is beginning to catch up. The people in the Sub-Saharan African nation of Chad, for example, have had the least access to ICT. In 2000, only one in every 5000 Chad residents had a mobile phone subscription. By 2013, this had become one in every three.

For many people in developing countries, the Internet and mobile phone have become a way to access the promise of a better future for themselves and their children. The number of mobile phone subscriptions has skyrocketed to six billion in the past decade – approximately 75 per cent of the world's population now has access to a mobile phone. Africa is currently the fastest growing mobile phone market, with more than 700 million mobile phone users. This rise in mobile phone subscriptions has greatly increased access to information for Africans. It has also changed lives. For example, online banking using mobile phones means that people in remote areas no longer have to travel for hours to reach a bank.

Source 9.46 This data is from the International Telecommunications Union, a branch of the United Nations, and shows the developing rates of mobile and Internet use in developed and developing nations as a percentage of the population (i.e. per 100 habitants).

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mobile phone subscriptions	Developed	82.1	92.9	102.0	107.8	112.1	113.3	113.5	116.0	118.4	119.9	120.6
	Developing	22.9	30.1	39.1	49.1	58.2	68.5	77.4	82.1	87.8	91.1	91.8
Homes with Internet	Developed	44.7	48.2	53.4	57.7	62.6	66.3	70.2	74.0	77.7	78.0	81.3
	Developing	8.1	9.6	11.2	12.5	14.1	16.4	20.2	24.0	28.0	31.0	34.1
People using the Internet	Developed	50.9	53.5	59.0	61.3	62.9	67.3	70.5	73.4	76.8	78.0	82.3
	Developing	7.8	9.4	11.9	14.7	17.5	21.2	24.5	27.5	30.7	32.0	35.3

SKILL DRILL

Creating column and line graphs

Graphs are used in geography to display data and make it easier to understand. Raw data often appears as a confusing table of numbers, so turning data into graphs makes it easier to recognise and analyse trends and patterns. Some commonly used graphs in geography are:

- column graphs – used to compare data (for example, to compare the sizes of several cities)
- line graphs – used to show trends over time (for example, the growth of a city's population).

To draw a graph you should follow these steps:

Step 1 Decide whether a column graph or line graph will best suit your purpose.

Step 2 Examine the data carefully to decide on the axes and the scale you should use so that all the data fits. It is important that the scale on each axis is an even scale; for example, 1 centimetre equals 1 million people.

Step 3 Construct your axes and your scale using a ruler.

Step 4 Plot the data carefully. Use a straight, horizontal line for a column graph. Use a small, neat dot for a line graph.

Step 5 On a column graph, draw a series of columns that extend to the horizontal axis. Lightly shade each column with a coloured pencil. On a line graph join the dots with a smooth, freehand line.

Step 6 Label each axis with a description of the data and give your completed graph a title.

Apply the skill

1 Using the data in Source 9.46, create two different types of graphs:

a a line graph showing the number of mobile phone subscriptions for the developed nations between 2005 and 2015

b a column graph showing the number of mobile phone subscriptions for the developed nations between 2005 and 2015.

REVIEW 9.2.2

Remember and understand

1 Describe what is meant by the term 'digital divide'.

2 Describe some likely consequences of this divide.

Apply and analyse

3 Examine Source 9.45.

a Describe the distribution of countries with high digital access.

b Describe the distribution of countries with low digital access.

c Account for the differences in digital access.

4 Examine Source 9.46.

a Describe the general pattern of changes in digital access in developing countries.

b What does a score of 120 per cent in mobile phone subscriptions by the developed world in 2015 mean? How is this possible?

Investigate and create

5 Using Sources 9.45 and 9.46 to provide you with the necessary information, imagine that you work at a mobile phone and Internet company, and are in charge of developing new markets for sales.

a Which regions of the world have the greatest potential and which the least to increase their percentage of mobile phone and Internet users? Provide data and examples to support you answer.

b Design a poster that promotes either mobile-phone use or Internet use for people in developing countries. How will it change their lives for the better? What are the advantages for people to join the 'digital age'?

CONNECTING WITH REMOTE AREAS

While many of us live or spend most of our time in towns or cities, there are significant numbers of people who live in, or travel to, more remote areas. In the past, the physical distance that separated places posed significant issues, even risks. Alerting someone located in a remote area of an incoming violent storm, for example, may have been difficult, even impossible. Even now, restricted mobile phone coverage and slow Internet access can still make connecting with some places decidedly challenging.

People travel to remote places for many reasons. There are scientists who go out into the field to research and explore, religious missionaries or educators who might visit or do short stays in an area to help or teach a language, and those who simply want to tackle the frontiers of places that are still relatively unchartered. Here, we will look at how people who travel to remote areas as well as how those who live in such places interconnect with the world.



Source 9.47 Alone but connected: Felicity Aston sets off across Antarctica.

Changing the ways explorers interconnect

Antarctica is the most remote place on Earth. Explorers in the 1900s such as Robert Falcon Scott and Ernest Shackleton effectively disappeared once they sailed away from their last port in New Zealand or Argentina. Their families and supporters knew that it would be years before they would see them again. Communication with the 'outside world' was simply not possible. This was the case throughout many remote places on Earth, including vast areas of inland Australia, until only recently.

Explorers still travel to Antarctica and although this extreme environment is as challenging as ever, they are no longer as isolated. In 2012, British adventurer Felicity Aston skied alone for 1477 kilometres across Antarctica, becoming the first woman to do so (see Source 9.47). Among the equipment she carried in the two sleds she dragged behind her were a satellite phone that gave her coverage for the complete 59-day journey and a solar panel to recharge it. Connecting to a series of satellites orbiting the Earth 780 kilometres above her allowed Felicity to chat to family and friends, make a daily safety call, take part in live radio interviews, maintain a blog and Facebook page, and tweet to hundreds of thousands of followers daily.



Source 9.48 This picture shows the positions of the 6000 artificial objects currently orbiting the Earth. Note that they are shown as much larger than their actual sizes.

The technologies that allow people in remote places to connect to other places all rely on a system of satellites that orbit the Earth. These receive signals from devices such as satellite phones and bounce them back to Earth or to another satellite. There are about 6000 of these satellites currently in orbit and this number increases by about 200 a year. These are used to relay messages to devices you probably have in your home, such as televisions and GPS receivers.



Connections in the Outback

Australia is one of the world's largest countries and some people live vast distances from the goods and services they need. This has resulted in unique problems that require unique solutions. The Royal Flying Doctor Service and School of the Air, for example, have helped to bring medical services and schooling to some of the world's most remote communities.

The Northern Territory Aboriginal community of Mungalawurru lies 90 kilometres north-west of Tennant Creek. In 2011, there was little contact between the community and people in other places. There were no home phones or mobile phone coverage and the pay phone was usually out of order. This situation is typical of many remote communities but an experiment in Mungalawurru changed connections in this outback community forever. A partnership between several technology providers and social researchers saw computers with Wi-Fi and satellite connections installed in most homes, and education given to the local community about their use. Within months they became widely used, particularly for music downloads, online banking and emails.

STRANGE BUT TRUE

The portrait of the founder of the Royal Flying Doctor Service, Reverend Dr John Flynn, can be seen on the Australian $20 note.





Source 9.49 The Internet is providing connections in remote places where there was previously little contact with other communities.

REVIEW 9.2.3

Remember and understand

1 Explain why some people travel to remote areas.

2 Describe how explorers in Antarctica today are able to connect to people in other places. How does this differ from explorers in the past?

Apply and analyse

3 Describe how access to the Internet in Mungalawurru changed this community.

4 Have you ever lost your phone or had the Internet cut out at home? How did you feel, or how do you think you would feel if you lost your usual access? In small groups, make a list of how your life would change if all systems of digital communication such as mobile phones and the Internet were cut. Using a mind map, consider how you would overcome any problems this might create for you.

5 What factors might you need to consider if you were to travel to an area that had limited mobile network coverage? What things might you need to pack or prepare that you would not normally have to consider?

Investigate and create

6 Examine Source 9.48 in light of the issue of waste management. Research the amount of space junk that is currently in the atmosphere.

a What problems could having so much space junk floating unregulated in the atmosphere cause in the future?

b Are there any ways you think this should be addressed or strategies that you think should be implemented to tackle this potential problem?

9.2

CHECKPOINT

WHAT ROLE DOES TECHNOLOGY PLAY IN CONNECTING PEOPLE TO PEOPLE, GOODS, SERVICES AND INFORMATION IN OTHER PLACES?

- **Investigate the way transportation and information and communication technologies are used to connect people to services, information and people in other places**

1 Describe how the Internet has had a negative impact on in-store retail sales within Australia? [5 marks]

2 Explain why many service companies, such as phone companies and insurance companies, have decided to send their customer call centres overseas to countries such as the Phillippines and India. [10 marks]

3 Using the information in Sources 9.45 and 9.46, illustrate how a digital divide is obvious between the developed and developing countries of the world. [10 marks]

4 When living in, or travelling to, remote areas, interconnectedness is less of an issue than it has been in the past. Explain why this is so. [5 marks]

TOTAL MARKS [/30]

RICH TASKS



Source 9.50 This is Sara, a 12-year-old girl. She lives with her parents in Ouaddai, eastern Chad, central Africa. The family make their living from a small herd of beef cattle that they breed and sell at market. Sara's job is to ensure the cattle water trough is never empty. Some days she must walk 5 kilometres to the well and back several times. When she has time, Sara plays soccer with her twin brothers, aged 14. Sara is an excellent player. A French aid agency has set up a satellite dish and provided access to a computer and the Internet.

Task 1: Ouaddaian girl from Chad

Processing geographical information

1 Identify all the ways, both positively and negatively, that Sara's life can be affected by this new global connectivity.

2 Would a smartphone be useful to Sara? Explain why or why not.

3 What changes would you expect to see in Ouaddai in 10 years' time if a national broadband network were introduced today?

Task 2: How the Internet connects you to the world every day

Over a short period of time, we have come to rely on the Internet to connect us to the world in many ways throughout our day. We use it to play games, shop, research, find directions, work, read books, plan activities, complete homework and, more than ever before, to communicate with each other. We can access the Internet through various means, including desktop computers, laptops, smartphones and tablets.

Some of the ways in which we use the Internet every day include:

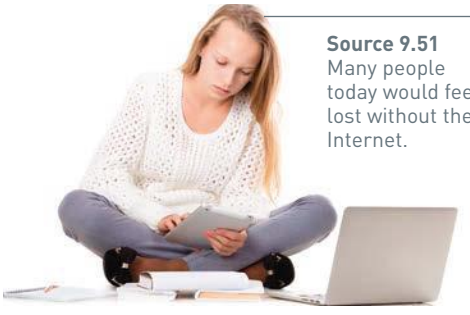
- online banking
- downloading podcasts and apps
- finding out sports results
- playing online games
- sending or reading email
- streaming music, movies and TV programs
- getting news updates
- checking weather reports
- buying clothes, groceries and presents
- completing and submitting homework.

Communicating geographical information

1 Conduct your own survey about Internet use. Follow the steps in the Skill drill section on the next page and complete the Apply the skill questions.

2 Write a 200-word report based on your survey results, explaining how often and in what ways those surveyed used the Internet.

3 Present the results of your study to the class. Use your table or graph from the previous question as a visual aid, and talk through the most popular websites that people used, as well as the differences or similarities between the ways your family members and classmates used the Internet.



Source 9.51 Many people today would feel lost without the Internet.

SKILL DRILL

Conducting a survey and presenting the results

Geographers use surveys to explore people's opinions, ideas and activities. By analysing the results they can gain valuable insights into personal and social behaviour. The key to finding useful information from a survey is asking the right questions. Try to ask closed questions (yes/no questions or questions that provide a limited selection of options to choose from) as much as possible. Closed questions in surveys are commonly multiple-choice. Follow these steps to design a survey and present the results.

Step 1 Decide on the focus of your study.

Step 2 When you have decided what your study will be about, work out what information you are interested in finding out. For example, your study might be about the Internet, and you may want information on how often people use it.

Step 3 Decide whom you will survey. You will need to talk to at least 10 people to get data you can report on. Make sure that you have enough forms for all the people. The more people you survey, the more useful and reliable your results will be.

Step 4 Write a series of closed questions about your study. A closed question might look like this:
How often do you use the Internet at home?
At least once a day ❑
At least once a week ❑
At least once a month ❑
No Internet at home ❑

Step 5 Once you have your questions written, go over them to ensure that they all focus on the subject of your study and will find out the information you want. Make sure they are clearly worded and cannot be misinterpreted by people completing the survey. Ask a friend to read over your questions if you are unsure.

Step 6 Conduct your survey. Ask the questions and fill in the forms yourself, or you can get your participants to fill them in. Make sure the responses have been entered correctly and that you have accurate records.

Step 7 Once you have completed your surveys it is time to put the results together into a form you can use – this is called data analysis. This is often best done in a table like the one shown here.

Source 9.52 Data can be presented in a visual format such as a table so the researcher can access information quickly and easily.

How often do you use the Internet at home?	Number	Percentage (%)
At least once a day	14	58.3
At least once a week	7	29.1
At least once a month	1	4.2
No Internet at home	2	8.4
Total	24	100.0

Step 8 Present your survey results in a way that make them easy to understand. Rather than a lot of numbers and writing, use graphs. Make sure you clearly label each graph with the question you asked and below each graph write a short summary of the results.

Apply the skill

1 Design and complete a survey about the ways in which people in your class and members of your family use the Internet. Include at least 10 questions. Survey a minimum of 20 people.

2 Once you have completed the survey, analyse the results and present them in table and graph formats.

CHECKPOINT

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

» Concepts: Interconnections, Space, Place
» Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
» Tools: Fieldwork, Multimedia, Graphs and statistics

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHAPTER

10



Source 10.1 Bangladeshi ship breakers at the Chittagong ship-breaking yard pull apart old container ships and oil tankers by hand so the steel can be recycled.

THE EFFECTS OF GLOBAL CONNECTIONS

The increased movement of goods, services, people and ideas across the world has the potential to improve the lives of millions of people and bring people and cultures closer together. It also has the potential to degrade natural environments and to deepen the divide between the wealthy and the poor.

These men are employed as ship breakers at the Chittagong ship-breaking yard in Bangladesh, south of the capital Dhaka. They pull apart old container ships and oil tankers by hand so the steel in them can be recycled and reused. Many of the ships are owned by the wealthiest multinational companies in the world. It is dirty and dangerous work and there are virtually no health and safety regulations to protect workers. A labourer here can earn about $1.50 a day working as a ship breaker. Ships arrive in the South Asian breaking yards at the rate of about one a day.



WHAT ARE THE CONSEQUENCES OF A GLOBALLY CONNECTED WORLD FOR PEOPLE AND PLACES?

10.1 SECTION

In this section you will investigate:

- the ways places and people are interconnected through trade in goods and services across a range of scales

CHECKPOINT 10.1

WHY ARE INTERCONNECTIONS IMPORTANT FOR THE FUTURE OF PLACES AND ENVIRONMENTS?

10.2 SECTION

In this section you will investigate:

- the effects of the production and consumption of goods on people, places and environments throughout the world

CHECKPOINT 10.2

GEOGRAPHER'S TOOLKIT

Geographical concepts

- **Interconnection:** how people are affected by the environment; how people affect the environment
- **Place:** the effect of global trade, transport, information and communication technologies on places across the world
- **Environment:** the economic value of environments to people
- **Sustainability:** pressures on the Earth's water resources and landscapes
- **Change:** changes to resources and places over time through human geographical processes and events

Geographical inquiry skills

- **Acquiring geographical information**
- **Processing geographical information**
- **Communicating geographical information**

Geographical tools

- **Maps**: thematic maps, political maps, flow maps, choropleth maps
- **Graphs and statistics:** tables, column graphs, bar graphs
- **Visual representations:** cartoons, photographs, aerial oblique photographs, satellite photographs, block diagrams, pictograms
- **Spatial technologies:** satellite photographs



10.1 AN INTERCONNECTED WORLD

WHAT ARE THE CONSEQUENCES OF A GLOBALLY CONNECTED WORLD FOR PEOPLE AND PLACES?



Source 10.2 Steven, a Mooi child, squats in front of what used to be the forest that supported his community. The Mooi are one of the Indigenous people who live off the forests of West Papua. Their ancestral lands are being devastated by logging and taken away for palm oil plantations. Palm oil is used in many processed foods in Australia.

We live in an increasingly interconnected world, in which there is relatively free and frequent movement of goods, money, people, information and ideas across the globe. This movement is necessary because we cannot individually grow or make everything that we need. Our homes are filled with goods made by people we will never meet in places we may never visit. We now have access to the skills, expertise and labour of billions of people to supply our needs and wants. This intertwines our lives with people in all parts of the world, through the food we eat, the clothing we wear, the music we listen to, the information we receive and the ideas we hold.

Consumers are obvious winners. Some companies, industries and countries are also winners. China, for example, has become increasingly wealthy and powerful by making and supplying goods and services for the global marketplace. Many people believe that having better trade between nations also spreads the world's wealth.

Despite the many winners in our interconnected world, there are also clear losers. Workers in developing countries are sometimes exploited for their cheap labour and are paid much less than those in the wealthier countries who are buying the goods they produce. Their working conditions are often much worse as well.

Interconnections can also lead to the loss of traditional skills and customs. Additionally, small local businesses can find it difficult to compete with large multinational companies. The closure of these businesses can lead to job losses for local workers and negative effects for societies and communities.

The environment is also often a loser when it comes to interconnections. As more and more raw materials such as timber, land and minerals are used to feed the world's factories, natural environments are changed forever (see Source 10.2). The need to transport these goods to countries all around the world also adds to major environmental problems such as air and water pollution, deforestation and climate change.

From 'riding on the sheep's back' to 'riding on the dragon's tail'

Australia today is part of the global marketplace. Billions of dollars' worth of goods and services are traded between Australia and the rest of the world every year. For much of the last century, most of Australia's exports came from the farming sector, and our major trading partner was the United Kingdom. Products such as wool, butter and meat were shipped around the world and sold to British consumers. Australia was known as 'Britain's farm', and

because our prosperity largely came from the sale of wool, Australia was said to be 'riding on the sheep's back'.

This century has seen dramatic changes in our main exports and trading markets. Less than 10 per cent of our total exports now come from the farming sector and the United Kingdom is only our seventh biggest trading partner. Over half of our total exports now come from the mining sector (mainly iron ore, coal, natural gas and gold), and our two biggest trading partners are China and Japan. China is by far our leading supplier of imported goods (A$52 billion a year) and buyer of our exports (A$90 billion a year). This change has led many observers to remark that Australia is no longer riding on the sheep's back – instead we are riding on the dragon's tail.



Source 10.3 Cartoonists often portray a complex issue using a simple, humorous image.

REVIEW 10.1.1

Remember and understand

1 Describe how Australia's place in the global marketplace has changed over the last 50 to 60 years.

2 What Australian products make it important in the global marketplace?

Apply and analyse

3 Examine Source 10.3. What point is the cartoonist making about China and Australia's relationship?

4 Examine Source 10.2.

a Do you think the child shown in this picture has benefited from global trade in any way?

b What possible local benefits could there be from the logging that takes place in this area?

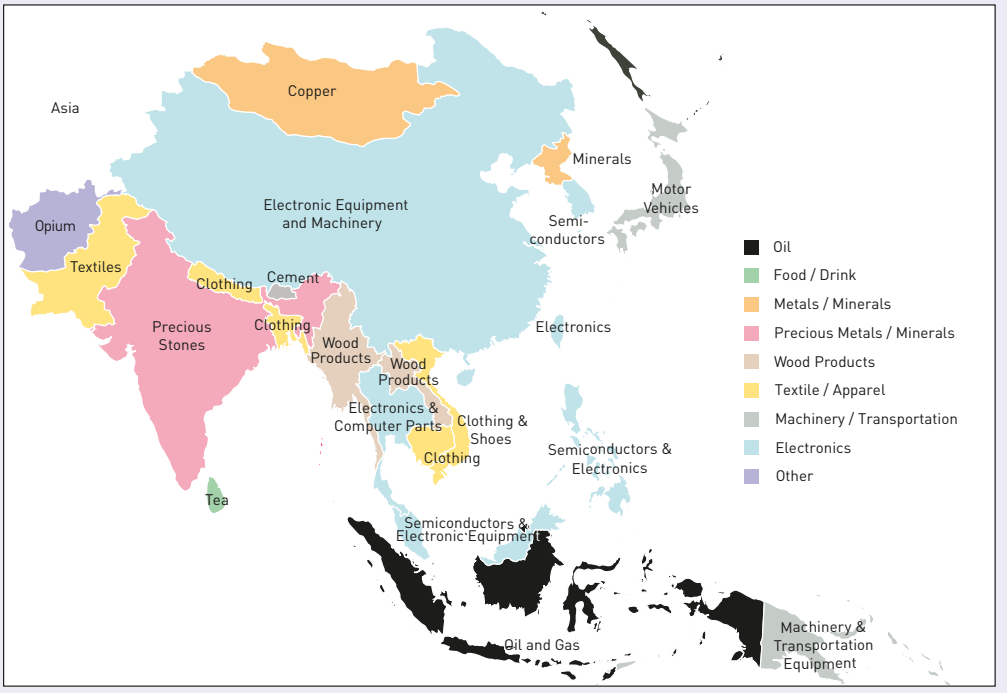
Investigate and create

5 Design a political cartoon based on the phrase 'riding on the sheep's back' or 'riding on the dragon's tail'. Before you begin, think about the message you want to convey about this phrase.

6 Use the CIA World Factbook to complete a map of our region to illustrate each nation's most valuable export. Source 10.4 shows an example for Asia. In the CIA Factbook, select a country to view, and then click on the Economy tab to investigate that country's most valuable export.

7 What benefits do you personally experience from the global increase in trade links between people and places? In what ways are you worse off because of these links?

ASIAN COUNTRIES' MOST VALUABLE EXPORTS

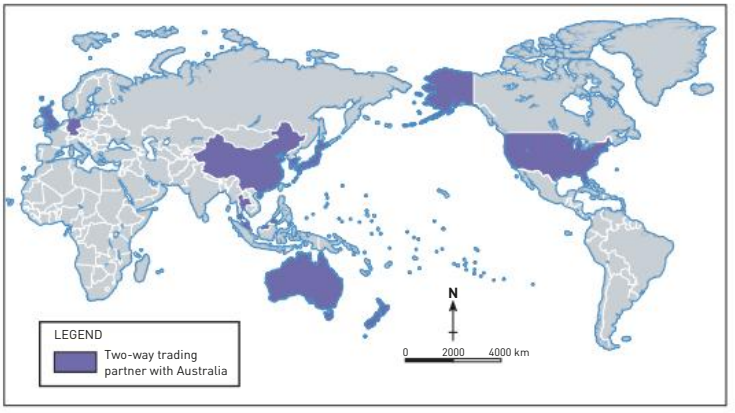


Source 10.4 GlobalPost illustrates Asian countries' most valuable export Source: Global Post

AUSTRALIA'S TRADE CONNECTIONS

Australia is linked to many places in the world through the goods and services produced here that are exported to other countries. 'Fruit and vegetables picked on a Monday morning in Victoria can find their way onto Gulf States' supermarket shelves before midday on Tuesday. It's also a little known fact that 14 000 litres of fresh milk is flown out of Avalon Airport each morning into Asia.' (Andrew Robb, Minister for Trade and Investment, 2015).

AUSTRALIA: TOP 10 TWO-WAY TRADING PARTNERS



Source 10.5

Source: Department of Foreign Affairs and Trade (DFAT), 2014

Source 10.6 Australia's top 10 exports and imports in 2014

	Exports	Imports
1	Iron ore	Personal travel services
2	Coal	Crude petroleum
3	Natural gas	Refined petroleum
4	Education-related travel services	Passenger motor vehicles
5	Personal travel services	Telecom equipment and parts
6	Gold	Freight transport services
7	Crude petroleum	Medicaments
8	Beef	Computers
9	Aluminium ores	Passenger transport services
10	Wheat	Goods vehicles

Source: DFAT

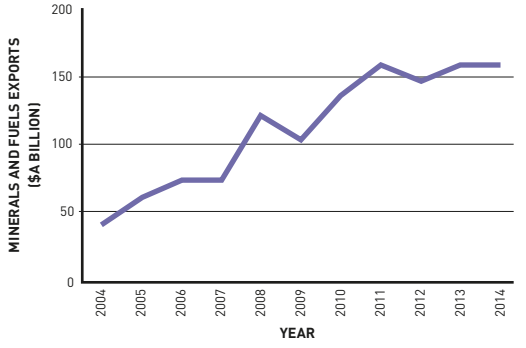
Source 10.7 Australia's top 10 trading partners in 2014, showing volume of trade and the major products traded

	Country	Exports		Imports	
		Trade volume (A$ million)	Major products	Trade volume (A$ million)	Major products
1	China	98 210	Iron ore, gold, copper, coal, travel	54 258	Telecom equipment, clothing, computers, furniture, mattresses, cushions
2	Japan	50 247	Coal, iron ore, beef, copper	19 971	Motor vehicles, refined petroleum, goods vehicles
3	South Korea	22 017	Iron ore, coal, beef, aluminium, education travel	12 609	Refined petroleum, motor vehicles, pumps, heating and cooling parts
4	United States	18 510	Beef, business services, personal travel, aircraft parts	41 932	Motor vehicles, personal travel, business services, measuring instruments
5	Singapore	12 085	Gold, crude petroleum, business services, animal fats and oils, computers	18 102	Petroleum, transport, business services
6	New Zealand	12 125	Person travel, transport, computer parts, motor vehicles	11 343	Personal travel, crude petroleum, transport, gold
7	United Kingdom	8 319	Gold, personal travel, financial services, alcoholic beverages	12 469	Motor vehicles, personal travel, business services
8	Malaysia	7 923	Copper, nickel, coal, wheat, education travel	12 659	Crude petroleum, monitors, TVs
9	Thailand	6 105	Crude petroleum, gold, aluminium, coal	12 873	Goods vehicles, passenger motor vehicles, travel
10	Germany	2 867	Motor vehicles, medicaments	13 858	Gold coin, legal tender coin, precious metals, personal travel, oil-seeds

Source: DFAT

Over 60 per cent of our exports are minerals and fuels, such as iron ore, gold, aluminium, crude oil and coal. In recent years, there has been a rapid growth in the amount of minerals exported from Australia (see Source 10.8). Known as the mining boom, this rapid growth was driven by Australia's vast mineral wealth and a demand for its minerals from China and India.

AUSTRALIA: GROWTH IN MINERALS AND FUELS EXPORTS, 2004–14



Source 10.8

Australia's vast mineral wealth

Australia is one of the world's biggest suppliers of many metals and minerals used around the world. For example, Australia has the largest reserves of lead, nickel, silver, uranium, zinc and zircon on Earth. Australia has the world's second largest iron-ore deposits – about 28 billion tonnes – almost all of which are located in Western Australia. It also has some of the world's largest coal deposits, which are used to provide about 80 per cent of our electricity. Large amounts of coal, mainly from the Bowen Basin in Queensland, are exported to Asian markets. Queensland has become the world's largest exporter of coal by sea.



Source 10.9 A gold mine near Kalgoorlie (now known as Kalgoorlie–Boulder) in Western Australia

Demand for Australian minerals from China and India

As China and India moved from being rural societies to modern, urban and industrialised ones, they required vast amounts of raw materials. In particular, they needed iron ore to produce steel for building projects. They also needed a cheap source of energy, such as coal, to generate electricity to power homes and businesses. In the last few decades, Chinese industries have developed enormous factories producing goods such as machinery, ships and cars, all of which require steel made from iron ore. India has large reserves of iron ore but few coal reserves, whereas Australia has large quantities of both. This demand has seen a huge increase in the value of coal and iron ore. However, the demand in recent times has declined because of a downturn in Chinese production and a slowing of its economic growth.



Source 10.10 BHP Billiton is Australia's biggest privately owned business and the world's largest mining company. It operates mines in 16 countries and employs around 43 000 people. This ship is being loaded with iron ore at the BHP Billiton facility in Port Hedland, Western Australia.

REVIEW 10.1.2

Remember and understand

1 Why are coal and iron ore in such demand in China and India? What are they used for?

2 Describe what changes are taking place in India and China that have resulted in changes in Australia.

Apply and analyse

3 Using Source 10.6, describe the types of goods and services that Australia exports.

4 Examine Source 10.7.
- **a** Which region receives most of Australia's exports?
- **b** Make three interesting observations based on the information in the table. Give reasons for your choice. (Look for some detail that is unusual, for example, exports to Germany.)
- **c** Why do you think Japan and the United States both import Australian beef?

Investigate and create

5 Which individuals and companies benefited most from the mining boom of the recent period?

6 Looking to the future, what and with whom will Australia be trading in another 50 years and 100 years?

THE GLOBAL FLOW OF TRADE

Countries trade with each other because they are unable to produce all the goods and services that they want. Japan, for example, has no oil reserves of its own, but it is the world's fourth largest consumer of oil. So it must import all the oil that it needs. By developing and exploiting the resources that countries do have, they are able to specialise and become really good at producing certain goods and services. For example, Australia has a lot of natural resources, especially iron ore and coal, so we specialise in digging them out of the ground and transporting them to countries like China and Japan. They need the coal to generate power and the iron ore to refine into steel to make cars and refrigerators, for example. We buy motor vehicles from Japan that have been made from Australian iron ore. Goods and services may cross borders three, four or even five times before ending up as a finished product. This is why we think of trade as a flow or **value chain**, not just a one-way trip!



Source 10.11 About 90 per cent of international trade in goods is carried out by ship. Bulk shipping of goods such as oil, gas and grain accounts for most of this. These ships are waiting to load or unload in Hong Kong Harbour, one of the busiest ports in the world.



Source 10.12 This is the world's second largest cargo plane. It can carry 150 tonnes of cargo over 3000 kilometres.

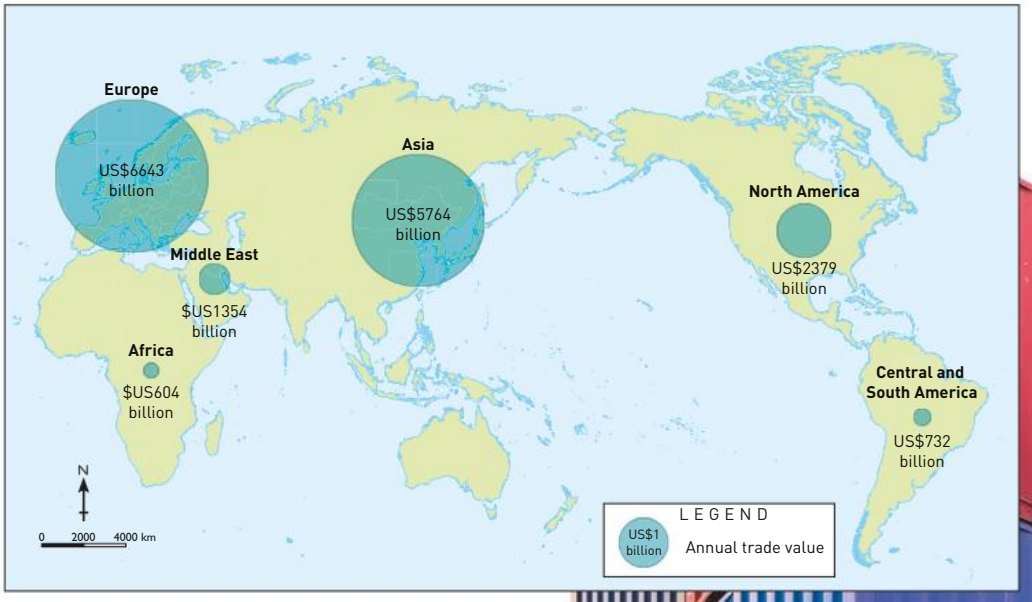
Source 10.13 shows the value of trade in the different economic regions worldwide in 2014. Imports and exports have a huge economic value for countries and the amount of trade taking place between countries grows bigger each year. A nation's wealth is linked to trade opportunities beyond its borders.

International trade is dominated by a few big players. The United States, Germany and Japan together account for about one-quarter of all exports and have done so for several decades. This dominance is threatened, however, by the rapid growth in emerging economies, particularly China,

India and Brazil. In 2014, China exported US$2209 billion worth of merchandise, up 8 per cent from 2013; India US$313 billion, up 6 per cent from 2013 and Brazil US$242 billion.

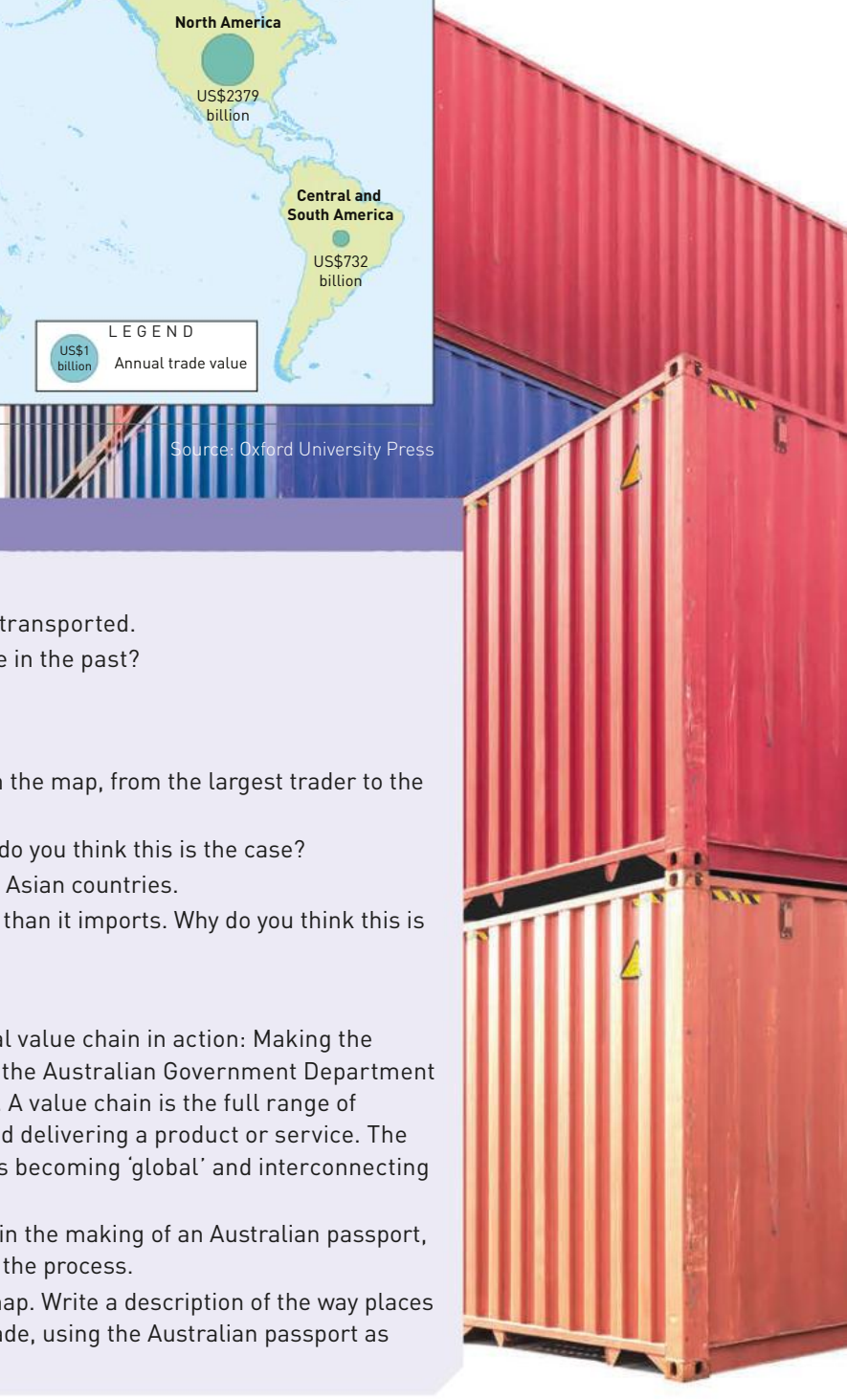
Australia accounts for about 1.5 per cent of global trade and is ranked 23rd in a list of the world's biggest exporters.

WORLD: GLOBAL TRADE, 2014



Source 10.13

Source: Oxford University Press



REVIEW 10.1.3

Remember and understand

1 Describe how most of the world's goods are transported.

2 Which countries have dominated global trade in the past?

Apply and analyse

3 Examine Source 10.13.

- **a** Rank the six regions of the world shown in the map, from the largest trader to the smallest.
- **b** Which region is the smallest trader? Why do you think this is the case?
- **c** Research the destinations of exports from Asian countries.
- **d** Find out which region exports much more than it imports. Why do you think this is the case?

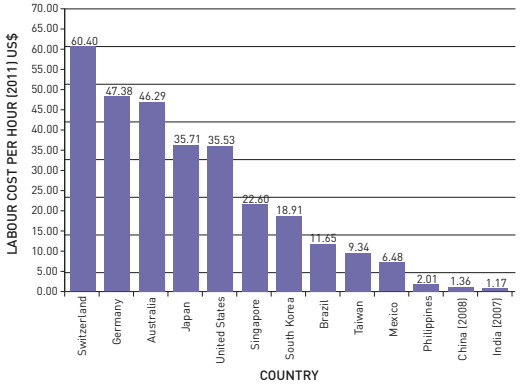
Investigate and create

4 Using your Internet browser, look up 'A global value chain in action: Making the Australian passport' (this is a publication on the Australian Government Department of Foreign Affairs and Trade (DFAT) website). A value chain is the full range of activities involved in designing, producing and delivering a product or service. The nature of trade is changing, with value chains becoming 'global' and interconnecting across more borders than ever before.

- **a** Make a list of all of the countries involved in the making of an Australian passport, and explain each country's contribution in the process.
- **b** Label all the countries on a blank world map. Write a description of the way places and people are interconnected through trade, using the Australian passport as evidence.

TRANSNATIONAL CORPORATIONS

SELECTED COUNTRIES: HOURLY RATES OF PAY FOR MANUFACTURING WORKERS



Source 10.14

One of the most common factors linking us around the world to people in different places is the movement of goods and services. In the last few decades, many large businesses based in wealthy **developed countries** have chosen to manufacture their goods in poorer developing countries. Because these businesses operate in more than one country, they are called **transnational corporations** (**TNCs**). Some of the largest, most profitable and most recognisable brands in the world are produced by TNCs. These brands include Coca-Cola, Apple, IBM, McDonald's, Louis Vuitton, Adidas and Nike.

TNCs choose to base their manufacturing in developing countries for a variety of reasons, but the main one is cost. Labour costs are much lower in many of these countries (see Source 10.14) and this allows TNCs to spend less on manufacturing and thereby increase their profit.

CASE STUDY

Apple – a global giant

Apple is one of the world's largest and most profitable multinational companies in the world today with annual revenues of over US$150 billion. The company began in 1976 and at the time proudly boasted that all of its computers were made in the United States. Now virtually all of the 159 million products it sells every year are made outside the United States, mostly in China. While the cost of labour was a major factor in moving to China, other considerations were also important.

Virtually all of the components used in Apple products such as glass screens and computer chips are also made in China, so it made sense to locate the assembly plant in the same place. Apple also found that Chinese plant owners and workers were much more flexible and willing to change than their American counterparts.



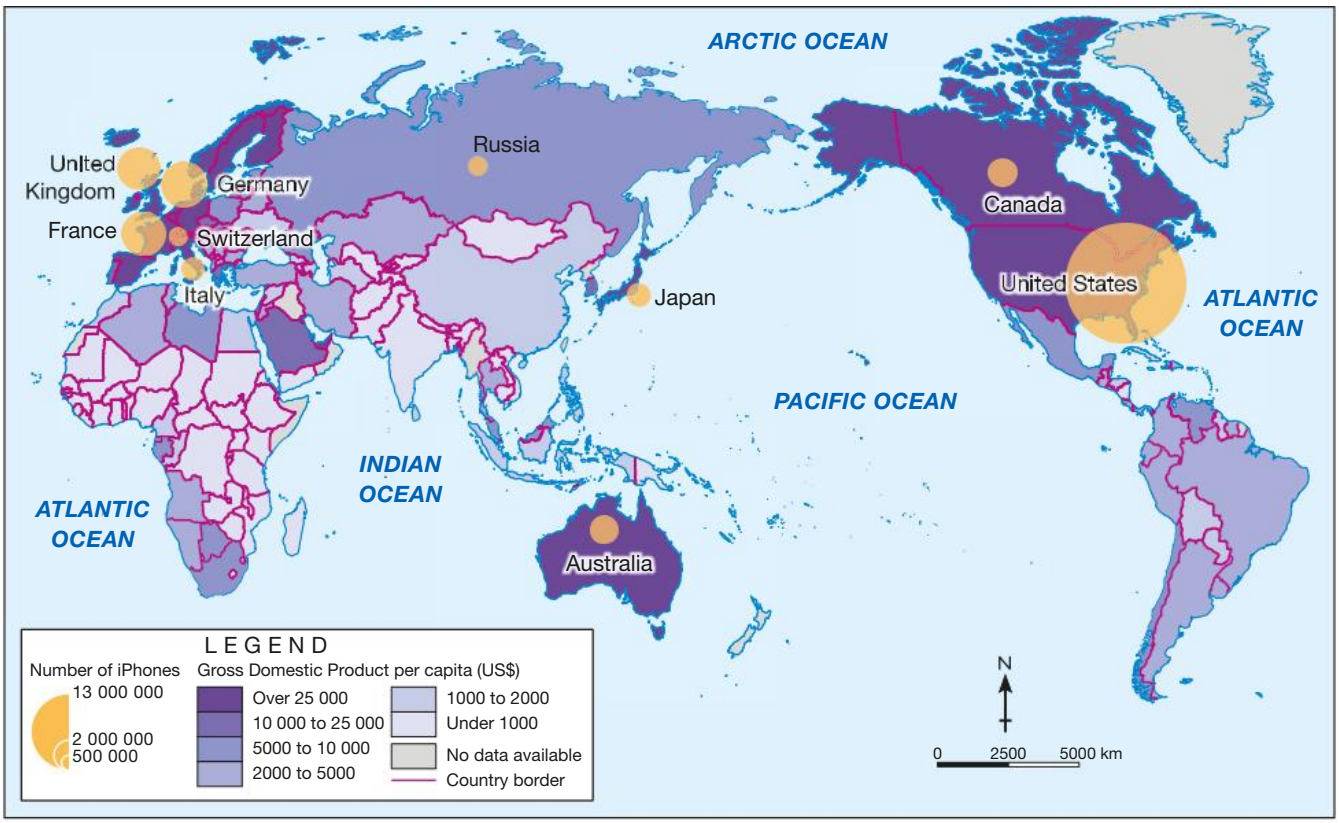
Source 10.15 Thousands of Chinese job seekers queue outside the Apple manufacturing plant in Shenzhen city, keen to become part of the global giant.

This is very important in a rapidly changing business such as electronics. The end result is that Apple can make an iPhone in China for about $8 in labour costs. The same phone would have labour costs of $73 in the United States.

Source 10.16 Top five smartphone vendors, market share and growth, 2013–14

Vendor	2013 market share (%)	2014 market share (%)	Growth (%)
Samsung	32.3	25.2	–3.9
Apple	13.0	11.9	12.4
Huawei	4.3	6.9	95.1
Lenovo	4.7	5.4	38.7
LG	12.1	14.5	19.8
Others	40.6	45.8	38.7

WORLD: GROSS DOMESTIC PRODUCT AND IPHONE OWNERSHIP



Source 10.17

Source: Oxford University Press

REVIEW 10.1.4

Remember and understand

1 What is a transnational corporation?

2 Explain why Apple is described as a transnational corporation.

Apply and analyse

3 According to Source 10.14, which two countries pay manufacturing workers the highest hourly wages? Which two countries pay the lowest? Why do you think this might be the case?

4 Explain why Apple decided to move its manufacture of iPhones from the United States to China. Use evidence from Source 10.14 to support your answer.

5 Examine Source 10.15. What does this photograph tell you about the supply of labour in China?

6 Examine Sources 10.15, 10.16 and 10.17 and answer these questions.

- **a** In which Chinese city are iPhones made?
- **b** Where are iPhones sold?
- **c** Suggest reasons for the substantial growth in market share of smartphone vendors Huawei and Lenovo.
- **d** What is the relationship between wealth (measured as **gross domestic product**) and the purchase of iPhones?
- **e** Compare the gross domestic products of the United States and China.

Investigate and create

Complete some further research to do the following activity.

7 With a partner, discuss who benefits from the business activities of TNCs in different countries around the world. Consider consumers and the labour force in your discussion. Collate your ideas and report back to the class.



10.1

CHECKPOINT

WHAT ARE THE CONSEQUENCES OF A GLOBALLY CONNECTED WORLD FOR PEOPLE AND PLACES?

- **Investigate the ways places and people are interconnected through trade in goods and services across a range of scales**

1 Why do people trade? [4 marks]
2 Identify two positive and two negative impacts of trade. [8 marks]
3 What is Australia's most valuable product and why might this become a problem in the future? [10 marks]
4 Who are Australia's four most important trading partners? Explain your choice. [12 marks]
5 Describe the factors that make a company a TNC. [6 marks]
6 Explain how global interconnections have allowed companies such as Apple to manufacture and sell so many devices globally and continue to make record profits. [10 marks]

TOTAL MARKS [/50]

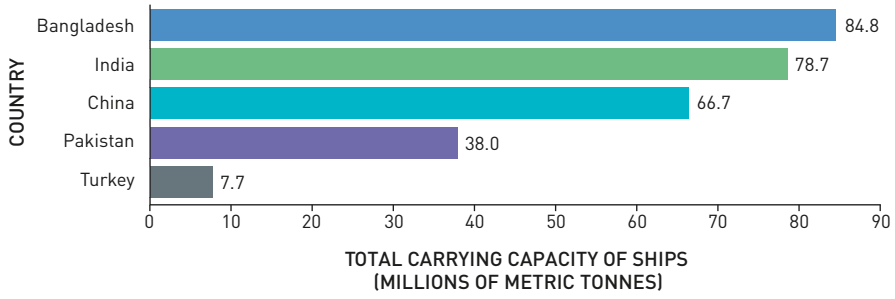
RICH TASKS

Task 1: Ship breakers

Examine Source 10.1 and then watch Tim Noonan's documentary *Ship breakers of Bangladesh* on YouTube. Next, study the quote and sources below before answering the questions.

> We all know how ships are born, how majestic vessels are nudged into the ocean with a bottle of champagne. But few of us know how they die. And hundreds of ships meet their death every year. From five-star ocean liners, to grubby freighters, literally dumped with all their steel, their asbestos, their toxins on the beaches of some the poorest countries in the world, countries like Bangladesh. You can't really believe how bad it is here, until you see it. It could be as close as you'll get to hell on earth, with the smoke, the fumes, and the heat.
>
> Bob Simon, 'The ship breakers of Bangladesh', *CBS News*, 29 August 2007

TOP FIVE SHIP-RECYCLING NATIONS, 2003–13



Source 10.18 Over the past decade, India has recycled more ships, but Bangladesh led in deadweight tonnage, meaning the biggest vessels generally ended up on its beaches. China and Turkey enforce more safety measures than the others and take steps to reduce the environmental impact.

Source: National Geographic

Acquiring geographical information

1 There are about 100 000 people in Asia employed as ship breakers. In what ways do these workers benefit from their employment?
2 Brainstorm the threats to health and safety for the workers at the Chittagong ship-breaking yard.
3 Identify the impacts of ship breaking on the coastal environment.

Processing geographical information

4 The ship-breaking industry was once concentrated in Europe but moved to India and Bangladesh after the 1970s. Why do you think the industry moved?
5 At least one man dies every week working as a ship breaker. Injuries are too numerous to count. Who is responsible? What could be done about it?

6 Ship yards buy the ships for around $5 million each and sell them in pieces for over $10 million. It has been suggested that this is an example of the developed world taking advantage of the developing world. Do you agree? Explain why or why not.

Task 2: Global brands, but who owns them?

Nestlé, based in Switzerland, is a brand you may have heard of. You may even use its products on a daily basis because it is a transnational corporation that deals mainly in the area of food and beverages.

In 2014, Nestlé had global sales of US$92.7 billion. Between 2013 and 2014, its global sales grew 4.5 per cent. It had operations in 197 countries, 442 factories in 86 countries and employed 339 000 people worldwide.

The following transnational corporations are also involved in the global food and beverage industry:

- Coca-Cola
- Unilever
- PepsiCo
- Danone
- Mars
- Kellogs
- General Mills
- Associated British Foods
- Mondelez International (formerly Kraft Foods).

Acquiring geographical information

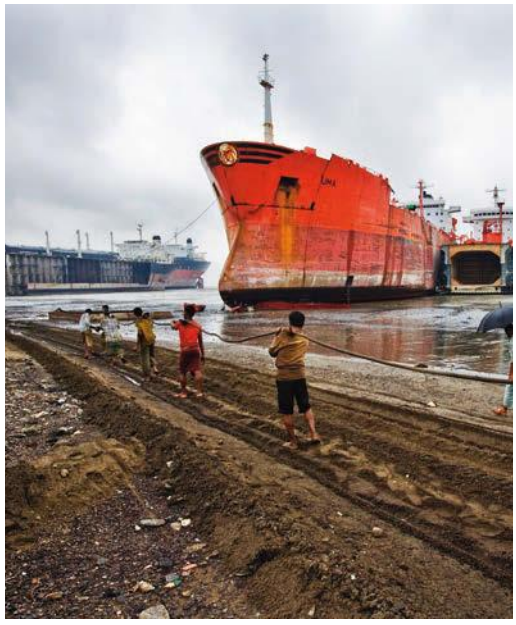
1 List any Nestlé products that you know.

2 Visit the Nestlé website and find its brands section. Make a list of 10 Nestlé products that you have used over the last month. How many of these 10 products did you know were manufactured by Nestlé?

Communicating geographical information

3 Research task. Choose one of the TNCs listed above. Go to its website and research the following information on the corporation to create an annotated visual display (AVD):
   - the logo of the TNC
   - the location of its head office
   - its global sales (US$) for 2014
   - the number of companies in which it operates
   - the number of factories it has around the world
   - the number of countries in which it has manufacturing plants (identify those countries on a world map in your AVD)
   - the number of people it employs globally
   - 10 of the TNC's brands or products:
     - Are those brands or products only food and beverage? If not, what other products does it manufacture?
     - How many of the 10 brands or products that you listed above do you have in your house? What are they?
     - Collect images of the 10 products.

4 Based on your knowledge of your chosen TNC, and of TNCs and globalisation in general, describe how a TNC is able to have manufacturing plants in many countries, sell its products to a global market, and have its global head office in yet another country. (Describe the advances in technology that have enabled companies to become truly transnational.)



Source 10.19 In Bangladesh, men desperate for work perform one of the world's most dangerous jobs.

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

» Concepts: Place, Space, Interconnection
» Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
» Tools: Maps, Graphs and statistics, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

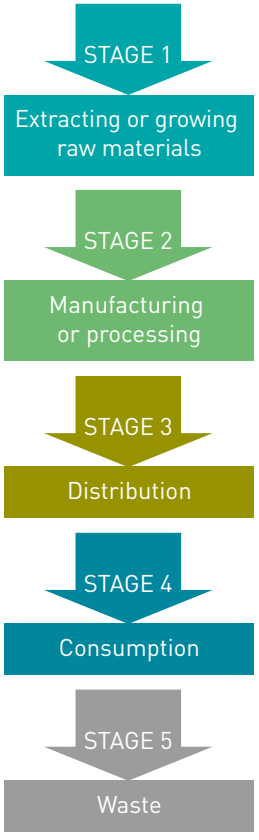
CHECKPOINT

10.2 STAGES OF PRODUCTION AND CONSUMPTION

WHY ARE INTER-CONNECTIONS IMPORTANT FOR THE FUTURE OF PLACES AND ENVIRONMENT?

As you have learnt, the production and consumption of goods around the world has brought change in both expected and unexpected ways to the lives of countless people. It has also changed the natural environment in many places and in many ways.

To help make sense of these changes geographers use a simple flow model known as the **supply chain**. Put simply, a supply chain is the journey of a product from its source to the consumer and then its disposal once it is used. You are surrounded by objects that have followed a series of supply chains to reach you. The main stages in supply chains are shown in Source 10.20.



Source 10.20 The main stages of the supply chain of production and consumption

Stage 1: Extracting or growing raw materials

All consumer goods begin as **raw materials**. They are dug from the ground, grown in farms and forests or taken from rivers and oceans. Raw materials include substances like oil, wood, water, metals and minerals. Most goods that we consume are made up of a combination of raw materials. A laptop computer, for example, contains at least 30 different minerals and even simple items such as a chair may contain three or four different materials. The processes involved in taking these raw materials impact on the natural environment at a range of scales from local to global.



Source 10.21 Growing produce is part of the first stage of production.

Stage 2: Manufacturing or processing

Most raw materials are processed in some way to transform them into useful consumer products. This may be as simple as washing, sorting and packaging tomatoes or other foods from farms, or it may be a very complex and intricate series of processes. An increasing trend is for different parts of the manufacturing process to occur in different places, often in different countries. This requires the movement of materials and partly manufactured goods around the world.



Source 10.22 Manufacturing or processing is the second stage of the supply chain.

Stage 3: Distribution

The manufactured goods must be transported to the consumer. The largest volumes of goods are moved by ships but planes, trains and trucks are also used. Goods are often taken to warehouses for storage and then to shops where they are accessed by the consumer, who then transports them to the place where they will be used.



Source 10.23 Stage 3 is distributing goods from one place to another.

Stage 4: Consumption

The use of goods and services is known as consumption. The volume of goods and services being consumed is growing rapidly. This is largely due to the growth of the world's total population and to increases in people's level of wellbeing. As more and more people are moving out of poverty, they are able to access more goods and services. This growth in consumption is bringing about great change to the natural environment, including supplies of fresh water and fertile soil. Perhaps most disturbingly, our consumption patterns are damaging the atmosphere and causing global changes to the climate.



Source 10.24 Consuming goods is a stage we are all familiar with.

Stage 5: Waste

We often forget what happens to goods once we have finished with them. While some are treated and recycled, others are simply dumped. As consumption increases, the amount of waste does, too. The availability of cheap replacements for many consumer goods means that broken or faulty goods are more likely to be thrown away than repaired. China generates an estimated 150 million tonnes of rubbish per year, and this is predicted to rise to 400 million tonnes by 2020, the equivalent of the world's entire rubbish production in 1997.



Source 10.25 After the consumption of goods, waste follows.

REVIEW 10.2.1

Remember and understand

1. Name the five stages of the supply chain.
2. Describe why the consumption of goods is increasing in many places around the world.

Apply and analyse

3. Explain how the global increase in consumption of goods impacts on the amount of waste produced. Give some examples in your response.
4. Name three raw materials that go into a product that your household uses every day.
5. Describe some of the ways in which people try to reduce the amount of household waste they generate.

Investigate and create

6. Rank the five stages in the supply chain from the one that causes the greatest impact on the natural environment to the one that causes the least. Explain your rankings to a partner and then discuss them with your class.
7. Select a common consumer item such as a toothbrush, chocolate bar or packet of biscuits. Look carefully at the item and write down all the materials in it. Use your research skills to trace the supply chain of these materials back to their sources.

BENEFITS OF GLOBAL TRADE FOR PEOPLE



Source 10.26 Nike employs more than one million people in 777 factories in 43 countries, including China. It began as a single factory in the United States but now only 1 per cent of its workers are employed in that country.

Benefits for individuals

Global trade means that you are now linked to manufacturers all over the world. This means that you can buy a wider range of products at cheaper prices than ever before. You are not restricted to paying for services or buying goods made in your local area, or even in your own country. Because of an intricate web of connections involving people from many countries you now have access to the global marketplace.

Online trade is spreading fast. As just one example, Australians have embraced online shopping for clothes at a remarkable rate. A single company, the British fashion site ASOS, racks up a purchase from Australia every 6 seconds, and is flying four jumbo jets of clothing into Australia every single week.

Not only do the buyers of goods and services benefit from global trade – there are also enormous benefits for the people that supply them. Employment and wealth has been created for hundreds of millions of people. This has improved living standards and life expectancies in many places and helped to pull people out of poverty. It is estimated, for example, that there are 600 million fewer people living in poverty in China today than was the case 30 years ago. This is largely because China has been transformed from an economy based on farming, supplying itself, to one based on manufacturing, supplying the world.

Benefits for businesses

Businesses are now linked to buyers from around the world. This means they may be able to sell more products to more people. They may also be able to access cheaper raw materials such as coal, iron and cotton from other places. These interconnections allow them to keep their costs down and sales up, which creates higher profits.

As well as accessing cheaper materials from other countries many companies have moved much of their manufacturing base to other countries. This is often done to take advantage of lower labour costs in these countries. Many products in Australian stores carrying the labels of Australian companies, for example, are made in places such as Vietnam, China, Bangladesh and Fiji.



Source 10.27 Australian shoppers have access to goods from all over the world.

Benefits of global trade for nations

Most nations around the world have welcomed the opportunities that closer links between nations have brought. Many have found that the benefits are greater if they specialise in a particular product or service. This is known as comparative advantage. If, for example, you can buy cheap cars from other places then you don't have to make your own. You can focus on producing





Source 10.28 The Indian film industry, part of which is known as Bollywood, is the largest in the world. India has a comparative advantage in film-making based on its large population, technical knowledge and fine weather.

another product such as clothing or electronics. If you are able to make these better or cheaper than any other country then you will capture the market.

There is also movement of money, ideas, knowledge and technology between countries. Ideas and advances in medicine, education and business can move quickly around the world. This can help to remove cultural barriers that often exist between countries, including language and religious differences. Sharing knowledge and ideas in this way also helps us move towards what is known as the 'global village'.

Some aspects of globalisation benefit people, businesses and entire nations. Bollywood, the Hindi-language part of the Indian film industry, is an example of this. The volume of movies produced means that individual actors (both Indian and international), dancers, musicians and other film professionals benefit from employment in the industry. Businesses reap the rewards on both small and large scales. Supporting businesses (catering or lighting businesses for example) enjoy employment and, on a wider scale, the film industry at large benefits from the continued success of Bollywood films. The nation benefits, too, in many ways, just one of which is the increased awareness of Indian culture on a global level.



REVIEW 10.2.2

Remember and understand

1 Describe some of the ways in which you benefit from global trade.
2 In what ways does the increasing globalisation of trade benefit other people?

Apply and analyse

3 Explain how global trade can help to reduce poverty.
4 Describe how the Indian film industry helps to break down cultural barriers.
5 Describe the ways in which the Chinese economy transformed over the last 40 years.
6 Many businesses that use cheaper labour in developing countries are often reluctant to reveal this. Explain why you think this is the case.

Investigate and create

7 Draw a diagram or find an image that sums up the concept of a global village to be displayed on your classroom wall. Examine the range of images submitted by your class and discuss the different ways you and your classmates have chosen to represent the idea.

CONSEQUENCES OF GLOBAL TRADE FOR PEOPLE IN AUSTRALIA

Australia is an active participant in the movement of goods and services around the world. We are the 55th largest country in terms of our population but the 23rd biggest exporter and the 21st biggest importer. Each year, around $500 billion worth of goods and services move between Australia and other countries. This trade brings many benefits to Australian individuals and businesses and to the country as a whole.



Source 10.29 These overseas students are studying at the University of Sydney. Chinese students are the largest group of overseas graduates there followed by those from India, South Korea, Malaysia and Brazil.

Benefits for individuals

Millions of Australians are employed in industries that export goods and services. These include agriculture, mining and tourism. Many others work in industries such as retail and manufacturing that rely on imported goods and services. This trade creates wealth and prosperity for these people and for the nation as a whole.

Australia's largest service export is education. There are more than 400 000 citizens of other countries enrolled in Australian universities and other education providers. This generates more than $16 billion of export earnings for Australia every year. As well as the financial benefits, Australia also receives other benefits. Many of these students apply to stay in Australia when they have finished their education and this leads to an increased number of people in many occupations, including medicine and education. Those that return to their home countries improve the level of skills in those countries and often help to improve levels of wellbeing.

Benefits for Australian businesses

Many Australian businesses have been able to take advantage of the increasing trade connections between people and places to become major players on the world stage. This includes Australian mining companies that have dominated world trade in minerals such as iron ore, coal and gold, as well as smaller companies that have developed uniquely designed products. Australian surf-wear brands are a good example of this.

Benefits of global trade for the Australian nation

It is difficult to work out exactly how much individual countries benefit from increasing trade links. Most researchers, however, agree that Australia has gained much from our greater interconnections since the 1970s. From this time we began to expand our range of trading partners from traditional markets such as the United Kingdom and New Zealand to markets throughout the world, particularly in Asia. Australian governments continue to try and reduce barriers to trade around the world and have done so for decades.

About one in every seven Australian workers is now employed in the production of exports. The figures are particularly high for those in mining (seven in every 10), farming (four in every 10) and manufacturing metal products (three in every 10). This brings extra revenue to the whole country through taxes and levies on workers and companies and has the potential to improve the wellbeing of many Australians. This has been particularly significant for many Indigenous Australians who have traditionally worked in agriculture. Many have also found employment in the booming mining sector.

CASE STUDY

Crumpler

The Australian brand Crumpler, most famous as the designer and supplier of distinctive messenger bags, is an example of an Australian business that has benefited from the interconnections of global trade.

Crumpler has stores across Australia and all over the world, including in Japan, the United States, Canada, the Philippines, Singapore and China. The head office is in Berlin, Germany. A key factor of the brand's success has been the high level of international sales, with stores supported by online sales and distributors in many other countries as well.

Crumpler has 1500 Twitter followers and almost 10 000 likes on Facebook, extending its global reach and consolidating its urban 'street' image.



Source 10.30 Crumpler is an example of an Australian company that has achieved global success.

Multiculturalism

The interconnections that come with global trade can bring many benefits apart from financial ones. As people move to or communicate with those from other places, there is a natural sharing that occurs. This can enrich the cultural landscape, as aspects of life such as language, religious tradition, art and food are shared and integrated with or added to the existing culture.

Sharing a different range of experiences and learning about different ways of doing things can have many positive results. Multiculturalism can broaden our outlook, lead us to interests or hobbies we wouldn't have otherwise heard about, or create opportunities to do further study or travel. This kind of sharing can also promote mutual understanding and acceptance of others' differences (see Source 10.31). This in turn may lead to a more harmonious society that is accepting of diversity.

From an economic perspective, a successful multicultural society makes Australia an attractive destination for tourism, education and business.



Source 10.31 There are many benefits that come with the interconnection that accompanies global trade. Learning about other cultures and food traditions are just a couple of them.

REVIEW 10.2.3

Remember and understand

1 Describe the ways in which Chinese citizens studying in Australia can bring benefits to both countries.

2 Describe how Australia's global trade connections changed during the 1970s.

Apply and analyse

3 Australia has a comparative advantage in providing a university education when compared to many other countries.
   - **a** Define 'comparative advantage'.
   - **b** Work with a partner to brainstorm the reasons for this advantage and then discuss this with your class.

4 Read the case study about Crumpler.
   - **a** Use the key concept of interconnection to explain the business operations of Crumpler.
   - **b** List five ways that Crumpler benefits from being interconnected with places all around the world.

Investigate and create

5 Examine Source 10.31 and suggest other examples of the positive effects of multiculturalism apart from the ones shown.

NEGATIVE CONSEQUENCES OF GLOBAL TRADE FOR PEOPLE

Global trade has the potential to bring benefits to people and to places. It is a leading contributor to reducing poverty in many places and provides wealth and prosperity for countless people. However, these benefits often come at significant economic and social cost to other people in other countries. This takes place at individual, business and national levels.

Drawbacks for individuals

Many companies that are based in developed countries actually manufacture their goods in developing countries. This is usually to take advantage of the cheaper labour that is available in these developing countries. While this provides jobs and income for millions of people, manufacturing in developing countries does come at a cost. Workers are paid much less than those who perform similar tasks in developed countries and they often work in appalling conditions.

The demand for cheap labour and high levels of poverty mean that child labour is used in some countries. There are estimated to be over 200 million children working in the world. Most of these children work on small family farms in developing countries, but around 160 000 of them work in manufacturing.



Countries with high levels of child labour tend to share similar characteristics. These include:

- high fertility rates and a large percentage of the population being under the age of 15
- low rates of school attendance and low levels of literacy
- low levels of technology in comparison to other countries with whom they are competing
- a lack of government policies to deal with child labour
- large numbers of people living in poverty.



Source 10.32 Workers in a clothing factory in Dhaka, Bangladesh

Drawbacks for businesses

The interconnections that link the consumer to the person who made their product have, in some cases, become so complex that businesses lose control of the process. In Asian countries such as India and Bangladesh, for example, it is common practice for manufacturing plants to 'outsource' parts of their operations to smaller factories. They, in turn, may also outsource parts of the operations. The company executives in an office on the other side of the world then have little idea of the factories they are actually using, or whether they are involved in unsafe work practices. It also makes it difficult to maintain quality controls on the products. Additionally, there may be a backlash from consumers in the developed world once these practices become known to them.

Drawbacks for nations

Many critics of the growth in trade between countries believe that it benefits the people and businesses of the developed world at the expense of those in developing countries. These poorer countries are seen only as a source of cheap raw materials and labour. This, they argue, tends to widen the gap in wellbeing between wealthy and poor countries.

Another criticism of increased globalisation in trade is that problems in one place can affect many other places very quickly. In 2008, a dramatic fall in house prices in the United States triggered a global financial crisis and caused banks and investment companies to collapse throughout the developed world. Many companies were forced to close and spending on consumer goods fell dramatically. As developed countries reduced their consumer spending, imports went down and hundreds of thousands of people in developing countries were also plunged into poverty.

Financial problems are not the only things to spread quickly. Greater global trade may also result in the spread of infectious diseases between regions of the world as people travel more frequently for trade. In 2002–03, a respiratory disease, SARS, was spread by tourists from its origins in China to many other countries. By the time the epidemic finished it had killed more than 8000 people in 17 countries. Outbreaks of bird flu and other health concerns such as norovirus can also be spread quickly by people who are travelling around the world for business.



Source 10.33 These protesters in South Korea are campaigning against a G20 meeting of the leaders of the world's wealthiest nations. Many people are concerned that increasing global trade results in a widening gap between rich and poor countries.

REVIEW 10.2.4

Remember and understand

1. Describe why many children in developing countries work rather than go to school.
2. What is outsourcing? How can it negatively affect people and businesses?
3. Factories such as the one in Source 10.32 are often called 'sweat shops'. Why do you think this is the case?

Apply and analyse

4. Examine Source 10.32.
   - **a** Estimate the number of workers in this room.
   - **b** Estimate the percentage of women workers.
   - **c** What are the roles of men in this factory? What does this tell you about gender roles in this place?
5. Imagine that you work in the clothing factory shown in Source 10.32. Describe a day at work.

Investigate and create

6. Examine Source 10.33. Create a table listing both the benefits and the costs of global trade. Discuss which groups in society are likely to be opposed to globalisation and which would support it.

EFFECTS OF GLOBAL TRADE ON PEOPLE AND CULTURE



Source 10.34
The imbalance in distribution of available food is one negative impact that globalisation has had on people in different places around the world. Here, Chinese children attend a weight-loss camp.

Geographers use the word 'culture' to describe the characteristics of a particular group of people. Culture can be a difficult topic to study because it is an abstract concept and is not something tangible like, say, a mountain or a tree – it is not 'real' in the sense that we cannot touch it. Geographers, therefore, tend to study the products of culture. These include objects such as buildings, statues and clothing, as well as expressions of culture such as language, religion, art, food, music and dance.

Another thing that makes culture difficult to study is that it is constantly changing. Cultures grow and decline or adapt to new influences all the time. With the rapid increase in the movement of goods, services, people and ideas that has occurred in the last few decades, many cultures have changed.

Here, we will examine the ways that global trade affects people and culture. Sometimes these changes have positive outcomes for the culture of a certain country. At other times, the results can be unplanned, more serious than forecast, or have serious and negative impacts.

Negative effects of global trade on people and culture

The term **cultural erosion** has been developed to describe the loss of cultural diversity that is occurring in many places. This is due in part to new ideas, new products and new ways of doing things entering a culture. Examples include the spread of food, drink, clothing, music, movies and language from dominant cultures, particularly the United States.

One impact of cultural erosion is a loss of languages. More than 40 per cent of the world's 7000 languages are considered to be endangered and more than 200 have become extinct in the last few decades. Languages become endangered and then extinct when people stop using them. This can happen for a variety of reasons including the dominance of only a few languages in education, politics and trade. Those who do not speak the dominant language are at a disadvantage.

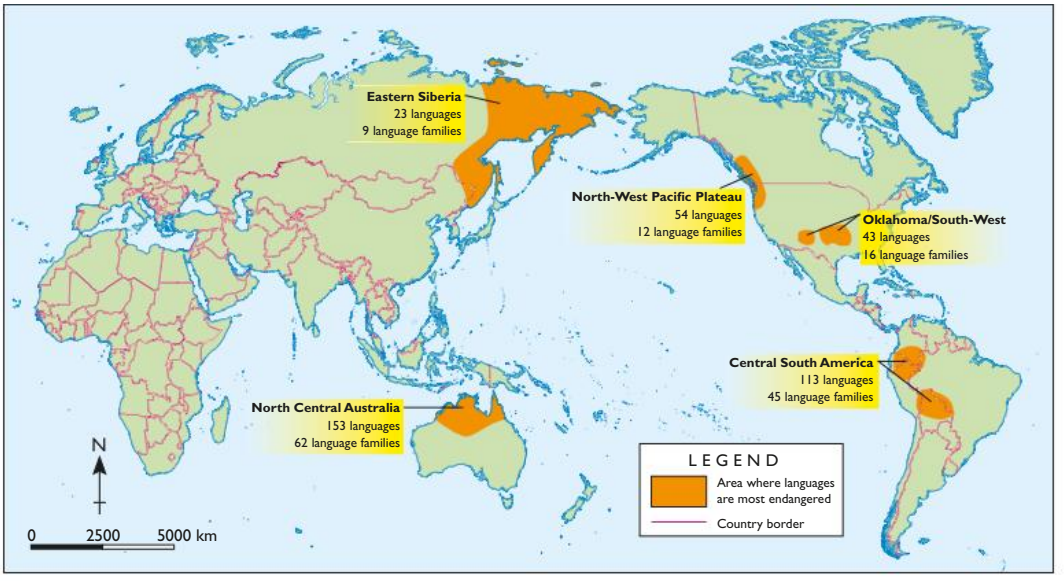
Places where language families (groups of languages that have descended from the same 'ancestor' language) are endangered are shown in Source 10.35.

Positive effects of global trade on people and culture

Increased links between people and places have the potential to erode cultures but can also bring cultural benefits. Modern information and communication technologies (ICT) have brought people closer together. They help people to better understand cultures different from their own and to share ideas and knowledge.

These interconnections can create a greater awareness of people and cultures in other places. This often leads to a greater respect of cultural diversity and a better understanding of the ways in which various cultural identities are formed, changed and threatened. ICT also

WORLD: ENDANGERED LANGUAGE HOT SPOTS



Source 10.35

Source: Oxford University Press

allows individuals to tell their own stories rather than rely on governments and the traditional media to tell them.

For example, deep in the heart of one of the world's great wilderness areas, the Amazon rainforest, Indigenous tribes are using modern tools to fight back against illegal logging that threatens their culture: GPS, the Internet, mobile phones and Google Earth. They photograph loggers entering the forest, plot their location using GPS and inform authorities who can then send out a team to arrest the loggers. The Indigenous tribes are also linked through email, Skype and Facebook to thousands of supporters around the world.



Source 10.36 The chief of the Surui tribe in Brazil with his laptop computer. He uses his laptop for communication, in order to protest and protect his culture and his rainforest home.

REVIEW 10.2.5

Remember and understand

1 Describe how global interconnectedness has led to a greater understanding of cultural differences.

2 Define 'cultural erosion'.

Apply and analyse

3 Examine Source 10.35.

- **a** Of the language hot spots identified, which has the greatest number of threatened languages?
- **b** Describe the likely threats to language in this region.

4 Describe how the Surui tribe in Brazil uses ICT to protect their culture. In a small group discuss other ways in which ICT can lead to a greater understanding of other cultures. Report back to your classmates.

Investigate and create

5 Brainstorm the ways in which cultures can be strengthened by increased contact with other cultures around the world.

6 Do you think it matters if a language becomes extinct? Give some reasons for your answer.

EFFECTS OF GLOBALISATION ON INDIGENOUS PEOPLES

The original inhabitants of a region or country are known as its Indigenous people. These communities often developed a way of life suited to the natural environment in which they lived without influence and interference from the outside world.

With increased links between people and places, Indigenous peoples and their cultures have been threatened by the expansion of dominant cultures, or from the arrival of new people and cultural groups.

As people from different cultures have moved around the world and settled in new places, they have often come into contact with the Indigenous peoples. In some cases this first contact has been friendly, while in other cases conflict has broken out. Whatever the nature of the first contact, the long-term effects are largely negative for Indigenous peoples. They often become a minority in their own country and suffer from widespread prejudice and discrimination. As a result, their unique culture is threatened and may become extinct.

The United Nations estimates that there are almost 5000 Indigenous groups in the world today. In total, this accounts for about 370 million Indigenous peoples living in 70 countries. Australia is home to two groups of Indigenous peoples – Aboriginal Australians and Torres Strait Islanders.

The world map (Source 10.37) and the information provided below give examples of some of the Indigenous cultures currently threatened by new global links, and explain how they have been affected.



1 The Saami

The Saami are the Indigenous people of northern Europe, living in parts of Norway, Sweden, Finland and Russia. The Saami are traditionally semi-nomadic reindeer herders, but globalisation has brought changes to their way of life. Today, many Saami have modernised and now use snowmobiles and helicopters to herd the reindeer. However, pasture land for the reindeer is becoming limited as oil and gas mining are developed on traditional Saami lands. The oil and gas is refined and shipped around the world. The Saami are facing other environmental threats from dam building, logging and the effects of climate change.



2 The Masai

The Masai are the semi-nomadic people of East Africa, and live in southern Kenya and northern Tanzania. The Masai have been subjected to eviction and to opposition to their semi-nomadic lifestyle over many years. Masai lands in Kenya were reduced by 60 per cent at the beginning of the 20th century, when the British took the lands to build ranches, then later, wildlife reserves and national parks. Today, loss of land to large-scale private farms and game parks for international tourists has made nomadic grazing impossible for the Masai. Many Masai now live in towns or depend on tourism for survival.



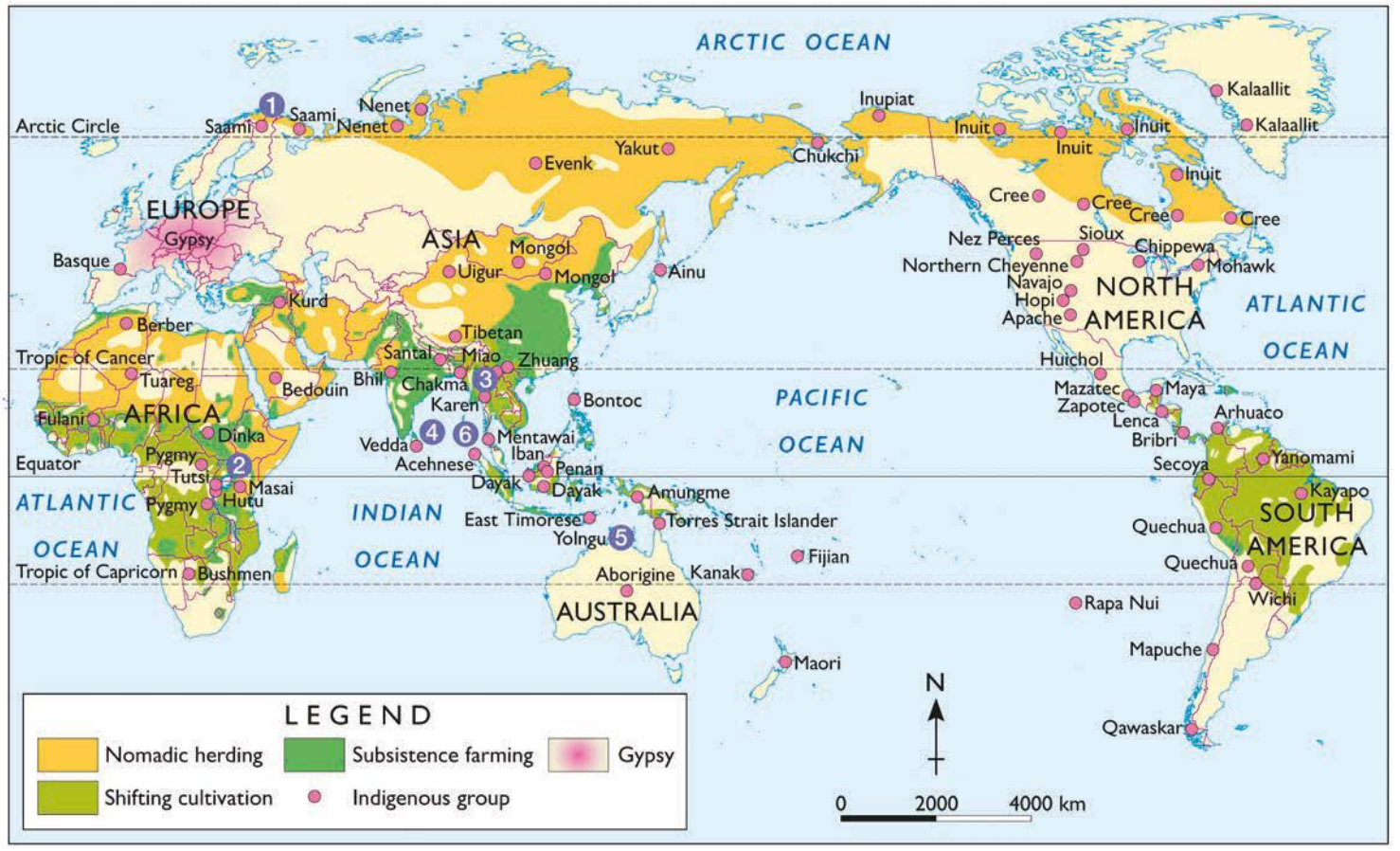
3 The Karen

The Karen are an Indigenous group from Myanmar (Burma) who have long fought for their own homeland. Possibly the most recognisable Karen are the Red Karen, or Kayah, a subgroup whose females wear a series of brass rings to make their necks appear longer. Located in a political hot spot, the culture and lifestyle of the Karen have long been under threat from political tensions and military action in Myanmar. There are estimated to be 200 000 Karen hiding in the jungle from the Burmese army, and many Karen have fled across the border to Thailand. Here, they find themselves in refugee camps, or in villages where they are little more than a tourist attraction.



4 The Vedda

The Vedda people are Indigenous to Eastern Sri Lanka, and were originally forest dwellers. The Vedda people have been exploited for centuries by outsiders wanting their land. This land has been turned from forest to housing developments and government parkland. The Vedda have been banned from the parkland areas. Those who do still try to hunt risk being arrested or even shot by park guards.



Source 10.37

Source: Oxford University Press



5 The Yolngu

Yolngu is the name the Indigenous people of East Arnhem Land give themselves. Arnhem Land, in the Northern Territory of Australia, is owned solely by the Yolngu people, who are under threat from mining interests in the region. They are attempting to balance the needs of their traditional Aboriginal heritage with the demands of the mining industry, an industry that is a huge business for Australia. Some argue that while there are serious problems within their own communities – health, poverty and substance abuse – Yolngu manage a way of life that blends Western technology with traditions that have been passed through generations.



6 The Mentawai

The Mentawai are the native people of the Mentawai Islands in Indonesia. The Mentawai have traditionally relied on the rainforests of the Mentawai Islands for all their needs. Today, rapid change has led to the clearance of forests, replacing the forests with profitable palm oil plantations. As a result, the Indonesian Government has relocated many Mentawai to villages where they are unable to follow their traditional ways. They now suffer high rates of poverty and disease. The Mentawai Islands are popular with international surf tourists and the Mentawai have found themselves the unlikely beneficiaries of Internet connections via groups such as Surfaid, which aims to help people in isolated areas. Surfaid's members are connected through surfing.

REVIEW 10.2.6

Remember and understand

1 Explain why Indigenous populations often decline when settlers from other places arrive.

2 Describe the type of environment the Saami live in.

Apply and analyse

3 List one forest-dwelling Indigenous group. Describe the threats to their way of life that forest-dwelling Indigenous groups face.

4 Identify what the Masai and the Mentawai have in common.

5 Explain how technology has changed the way of life of one Indigenous group.

Investigate and create

6 Make a list of the ways in which Indigenous cultures are changing. Construct a flow diagram showing how some or all of these changes are connected to each other.

7 Select one of the Indigenous groups described on these pages. Research the issue described and report back to your class on the ways in which this group is changing.

EFFECTS OF EXTRACTING OR GROWING RAW MATERIALS ON PLACES

The first stage in the supply chain of production and consumption is extracting or growing raw materials. Extracting includes activities such as mining (of gold, minerals, uranium and so on) or taking natural gas or petroleum from the Earth to use for energy (to heat, cook and generate electricity) and fuel.

We also grow crops to provide the raw materials to produce food (wheat, which is used to make bread) or clothing (such as cotton).



Accessing the raw materials that are used to supply our needs and wants can bring about many changes in the natural environment. Extracting raw materials from the Earth, such as the minerals that go into many everyday items we use, can cause erosion, a loss of biodiversity and contamination of soil and waterways.

If the raw materials are grown, fresh water and soil systems can be affected. Intensive farming can cause soil degradation, water scarcity and salinity in places.

CASE STUDY

Grasberg mine, Papua, Indonesia

The Grasberg mine, located in the Indonesian province of Papua on the island of New Guinea, is the third largest copper mine and the largest gold mine in the world. Its gold reserves are estimated to be worth over $20 billion and it also contains the world's largest deposit of copper.

The mine is located high in the mountains that run the length of the island. The mining company also controls much of the land between the mine and the coast, a distance of 80 kilometres. This land is used to house the miners and to grow food for them.

In the mining operation, vast amounts of water are used and the refuse from the mining process (known as **tailings**) washes into the river systems. These tailings contain silt, and this silt is changing the patterns of river flow below the mine. Most of the sediment flows into the Ajkwa river system. This river system naturally carries up to 20 000 tonnes of sediment a day, but the mining operation is dumping an additional 238 000 tonnes a day into the river. This extra sediment is collecting in the lower reaches of the river, greatly altering the river system. Much of the sediment has ended up as a large plain, which has now grown to 166 square kilometres.

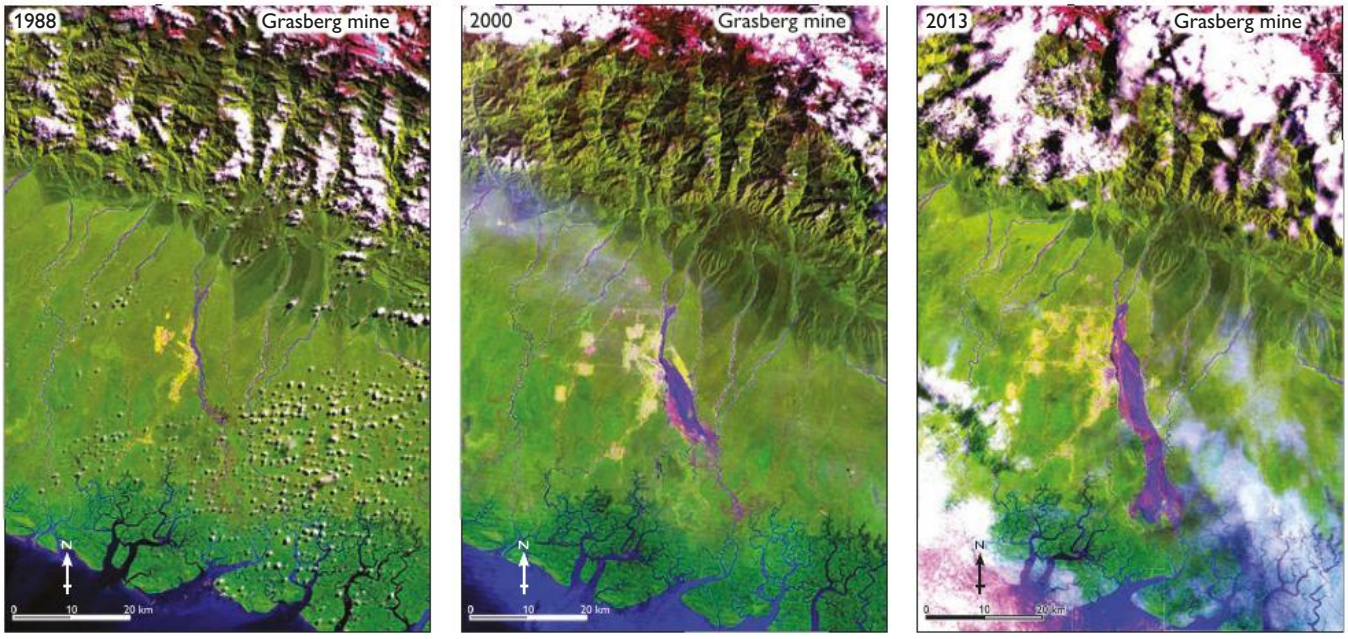
One billion tonnes of sediment have already been added to the river system. There is so much sediment that the river has ceased to flow in some places. The mining company has built a series of levees in an attempt to contain the sediment and to channel it towards the sea.



Source 10.38 The Grasberg mine in Papua, Indonesia, is an example of the process of extracting raw materials. The mine itself can be seen as a dark hole in this satellite image.

Independent reports have found that the mine is creating many other environmental problems. These include:

- dissolved copper, acids and sediments in the water supply at more than 100 times the legal limit
- unstable rock piles up to 270 metres high that sometimes collapse
- landslides due to the changing shape of hillsides
- poisoning and death of fish from polluted rivers
- risk to animals and birds that rely on the fish as a food supply
- loss of shellfish in the river estuary
- loss of mangroves along the coast and rainforest in the plain below the dam
- large areas of rainforest destroyed for settlement, agriculture and tailings.



Source 10.39 These satellite images, taken in 1988, 2000 and 2013, show changes to the Ajkwa River over time. In these false-colour images, pink shows areas of dry tailings and bare soil, and blue shows tailings of waste deposits. Black shows areas of water, while light green areas are disturbed vegetation.

REVIEW 10.2.7

Remember and understand

1 What minerals are mined at the Grasberg mine?

2 Describe the location of the Grasberg mine. Locate this region in your atlas.

Apply and analyse

3 Explain the sediment problems caused by the Grasberg mine in your own words.

Investigate and create

4 Create a sketch map of the area shown in Source 10.39. Use a legend to show:

- areas of disturbed vegetation in 1988
- areas of disturbed vegetation between 1988 and 2013
- tailings in 1988
- tailings in 2013.

5 List the environmental effects of the Grasberg mine, ranking them from greatest impact to smallest.

6 Explain why this case study is an example of the key concept of interconnection.

EFFECTS OF MANUFACTURING AND PROCESSING ON PLACES



Source 10.40 A paper mill in the United States. For decades, the US was the world's largest producer of paper but has recently been overtaken by China.

Once raw materials have either been extracted from the Earth or grown, they go through the next stage of production. This is the manufacturing or processing stage.

Virtually every product you use or consume has been processed in some way, or is entirely manufactured. This includes the food you eat, the clothes you wear, the transport you use and the things you consume such as paper, plastic, furniture and appliances. The processing of raw materials into these and millions of other consumer items impacts on the natural environment in many ways.

The impact this has on places depends on the type of product manufactured. Manufacturing car tyres, for example, may result in chemical emissions to air, water and soil. Manufacturing aluminium – used in products ranging from bottle tops and soft drinks to outdoor furniture and building construction – produces greenhouse gases that are released into the environment.

The manufacturing process

Different processing industries have varying levels and kinds of environmental impact. Here we will examine the example of woodchip processing for paper production and the effects it has on the environment.

Woodchip processing for paper production

On average every Australian consumes about 200 kilograms of paper each year, two-thirds of which is imported. Paper is usually manufactured from trees. The trees are cut down and transported to a mill where they are converted into woodchips. The chips are then ground and cooked in a chemical solution to produce pulp. Chemicals such as bleaches and titanium oxide as well as fillers such as clay and chalk are added to the pulp, which is then filtered and squeezed between giant rollers to produce paper.



"What a coincidence, this letter complaining about our paper mill polluting the river is written on notepaper printed there."

Source 10.41 What does this cartoon say to you about the effects of manufacturing and processing?

These processes impact the environment in several ways. Removing trees contributes to global climate change, as does transporting them to the paper mill. Mills use large amounts of electricity, which often comes from burning **fossil fuels**, another climate change contributor. Mills use thousands of litres of water to produce paper, and they release chemicals such as sulphur dioxide into the air. Chemicals used in the process may also be released into nearby streams and rivers.

Studies in the United States have found that the paper industry is the largest consumer of water per tonne of finished product in the country. It is also the third-largest user of energy. The industry is the fourth-largest water polluter and the third-largest air polluter. It has been estimated that each tonne of recycled paper saves 13 trees, more than 30 000 litres of water and 2.5 barrels of oil.

CASE STUDY

Manufacturing in China

China is now the world's leading manufacturer, having taken the top spot from the United States since 2010. Manufacturing has grown in China due to a range of factors, including opening up the country to foreign trade, the modernisation of Chinese factories and transport networks, and the movement of Chinese people from farms to cities in search of work. This has led to improved levels of wellbeing for hundreds of millions of people living in China. These rapid changes have, however, come at a cost to the natural environment.



Source 10.42 A worker at a Chinese steel mill checks the blast furnace. China is the world's leading steel producer. Most Chinese steel is made from Australian iron ore.

Air pollution

About two-thirds of China's energy for producing electricity, heating and cooking comes from burning coal, the cheapest but most polluting way to get energy. China is now home to 16 of the 20 most air-polluted cities on the planet (see Source 10.43). A third of China's urban residents are exposed to harmful levels of pollution resulting in a rise in cancers, asthma and birth defects. A UN study found that outdoor air pollution is associated with some 300 000 deaths and 20 million cases of respiratory illness in China each year.

Water scarcity

Many communities in China face water scarcity due to the over-extraction of water for industry or from water pollution. Some studies have found that more than 70 per cent of China's rivers and lakes are polluted and that more than 300 million people nationwide have no access to clean water. This drastically affects their wellbeing as they are more susceptible to water-borne diseases and food insecurity.

Source 10.43 Chinese cities with the highest levels of air pollution, measured by the amount of small particles considered dangerous to health in the air (a reading of 20 is considered the safe limit).

Cities with between 4 to 5 times the safe limit of air pollution		Cities with more than 5 times the safe limit of air pollution			
Changchun (85)	Shanghai (81)	Beijing (121)	Hefei (111)	Shenyang (110)	Urumqi (140)
Changsha (92)	Yinchuan (90)	Chengdu (111)	Jinan (123)	Shijiazhuang (104)	Wuhan (105)
Hangzhou (97)	Zhengzhou (99)	Chongqing (105)	Lanzhou (150)	Taiyuan (106)	Xi'an (113)
		Harbin (101)	Nanjing (100)	Tianjin (101)	Xining (141)

Acid rain

The burning of coal during the manufacturing and processing stage releases large clouds of sulphur dioxide, producing acid rain over 30 per cent of the country. Acid rain is caused when certain pollutants in the atmosphere mix with the moisture (water vapour) in clouds and become acidic. The clouds may carry the dangerous cocktail many kilometres, and when rain falls it poisons the water and soils, killing fish populations and forests. It also affects the yields of crops grown by farmers to feed China's millions. Sulphur dioxide produced by cars and nitrogen oxides from farming fertilisers also contribute to the problem. Acid rain falls on one-third of China's territory and 70 per cent of China's rivers and lakes are so full of toxins that they can no longer be used for drinking water.

REVIEW 10.2.8

Remember and understand

1 Describe how paper production affects the natural environment.
2 What is acid rain?
3 Explain why some communities in China suffer from water scarcity. How can this lead to lower levels of wellbeing?

Apply and analyse

4 Describe why the environmental impact of manufacturing is often greater in developing countries.
5 Examine Source 10.41. What point is this cartoonist making?

Investigate and create

6 Research the process of making concrete. What are the main ingredients in concrete, where do they come from and how does this impact on the environment?

EFFECTS OF DISTRIBUTION ON PLACES

After raw materials have been grown or extracted, then processed or manufactured, the resulting products are distributed. This is stage 3 in the supply chain. Distribution – transporting a product from one place to another – is a by-product of the way we frequently purchase and use things from all around the world. A product may travel many thousands of kilometres before it reaches us, by means including freight train, truck, aeroplane, shipping container and courier. The effects of distribution are many, and include direct impacts (emissions of carbon dioxide from fuel, for example) and indirect impacts such as traffic congestion and urban sprawl.



Source 10.44 Oil from the grounded *Exxon Valdez* ship affected 1770 kilometres of coastline and 28 000 square kilometres of ocean – an area approximately 10 times the size of the ACT.

Shipping

About 8 billion tonnes of goods are transported on ships every year. This represents more than 90 per cent of global trade. Ships are the most efficient form of moving large amounts of goods because of their large carrying capacity, and the lower ratio of emissions they produce. Cargo ships, for example, produce one-tenth of the greenhouse gases of trucks for every tonne of goods carried and about one-fiftieth of the gases produced by aeroplanes.

Shipping does, however, impact on the natural environment in other ways. Although the number of shipping accidents that result in oil spills has declined in recent years, they still have the potential to cause great damage to the natural environment. One of the worst shipping disasters occurred in 1989, when an oil tanker, the *Exxon Valdez*, ran aground in Prince William Sound, Alaska. Eight of its 11 tanks were damaged, spilling more than 40 million litres of crude oil into the sea. This resulted in the deaths of up to half a million seabirds, 1000 sea otters, 300 seals and 250 bald eagles. Billions of salmon and herring eggs were also destroyed.

To remain stable, ships carry water in their holds. Known as ballast water it is pumped into the ship's hold from the sea at the start of its journey and then carried to the next port where it is discharged back into the sea. Between 3 and 5 billion tonnes of ballast water is moved around the world every year. The ballast water keeps ships and sailors safe but it also carries marine organisms, including starfish and molluscs. It has been estimated that at least 7000 different species are carried in this way and this can cause great environmental damage (see Source 10.45). The Northern Pacific seastar, for example, arrived in Tasmania in ballast water from Japan in 1992 and was then carried to Victoria's Port Phillip Bay. Within 2 years, the population had reached 12 million and had begun to ravage the native shellfish.

Aeroplanes

Aeroplanes use large amounts of fossil fuel to transport goods as well as people around the world. Burning this fuel produces gases such as carbon dioxide and nitrous oxide as well as other pollutants such as soot and sulphate particles. Because most of these are produced at altitude they tend to have greater impact on the atmosphere than those produced at ground level.

Water vapour – also a greenhouse gas – is formed by aircraft at high altitude. Water vapour condenses into droplets to form condensation trails, or contrails (visible line clouds). Contrails are thought to contribute to global warming and climate change.

Aircraft also contribute to noise pollution levels, and they have other associated impacts on places they travel to and from. These include:

- the general level of pollution and emissions caused by energy use in airport buildings
- greenhouse gas emissions from ground airport vehicles

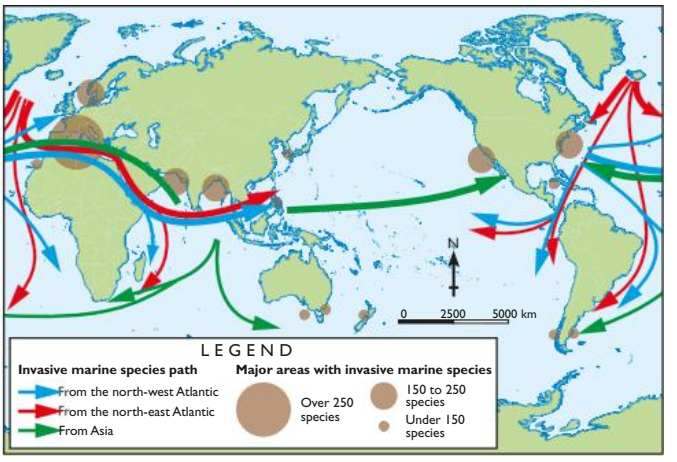
- carbon dioxide emissions from vehicles transporting goods to the airport for distribution
- waste products that accompany the manufacture of aircraft
- waste associated with airport construction and maintenance.

Many people are concerned about the level of greenhouse gases produced by aeroplanes, and are becoming more aware of the issue when evaluating their purchasing habits. You may have opted for something you bought online to be delivered from overseas by express, which means it would have travelled by plane, an increasingly common practice with the popularity of Internet shopping.

As the world's population grows, and we continue to live in a global marketplace, the levels of pollution contributing to climate change will become more and more of a concern. The impact of aircraft is under consideration by the International Civil Aviation Organisation and the UN, among others. Strategies that have been discussed to reduce the effects of aircraft on the environment include:

- increasing the price of air travel to reduce the number of planes in the air and amount of flying time
- increasing air freight costs to deter people from using airmail
- ending frequent-flyer programs that encourage people to fly as often as they can
- trialling alternative fuels
- striving for better efficiency
- discouraging the building of new airports or the expansion of existing ones.

WORLD: INVASIVE MARINE SPECIES AND PATHWAYS



Source 10.45

Source: GRID-Arendal



Source 10.46 The white trails behind jets are formed from water vapour, a greenhouse gas. They are sometimes called 'contrails', a shortened form of 'condensation trails'.

REVIEW 10.2.9

Remember and understand

1 What is ballast water? Describe how it affects the natural environment.

2 What are contrails? What impact might they have on the atmosphere?

Apply and analyse

3 Describe what happened in Alaska in 1989 at Prince William Sound.

4 Examine Source 10.45.

a List the regions that have large numbers of invasive marine species.

b Describe the movements of invasive marine species from the three main source areas around the world.

c Looking at the map, can you reach any conclusions about how the movement of invasive species might be interconnected with trade?

Investigate and create

5 Although the number of ships has increased, the number of oil spills and shipping accidents has decreased in recent years. Brainstorm the possible reasons for this trend.

6 Research the environmental impacts of train travel. Which has the greatest environmental impact: trains or aeroplanes?

EFFECTS OF CONSUMPTION ON PLACES

After raw materials have been grown or extracted, then processed or manufactured into a product and distributed, the stage of consumption follows. You have probably heard terms like 'consumer behaviour', 'consumer rights', and even 'consumer society'. All of these terms illustrate how much the consumption of goods and services has penetrated the way we live. You have probably been the consumer of many goods and services today. Some things you consume might be immediately obvious – a can of drink or a chocolate bar – but others, such as the gas that powered the hot water system for your shower – might be less evident.

As our levels of consumption increase, so the impact on the natural environment deepens. The way we consume products and resources has changed and damaged the Earth's **biodiversity** (the variety of living organisms on the planet), even contributing to plant and animal species disappearing.

STRANGE BUT TRUE

In July 2015, Nabire, one of the five remaining white rhinos, died in the Czech zoo in which she lived. In 1960 there were estimated to be up to 2000 white rhinos on the planet, but due to poaching, the species has been pushed to the brink of extinction.



Impacts of consumption on endangered species

Trading in wildlife is one of the largest industries in the world. Much of this trade is legal but still threatens many species: the legal forestry trade, for example, is endangering many plant species, while legal fishing poses threats for marine life. But the illegal wildlife trade is bringing many species to the point of extinction. The value of illegal trading in wildlife is second only to illegal drug trading.

Some people who are involved in the illegal trading of wildlife smuggle live birds and animals across international borders. Animal smugglers use a range of methods to hide the wildlife. Spiders are mailed in film canisters, small animals are drugged and stitched into luggage lining, and snakes are put into stockings and strapped to people's legs. Many animals don't survive the journey.

Other illegal wildlife traders smuggle animal parts across international borders. Crocodile skins, rhino horns, elephant tusks and tiger body parts all fetch huge prices on the illegal (black) market.

CASE STUDY

The online ivory trade

Many endangered species are facing a new threat brought on by increasing demand combined with Internet access. Studies by conservation groups have found that live endangered animals and body parts can be bought online. For example, a 2-week study of European auction sites found hundreds of items made from ivory, which comes from elephants' tusks. A similar study of Chinese sites found almost 18000 elephant products for sale on just 13 websites.



Source 10.47 A member of the Kenyan anti-poaching team guards two of Kenya's four remaining white rhinoceroses.



Source 10.48 A screenshot of the *Unveiling the Ivory Trade* app

Ivory is valued for use in carved statues and trinkets and, like the demand for rhino horn, is driven by demand in Asia. In the middle of last century there were about five million elephants in Africa, today several hundred thousand exist in the wild and they are listed as a vulnerable species. Some conservation groups estimate that up to 32 000 elephants per year have been killed in Africa for their tusks. One of these groups, the International Fund for Animal Welfare, has launched a digital magazine and iPad app *Unveiling the Ivory Trade* in an attempt to bring attention to the online trade in ivory (see Source 10.48).

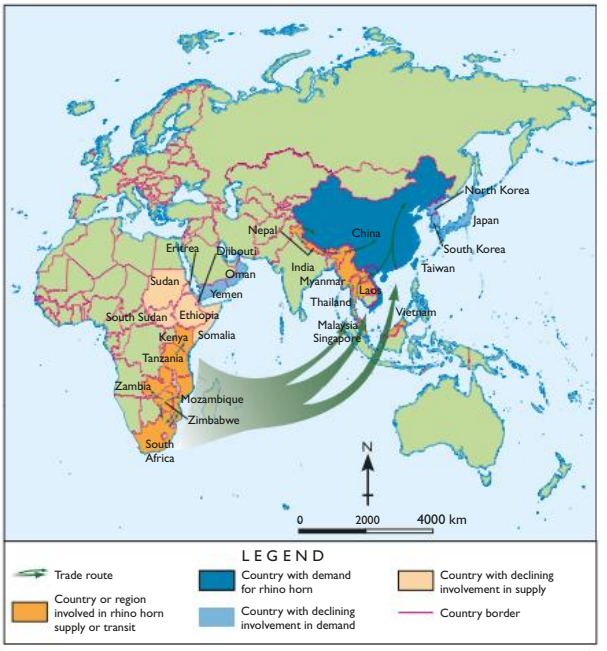
CASE STUDY

The black market trade in rhinoceros horn

The powdered horn of the rhinoceros is believed by many people, particularly in Asia, to be a cure for many diseases. This has resulted in rhino horn being valued at $65 000 a kilogram, making it more valuable than gold. African rhino hunters, often poor villagers, hunt rhinos across borders and into reserves and national parks, shoot them, cut off their horns with a machete or chainsaw and sell the horn to traders who smuggle them to Asia, usually on ships. Wildlife patrol officers shoot to kill those who hunt protected species such as the rhino.

Of the world's five rhinoceros species, three are considered to be critically endangered. The population of the black rhinoceros of Africa has declined from 850 000 in 1900 to less than 5000 today.

WORLD: BLACK MARKET TRADE IN RHINO HORN



Source 10.49

Source: http://ngm.nationalgeographic.com

REVIEW 10.2.10

Remember and understand

1 Explain why rhinoceros horns and elephant tusks are valuable.

Apply and analyse

2 Examine Source 10.49.

- **a** In which countries is there a demand for rhino horn? Where does this horn come from?
- **b** In which of these countries is the demand declining? Give some possible reasons for this decline.
- **c** Describe how the demand for rhino horn threatens this species.

3 Compare the threats facing elephants and rhinos in Africa. What are some of the similarities and some of the differences?

Investigate and create

4 List the various methods described to try to protect these two endangered species. Which of these do you think would be the most effective? Give some reasons for your answer.

5 One proposed method of conserving rhinos is to make the trade in their horns legal. Rhino would then be farmed and their horns harvested for sale. Discuss the possible consequences of this proposal.

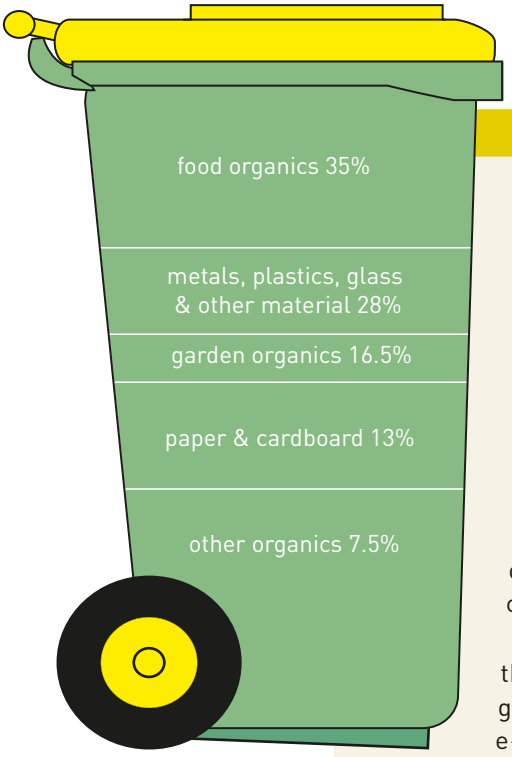
6 Tigers have been hunted throughout history, as souvenirs and to use in medicines in some parts of the world. Research the threats faced by tigers and compare these threats to those faced by elephants.

EFFECTS OF WASTE ON PLACES

The consumption of a product or a service is followed by waste, our fifth stage in the process of production and consumption.

Some sources suggest that only 1 per cent of all materials flowing through the American economy end up in products still being used 6 months after manufacture. What happens to the other 99 per cent? Mass production and the move of factories to developing countries have made goods cheaper and more readily available. New models are released constantly, older ones become out of date quickly and it is often cheaper to throw away a broken item and buy a new one than to have it repaired.

The move to this 'throwaway society' has resulted in vast volumes of waste being produced. City dwellers alone produce about 1.3 billion tonnes of waste a year, but the amount produced by each person varies a great deal between countries and regions. People living in developed countries such as Australia and the United States each produce about 2.2 kilograms of waste a day, five times that produced by those living in developing countries in South Asia.



Source 10.50 What is in your bin? An analysis of Australian wheelie bins found that most waste is organic (i.e from organisms that were once living).

KEY CONCEPT: ENVIRONMENT

E-waste



The fastest growing type of waste in the world is discarded electronic equipment such as computers, televisions and mobile phones. Known as **e-waste**, it is estimated to add up to more than 50 million tonnes a year worldwide. Monitors and computers contain significant quantities of heavy metals such as lead, mercury, cadmium and chromium. These metals are considered dangerous because they can build up in the soils, enter the food chain or contaminate water sources and, in sufficient concentrations, may cause health problems.

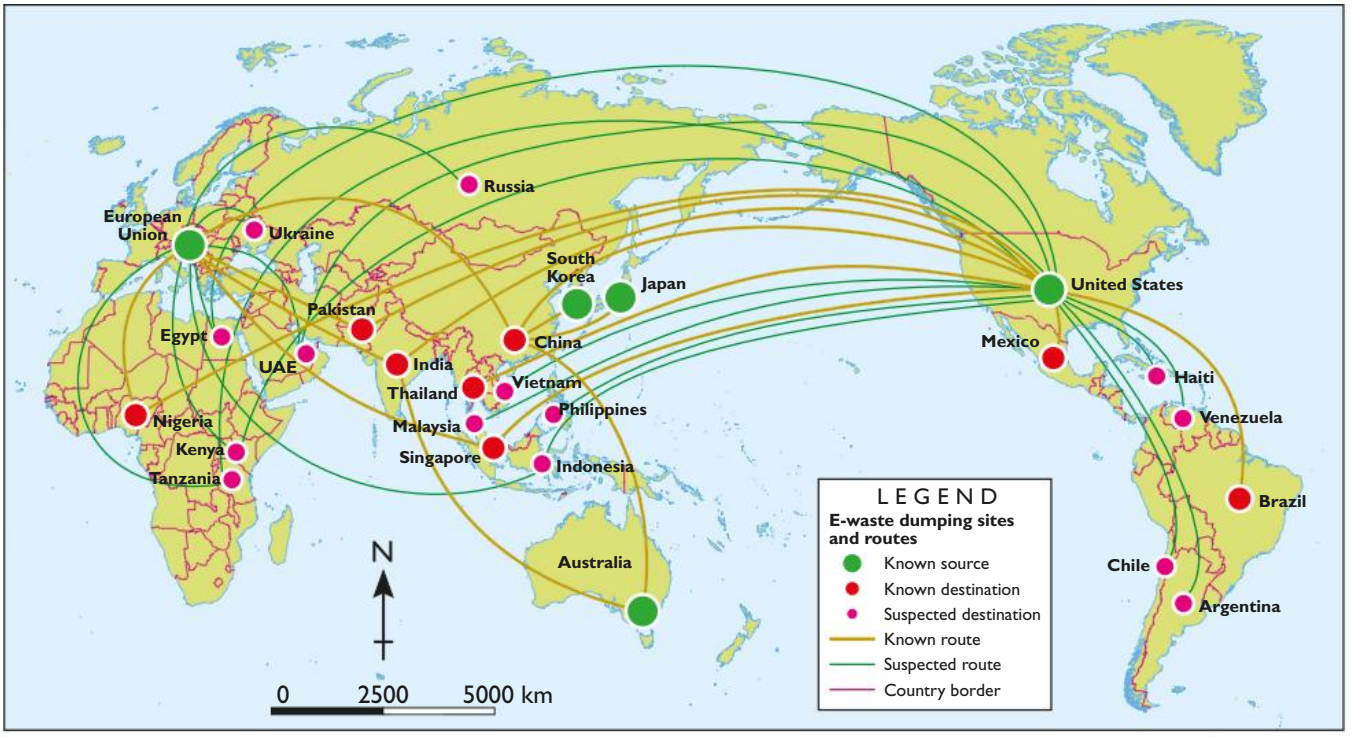
Computers and other forms of e-waste can be pulled apart so that the materials inside can be recycled. These include valuable copper, gold and nickel. This can reduce the environmental impact of dumping e-waste in landfill and also reduces the need to mine these raw materials for new equipment. Many Australian local councils operate e-waste recycling schemes and discourage people from dumping computers and televisions in landfill.

Recycling e-waste is labour intensive and therefore costly. For many developed countries, the solution is to ship the e-waste to poorer countries with lower wages and few or no health and safety regulations. In many communities in Africa and Asia, people pull apart the e-waste and melt the plastics in fires, releasing many dangerous chemicals into the air and water.

For more information on the key concept of environment refer to section GT.1 of 'The geographer's toolkit'.



WORLD: ELECTRONIC WASTE ROUTES



Source 10.51

Source: Oxford University Press

REVIEW 10.2.11

Remember and understand

1 What is meant by the term 'throwaway society'? Do you think we live in a throwaway society? Give some reasons for your answer.

2 Describe what happens to the e-waste in those places that receive it. How does this impact on people and the environment?

Apply and analyse

3 Examine Source 10.50.
   - **a** What percentage of household waste in Australia is wasted food? Why do you think this figure is so high?
   - **b** Describe how the amount of waste produced by Australians could be reduced.

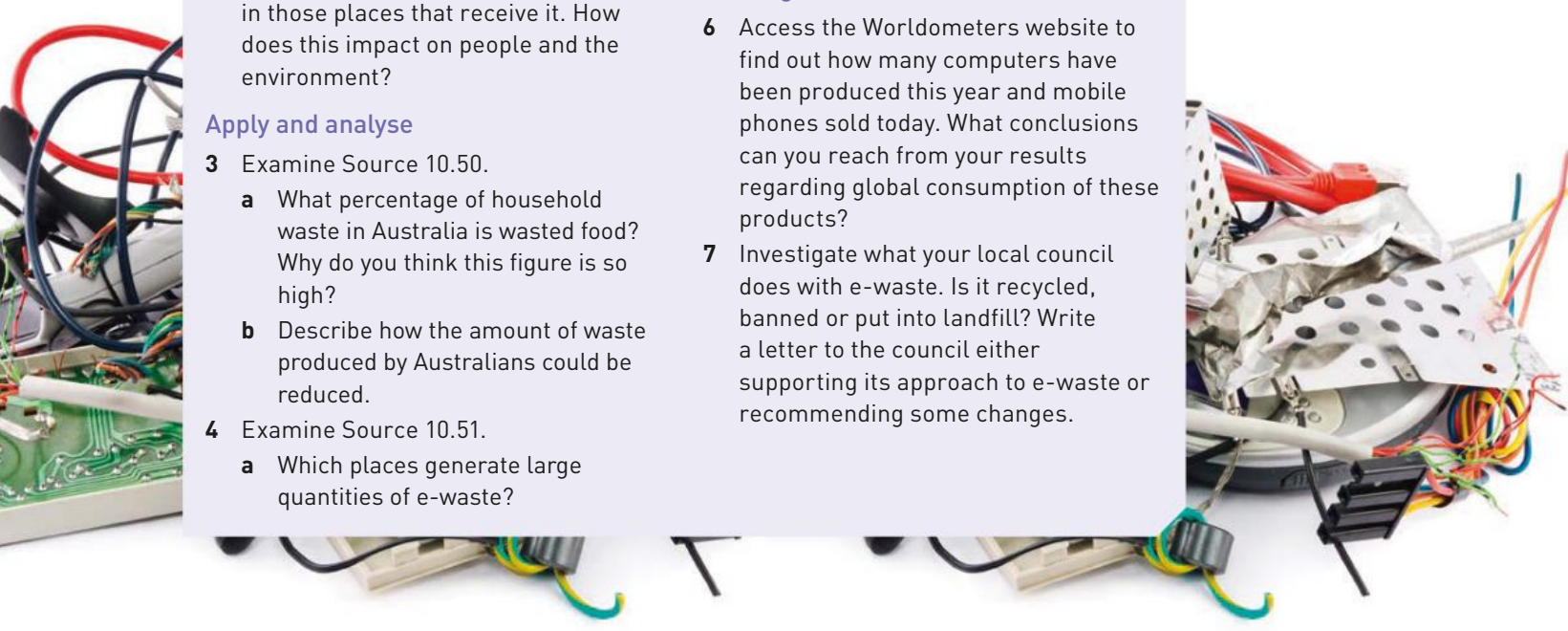
4 Examine Source 10.51.
   - **a** Which places generate large quantities of e-waste?
   - **b** Which places receive large quantities of e-waste?

5 Why do you think people in developing countries produce less waste than those in developed countries?

Investigate and create

6 Access the Worldometers website to find out how many computers have been produced this year and mobile phones sold today. What conclusions can you reach from your results regarding global consumption of these products?

7 Investigate what your local council does with e-waste. Is it recycled, banned or put into landfill? Write a letter to the council either supporting its approach to e-waste or recommending some changes.



10.2

WHY ARE INTERCONNECTIONS IMPORTANT FOR THE FUTURE OF PLACES AND ENVIRONMENTS?

CHECKPOINT

- **Investigate the effects of the production and consumption of goods on people, places and environments throughout the world**

1 Outline the five stages of production and consumption. [5 marks]
2 Identify and describe the benefits of trade for individuals, businesses and nations. [10 marks]
3 Identify and describe the drawbacks of trade for individuals, businesses and nations. [10 marks]
4 Outline the negative impacts that global trade can have on the culture of a region. [5 marks]
5 Identify and describe the impact that the extraction or growing of raw materials can have on places. [10 marks]
6 Identify and describe the impact that the consumption can have on endangered species such as elephants and rhinoceroses. [10 marks]

TOTAL MARKS [/50]

RICH TASK

The global coffee trade

Coffee is one of the world's most traded commodities. About $17 billion worth of coffee is traded between producing and importing countries every year. This makes it the second most valuable commodity (after oil) in the world. It is a particularly important crop to many developing countries as it accounts for as much as one-third of their entire export earnings. More than 25 million people are employed in the coffee industry, many of them small farmers.



Source 10.52 Brazil is the world's largest coffee producer and exporter. Coffee farms range from large plantations owned by transnational companies, such as this one, to small plots owned by a single farmer.

The overall demand for coffee is growing rapidly and this is causing many changes in its production and processing. Many small farmers in developing countries are finding it difficult to compete with large plantations, which are often owned by companies from developed countries. The demand for coffee is also creating environmental problems, particularly the clearing of rainforest to make way for new plantations and an increased demand for fresh water.

The coffee that ends up in your cup begins as a bean grown on plants in tropical countries, often on hillsides. The beans are picked, washed, dried, sorted and packed into 60-kilogram bags for export. Once transported the beans are roasted and ground before being packaged and sold to the consumer.

Processing geographical information

1 Many coffee-producing countries rely very heavily on this single crop for their export income. What are the possible dangers for countries in this situation? What kinds of risks does relying on a single crop expose them to?
2 Do some further reading or use the Internet to research the coffee industry in one of the top producing countries. How has this changed in the last 10 years and who has been impacted by these changes?

STRANGE BUT TRUE

The most expensive coffee in the world is *kopi luwak*, which costs $400 for 100 grams. The coffee beans come from Indonesia and have passed through the digestive system of the palm civet (a cat-like creature), which lives in the Indonesian rainforest.

SKILL DRILL

Describe, explain and compare patterns on maps

Geographers often use maps to interpret and analyse complex information and reach some conclusions. While a single map is a useful tool for describing a pattern, we can compare several maps to help explain these patterns. Follow these steps to describe, explain and compare the patterns on maps.

Step 1 Look at the title and the legend of the first map so that you know precisely what it is showing. Take note of any patterns that you notice. These may be a cluster of similar features located close together or other patterns such as features in a rough line (lineal pattern) or spreading out like spokes on a wheel (radial pattern).

Step 2 Repeat Step 1 for the next map and for any other maps you are using.

Step 3 Look for similarities between the maps. You can do this by using your notes and by scanning the maps with your eyes. You are looking for sets of data on the maps that seem to roughly follow similar patterns. Make a note of these similarities.

Step 4 Use your observations to find a logical explanation for these similarities. For example, when comparing maps of altitude and temperature it is logical that temperatures will fall as altitude increases. Similarly, it is logical that tropical rainforests are found in warm areas with high rainfall.

Apply the skill

1 Examine Source 10.53, showing the world's top coffee producers and coffee importers. Describe the distribution of the world's top coffee producers. Pay particular attention to the Tropics of Cancer and Capricorn.

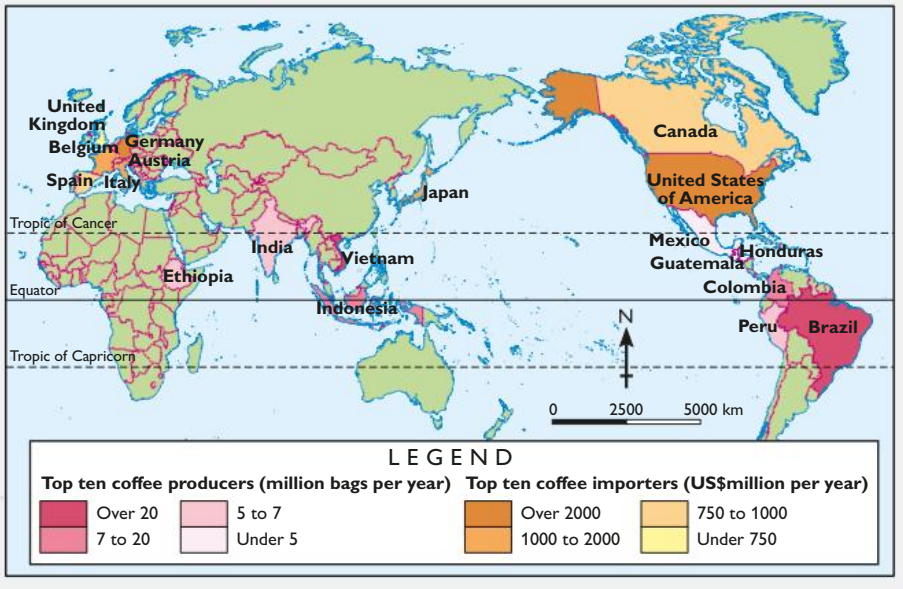
2 Examine Source 4.23 on page 144, showing the world's climates. Describe the main climate types found in the tropics.

3 Compare your answers to the previous questions and explain the distribution of the world's top coffee-producing countries.

4 Use Source 10.53 to describe the distribution of the world's top coffee importers.

5 Having examined the maps in Sources 10.53 and 4.23, what climate factors do you think influence the growing of coffee? What climate factors are apparent in the areas that import large amounts of coffee?

WORLD: TOP 10 COFFEE-PRODUCING AND CONSUMING COUNTRIES



Source 10.53

Source: Oxford University Press

In this Checkpoint and Rich Task, you will be applying the following geographical concepts, inquiry skills and tools:

- Concepts: Space, Place, Environment, Interconnections
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Graphs and Statistics, Visual representations

For more information about these concepts, skills and tools, refer to 'The geographer's toolkit'.

CHECKPOINT

GLOSSARY

A

aerial photograph
a photograph taken at some distance above (for example, from an aeroplane)

alphanumeric grid
a row of numbers and a row of letters on adjacent sides of a map or other image providing an easy way to locate particular features

altitude
the height of a place or thing above sea level

amenity
something that makes living someplace attractive (for example, public transportation, good roads, a park)

annotated visual display (AVD)
a way of presenting the final results of a research project, incorporating images, graphs, notes and explanations in a poster-style format

aquifer
layers of rock or soil in the ground that hold water or that water can pass through

arable
a word used to describe land that is suitable for growing crops

arch
a natural feature, usually formed from rock, that forms a bridge-like arc as a result of erosion

ash
very fine rock and mineral particles less than 2 millimetres in diameter that remain after burning

B

backwash
the backwards movement of sea water down a beach after a wave has broken

bar graph
a graph that shows information as a series of horizontal bars

barometer
an instrument used to measure atmospheric pressure

biodiversity
the variety of living organisms on the planet

blowout dune
a horse-shoe-shaped disturbance in a sand dune system

BOLTSS
a mnemonic (memory device) for remembering the essentials of a map: border, orientation, legend, title, scale and source

bore
(also called an Artesian well) a drilled well that brings water up from deep in the ground

breakwater
a wall that is built out into the sea to help prevent erosion

C

cardinal points
the four main directions shown on a compass: north, south, east and west

carrying capacity
the amount a particular element of the environment can hold (for example, the amount of water a river can carry before it will flood)

cave
a hollow space along the coast produced by the action of the waves

census
a 'head count' or audit of the number of people living in a particular place at a particular time; information collected during a census can often include age, occupation, income, etc.

change
a key concept in geography: the dynamic nature of all processes on Earth, whether slow or fast, small or large

choropleth map
a map that shows particular data or characteristics, such as population density, by using different shades of the same colour or different colours to show variations (for example, light green to dark green)

civil unrest
disturbances in a city characterised by protests against the government or ruling structures

climate
the average weather – particularly rainfall and temperature – experienced in a particular area over a period of time (usually 30 years)

climate change
the generally accepted idea that the Earth's climate is warming and will continue to warm due to pollution and overpopulation

climate graph
a combination bar-and-line graph that shows the rainfall and temperature of a given place; also known as a climograph

column graph
a graph showing information as a series of vertical columns

compass
an instrument with a magnetic needle that points to the north; used for navigation

compass bearings
a precise way of giving compass directions, such as 135° south-east

compound column graph
a column graph that has subdivided columns for further comparison of groups

concept map
a diagram or chart used to organise thoughts and ideas to show their relationship

condensation
the process that takes place when a gas cools and forms a liquid; for example, water vapour becoming water droplets

conservation
a landscape management strategy that involves the careful control of resources and planned activities in an area to minimise environmental impacts

constructive wave
a gentle wave that deposits material and builds up beaches

consumption
the use of a resource

continuous resources
a resource that is available in unlimited amounts

contour lines
lines drawn on a map that connect points at the same height to show the height and steepness of land

converging
coming together from different directions

Country
the way Aboriginal Australians refer to their land and their spirtual connection to it

cultural erosion
loss of cultural diversity

D

delta
a fertile area of land that forms at the mouth of a river

deposition
the building up of land through deposits of sand and other materials

desalination
the process of removing salt from sea water

desert
an area that receives less than 250 millimetres of rain every year; can be hot or cold

desertification
the transformation of fertile land into relatively dry desert

destructive wave
a strong wave that wears away coasts and removes material

developed country
an industrialised country with a well-developed economy capable of supporting its own people

developing country
a less economically developed country that has some difficulties in supporting its own people

digital divide
the unequal levels of access that people in different countries have to communication technologies like the Internet and mobile network coverage

direction
a way of orienting a map, usually shown by the use of compass points, such as north

distance
the amount of space between two objects or places, generally measured by using the scale on a map

distribution
the way in which things are arranged on the Earth's surface; the pattern formed by the way objects or places are distributed across a space

diverging
tending to move apart in different directions

dot distribution map
a map using dots or other shapes to show the location of a particular feature

E

eastings
the gridlines that run vertically on a topographical map

ecosystem
a term used to describe the way in which the living organisms (such as plants and animals) in a particular area interact with the non-living organisms in that area (such as water, rocks and climate)

ecotourism
a form of tourism that involves visiting a natural environment with the aim of observing, experiencing and learning about it while conserving and supporting the environment and its inhabitants

effluent
contaminated water that flows out of a treatment plant, sewage system, industrial site, etc.

environment
a key concept in geography: a specific place on Earth and all the things, both living and non-living, that are there

Equator
an imaginary line that runs around the middle of the Earth separating the northern hemisphere from the southern hemisphere

erosion
the wearing away of the Earth's surface by wind, water or ice

ethnicity
the background, nationality or culture of a person or group of people

evaporation
the process by which a liquid (such as water) is converted to a gas

e-waste
discarded electronic equipment, such as computers, tablets and mobile phones that are no longer wanted

exception
in geography, a feature that falls outside a usual pattern or does not follow an observed pattern

exploitation
the complete and unregulated use of natural resources in a landscape without any regard for sustainability

F

false-colour image
an image that uses colours that are different or more exaggerated than those which occur naturally, in order to make it easier to interpret

feature
a distinctive landform or characteristic of the landscape, either naturally occurring or made by humans

fieldwork
geographical study that takes place outside the classroom at the site of inquiry

FIFO
fly in, fly out; used to describe the lifestyle of workers who live far away from their place of employment (such as a mine)

floodplain
low-lying land next to a river or stream that is regularly flooded by water

flow map
a map that shows movement (such as people or goods) from one place to another

fossil fuel
fuel made from the decomposed remains of plant and animals that lived millions of years ago (for example, coal, oil)

G

geographic information system (GIS)
a software application designed to capture, store, manipulate, analyse, manage and present all kinds of geographical information

geographical inquiry
the stages that geographers follow to guide their investigations

geomorphic process
a natural action, change or function that brings about a result in the Earth's surface (such as erosion, weathering)

ghost net
an abandoned fishing net that floats free in the ocean and is a danger to wildlife

GIS
see *geographic information system*

glacier
a large frozen mass or river of ice that slowly moves down a mountain or valley in response to gravity

globalisation
the growth in the amount of interconnectedness in trade and communication between countries

global positioning system (GPS)
a device that uses satellites to accurately pinpoint the location of a car or phone, and then uses data in the form of a digital map to help us find our way around

greenhouse gas
a gas (for example, carbon dioxide, methane) that is partially captured in the Earth's atmosphere preventing some of the Earth's warmth from escaping into space

gradational forces
forces that wear down high places and fill in low places (for example, erosion)

grey water
relatively clean waste water from baths, sinks and washing machines that is sometimes used on domestic gardens and may be further treated for irrigation purposes

gross domestic product (GDP)
the total monetary value of all the goods and services produced by a country over a specific time period (usually a year)

groyne
an artifical barrier that juts out from a beach into the water, made to prevent erosion of the beach from the power of destructive waves and longshore drift

H

headland
a steep cliff jutting out into the sea

headwaters
the starting point of a river, the source

HIV/AIDS
human immunodeficiency virus infection/acquired immunodeficiency syndrome; an illness that disrupts a person's normal immune system, making him or her susceptible to many other diseases

hot spot
a point not on a plate boundary where there is tectonic activity

hub and spoke
a diagram or model in which information is arranged in a format shaped like a wheel, with the hub as the centre

I

ice cap
a permanent layer of ice over the ground, such as found at the North and South Poles

iceberg
a large mass of ice that has broken away from a glacier or ice sheet and is floating in open water

infiltration
the process of water seeping through the earth

infrastructure
the facilities and services necessary for any community, city or country to function (for example, buildings, electricity, roads, airports and water supply)

interconnection
a key concept in geography: the relationship between all things, both living and non-living, and all processes, both natural and human

irrigation
the watering of crops in some way other than by precipitation

K

key inquiry question
a question that helps geographers to plan and focus their geographical inquiries

L

lagoon
a shallow stretch of water which is partly or completely separated from the sea by a narrow strip of land

lahar
a type of mudflow or debris flow

land degradation
wearing down of the health of land resources through human actions in ways that threaten their ability to maintain their environmental functions

landform
a natural geographical feature or shape that appears on the Earth's surface (for example, dune, hill, valley, beach and cave)

landscape
a section of the Earth's surface made up of a variety of geographical features (known as landforms) that define and characterise it; landscapes can be natural (such as coastal landscapes and mountain landscapes) or built (such as neighbourhoods and cities)

latitude
imaginary lines running east–west around the Earth's surface, parallel to the Equator, used to work out location and direction

lava
the molten material that flows from a volcano

legend
(also called a key) a guide to the symbols and shading used on a map or other image

levee
a raised area between low-lying land and a body of water, built to prevent flooding

line graph
a graph that displays data as a line

life expectancy
the average number of years someone can expect to live based on statistics

liveability
a measure of what a place is like to live in according to particular criteria such as access to schools and work, and climate and safety

lock
a short section of a canal that has gates which are used to raise and lower the water level and allow safe passage of boats

longitude
imaginary lines running north–south around the Earth's surface, from the North Pole to the South Pole, used to work out location and direction

M

magma
the hot liquid (molten) rock beneath the surface of the Earth

magnetic north
the physical place on Earth, near the North Pole, to which a magnetised needle points

map
a simplified plan of an area shown from directly above

meteorologist
a scientist who studies the atmosphere, particularly the forecasting of weather

monsoon
weather or climate produced by major wind systems that change direction seasonally; in northern Australia, the north-western and south-easterly winds that produce the rainy season between December and February

N

natural process
see *geomorphic process*

natural resource
a resource that occurs in nature (for example, water, minerals, trees, livestock)

nomad
a person or group of people who travel from place to place, typically in search of fresh pasture for their animals and have no fixed address (such as Bedouins)

non-renewable resource
a resource that cannot be regenerated once it is used up (for exampe, oil, coal)

northings
the gridlines that run horizontally on a topographical map

O

oblique aerial photograph
a photograph taken from an aeroplane (or similar aircraft) where the camera is at an angle to the Earth's surface

overlay map
a map on some type of transparent paper or layer that is placed over a base map, used to show the relationship between features or events on the Earth's surface

P

physical map
a map that shows the locations and names of physical features of the Earth, such as mountains and rivers

pie graph
a graphical way of presenting data; a circle is divided into segments to represent the distribution of data

place
a key concept in geography: a part of the Earth's surface that is identified and given meaning by people

plan view
a way of showing something as if the viewer is looking down on it from above; a bird's-eye view

political map
a map that shows the locations and names of built features of the Earth, such as country borders, cities, roads, dams and railways

population density
a measurement of the number of individuals per unit area (for example, 1500 people per square kilometre)

population pyramid
a graph that displays the percentage of males and females in a region by age group

precipitation
the process of water in its various forms (rain, snow, hail, etc.) falling to the ground

preservation
a landscape management strategy that aims to keep an environment in its existing form

primary data
data for a geographical inquiry that was collected in the field by a geographer conducting the inquiry (for example, survey data, hand-drawn maps or photographs)

pyroclastic flow
a fast-moving and dangerous mixture of hot gas and rock that is ejected from a volcano

Q

qualitative data
any information that can be recorded in words; for example, Uluru is very large

quantitative data
any information that can be recorded as numbers; for example, Uluru is 3.6 kilometres long

R

raw material
the basic organic resources from which things are made; often refers to the Earth's natural materials such as oil, wood and water

refraction
the process by which the direction of a wave is changed when moving into shallow water

refugee
a person who moves to another country because of a natural disaster or to avoid persecution

region
an area on the Earth's surface that makes it different from surrounding areas

remote
far from centres of human populations

renewable resource
a resource that can regenerate or be regrown (such as trees) as opposed to one that cannot be regenerated (such as coal)

resource
anything human or natural that can be used by people to satisfy a need

run-off
water that does not penetrate the ground but flows on the surface towards rivers, lakes and seas

rural
a term used to describe an area located outside cities and towns, such as farming or agricultural areas

rural–urban fringe
the area where cities end and country or farming areas begin

S

salinity
the amount of salt content in the soil

sand dune
a hill or mound of sand formed by wind deposition on the landward side of a beach

sanitation
measures designed to ensure good health in a community by preventing human contact with health hazards (such as sewage)

satellite image
image of a place taken from satellites orbiting above the Earth's surface

scale
a key concept in geography: the level at which a geographical inquiry takes place – personal, local, regional, national, international or global

scale (mapping)
a system that indicates how the distances on a map are represented in the real world (for example, written scale, line scale, ratio scale)

sea wall
a barrier designed to direct the water's force at its solid construction of hard materials rather than the soft and easily moved sands and dunes

secondary data
data used for a geographical inquiry that was not collected by the geographer conducting the inquiry (for example, textbooks, atlases and government websites)

shield volcano
a volcano characterised by gentle eruptions that emit runny lava over a wide area

six-figure grid reference (GR)
a system used to locate exact points on a topographic map

slum
a settlement within a city where the inhabitants have inadequate housing and poor access to basic services

soil erosion
the process of washing or blowing away soil

space
a key concept in geography: the way things are arranged on the Earth's surface

spatial distribution
the shapes and patterns in which things are arranged on the Earth's surface

spatial technology
any form of technology that refers to place, space and location

spit
a curved build-up of eroded material that forms at the mouth of a river

stack
a part of a cliff that has separated from the mainland as a result of the erosive effect of waves

stewardship
the activity of protecting and being responsible for the planning and management of environmental resources in one's local area

storage dam
an area used to collect and hold water for later use, often artificial (such as a reservoir)

subduction
the process whereby a denser oceanic plate meets and is pushed down below a lighter continental plate

suburb
an area beyond a city centre, with medium-density housing

supply chain
the stages through which a product journeys, from its source to the consumer and finally its place of disposal

sustainability
a key concept in geography: the ongoing capacity of Earth to maintain all life

sustainable
capable of being continued with minimum long-term effects on the environment

swash
the movement of water up the face of a beach after it has broken

T

tailings
the waste material left over from commercial mining operations

tectonic activity
processes that tend to build up the various features of the Earth's crust (for example, types of mountain building, volcanic action, folding and faulting)

tectonic plate
one of the immense, slowly moving pieces that make up the Earth's surface (or crust) that carry the continents and oceans

thematic map
a map that shows details about a particular topic, such as land use or the distribution of resources

tombolo
a deposit of sand linking an island to the mainland (or to another island), formed by longshore drift

topographic map
a map that shows the shape of the land, its relief and landforms

topography
the shape and physical features of the Earth's surface, including hills, valleys, mountains and gentle slopes

training wall
a wall built to force water into a specific channel, usually built at a river's entrance into a large body of water

transform boundary
a fault line in the Earth's crust as a result of two crustal plates sliding past one another (for example, the San Andreas Fault, United States)

transnational corporation (TNC)
a large company that operates in more than one country

trend
a general direction in which something is developing or changing (for example, the trend in population in Australia is positive)

triangulate
to use triangles (trigonometry) to estimate distance in order to determine the location of a point

tropics
the area of the world between the Tropic of Capricorn and the Tropic of Cancer

tsunami
a giant ocean wave caused by an underwater earthquake

U

urban
a term used to describe a built-up area such as a city or town

utilisation
a landscape management strategy that allows productive human activity in an area (such as farming)

value chain
a series of activities/steps to deliver a product or service where each step of the process adds more value to the finished product or service than it costs to provide it, thus making a profit

virtual water
the volume of fresh water used to produce the product, measured at the place where the product was actually produced

visual representation
a tool used to visually communicate geographical data and information (for example, diagram, image, photograph, painting, illustration, symbol, model, poster, collage, cartoon, multimedia, infographic, mind map)

volcanic cone
a triangle-shaped hill formed as material from volcanic eruptions piles up around the volcanic vent or opening in Earth's crust

voluntary migrant
a person who is free to choose where and when they move

vulcanologist
a scientist who specialises in the study of volcanoes

vulnerability
exposure to stress(es) and the level of difficulty in coping with them

W

waste-water
water that has been used by people in domestic or industrial settings for washing, cleaning or flushing that contains waste products

water cycle
the continuous cycle by which water evaporates from lakes and oceans, condenses into clouds, falls on land as rain, finds its way into rivers (often after human use) and returns to the oceans

water footprint
an indicator of the amount of water (both direct and indirect) that is used to produce the goods and services

weather map
a map that shows conditions in the Earth's atmosphere, such as air pressure, wind speed, wind direction, and warm and cold fronts

weathering
wearing away by exposure to the Earth's elements

weir
a low dam built across a river to raise the water level upstream or regulate its flow

wellbeing
a state of being well, healthy and happy

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