civics + citizenship

geography

economics + business

good Geography

DANIELLE
O'LEARY

BEN
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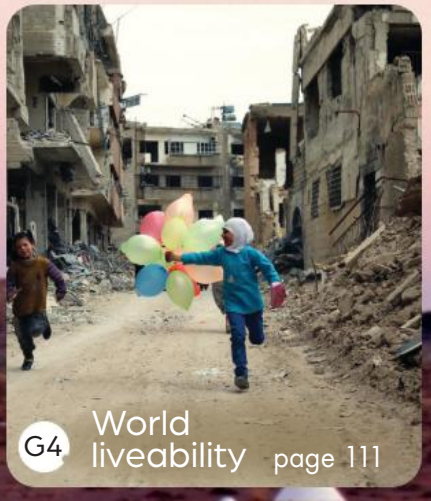
VAN NOORDEN

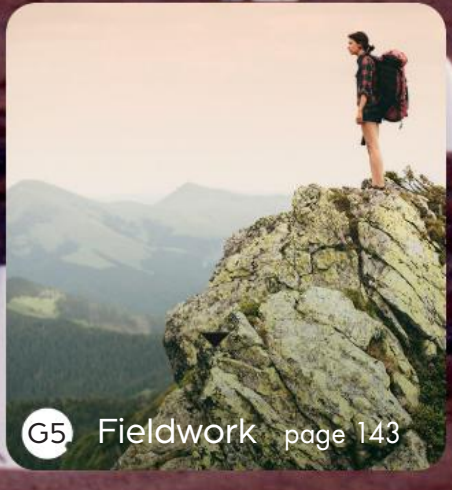
civics+ citizenship | geography | economics+ business

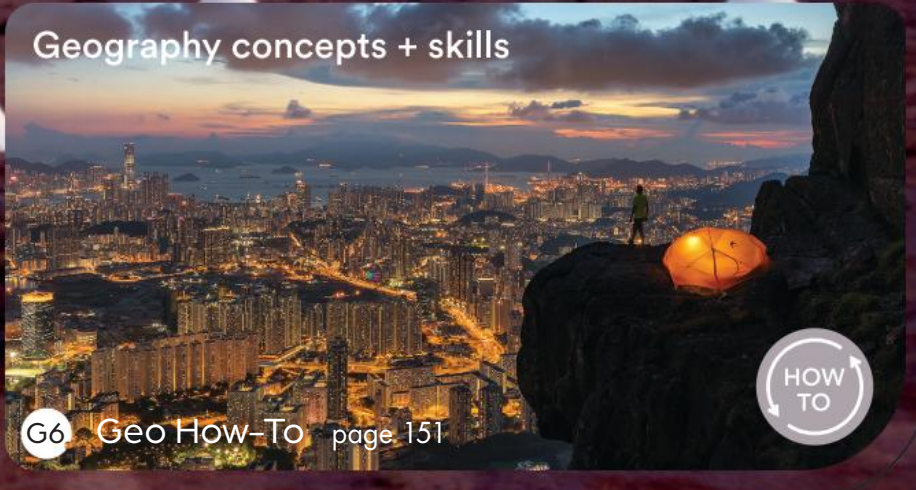
contents

Water in the world

Place + liveabilility







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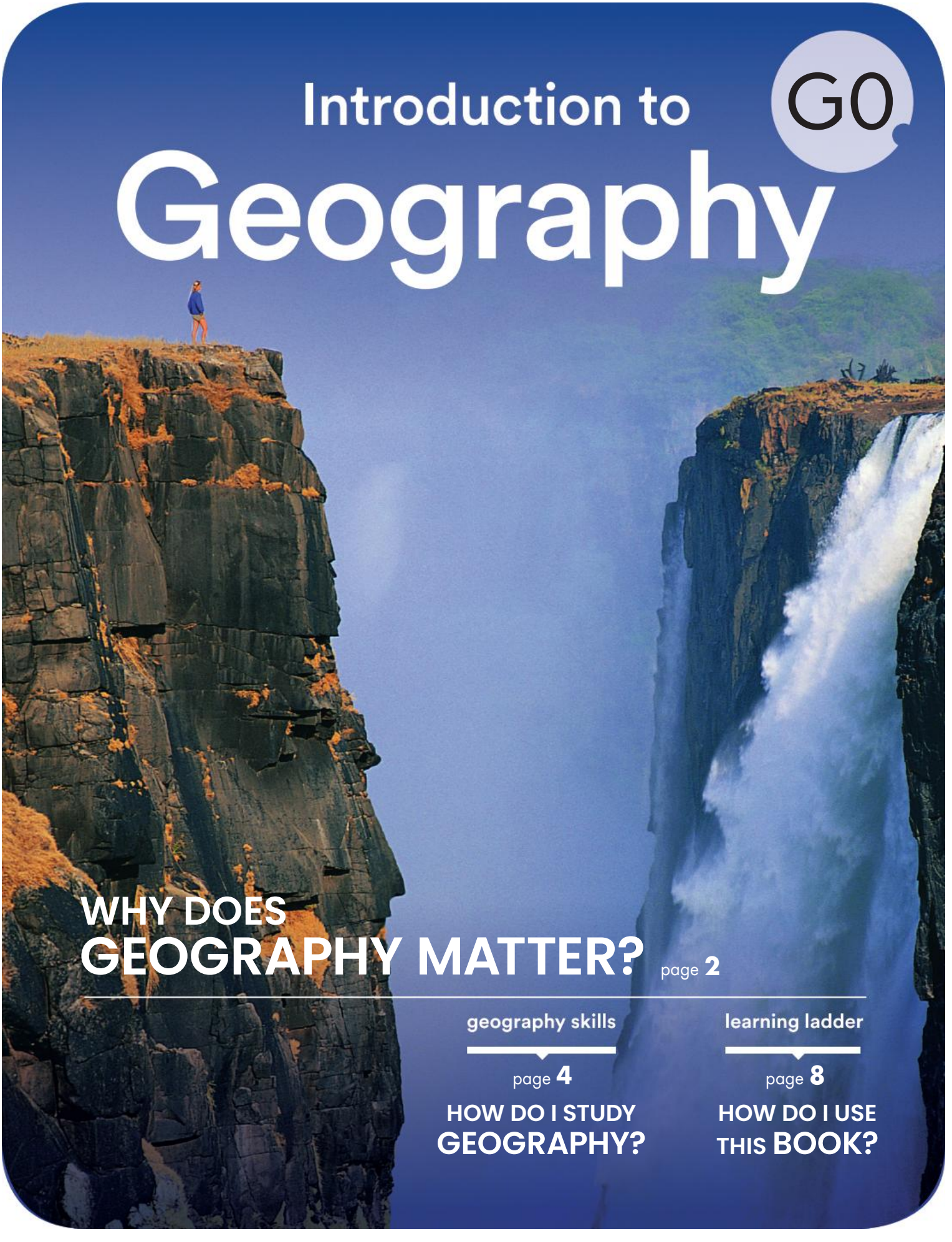
Introduction to Geography

G0



Why does Geography matter?

Geography is the study of our world and its characteristics, patterns and changes over time. In Geography, we focus on two main ideas: human activity and natural processes. We are interested in how humans influence the *space* in which they live and, in return, how the natural *environment* influences how we as humans live. We use maps, images, graphs and other sources of data to explore patterns, and conduct fieldwork to answer questions. Geography is key to understanding the world around us, because *without Geography, you are nowhere!*

Thinking like a geographer

As a Geography student, you are a trainee geographer! Geography is not just about reading and memorising; geographers *learn by doing*, using their geography skills to help them along the way. You have most likely already been practising many geographic skills in your day-to-day life.

If you like travelling or the outdoors, Geography helps you find your way and explain processes. If you like sport, you may already know a range of countries because of the team names. You may have experience using a map to find a friend's house or using social media to locate the best restaurant near your house.

Source 1

As a Geography student, you are a trainee geographer!

Three reasons why Geography matters

1 Exploring Geography will help you develop powerful skills

Geography is an active and vibrant study where you will *learn by doing*. To help you complete your learning, you will develop a new set of skills. These skills will remain with you and will help you in all aspects of your life. Some of these valuable new skills are:

- reading maps
- interpreting data
- creating visual representations
- navigating
- understanding how other people experience the places they live.

2 Exploring Geography lets you see the world (sometimes without leaving your desk!)

Do you want to visit the Amazon jungle? Are you concerned about coral bleaching on the Great Barrier Reef? Do you wonder where you would end up if you travelled 17 525 kilometres north of your exact location right now?

The study of Geography allows you to access every corner of the world: either on a fieldtrip, or at your desk using geographic information systems such as Esri or Google Earth. Through this process you will come to understand the *interconnected* nature of our world and the role we all play as custodians of our planet.

3 Exploring Geography makes us informed global citizens

Studying Geography helps us to understand ourselves and our planet. Geography has two main focuses:

- physical or natural geography
- human or built geography.

Physical geography is the study of the Earth's landscapes, landforms and natural processes, some which have been occurring for hundreds of thousands of years. Human geography is the study of how we interact with this natural world.

You might investigate how we change environments; how we use the environment; how different cultures, languages or religions are spread around the world; or even how we break up the world into land masses called continents and countries with political borders. Most critically, the study of Geography will empower you to be an active global citizen who makes informed decisions.

Learning Ladder G0.1

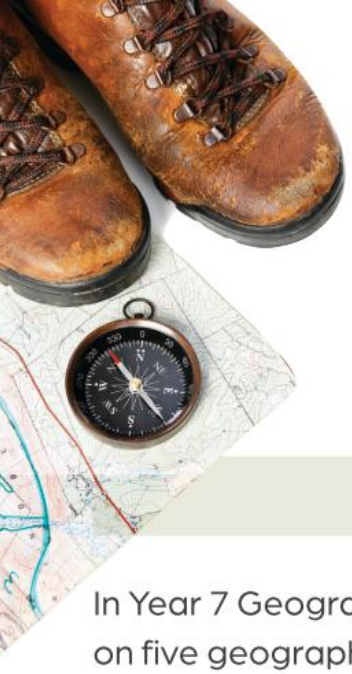
1 Why are skills so important in Geography?

2 What do you already know about Geography? Brainstorm a word or phrase that relates to Geography for every letter of the alphabet. (Hint: Your 'x' word could be *x*-axis on a graph!)

3 Geography is an 'umbrella' study that brings in many other subjects, such as Maths, Science, History, Civics and citizenship, and Economics and business. List five things that you enjoy learning about and explain how they link to Geography.

4 Look at the image of Huangguoshu Waterfall National Park on pages 4–5 of this chapter. Identify one example of human activity and one natural process that you can see in this image.

5 As a class, discuss how we all use Geography in everyday life. Think about apps, books or even plans you might make.



How do I study Geography?

In Year 7 Geography, you will focus on five geographical skills:

1. spatial characteristics
2. interconnections
3. geographical challenge
4. collect, record and display data
5. analyse data.

You will also practise the important skills of research and fieldwork. On the following pages you will be introduced to geographic concepts that help explain spatial characteristics and different types of maps that can be used to display data. The Geo How-To section on pages 151–167 will support you step by step when you begin to use the other geography skills in your work.

Geographic concepts

Geographic concepts will help you to think like a geographer. The acronym **SPICESS** can be used as a prompt to help you remember the seven geographic concepts:

- **S**pace
- **P**lace
- **I**nterconnection
- **C**hange
- **E**nvironment
- **S**cale
- **S**ustainability.

S Space

In a geographical context, *space* does not refer to *outer space*. Instead, it refers to the way that we use, *change* and distribute things on the Earth's surface. For example, this *space* is classified as a National Park. While tourists are allowed to visit this *space*, they must be respectful of the *environment* and remain on the designated pathways.

P Place

The concept of *place* allows humans to identify the location or position of something within a *space*. We can identify place through describing the relative or absolute location of that area. This *place* is called Huangguoshu Waterfall and it is located in China.

I Interconnection

Interconnection is the idea that two things or phenomena are related, interact or are linked in some way. For example, there is an *interconnection* between the abundance of trees and the movement of water through this environment. Without this water source, the trees would not be able to survive in such quantities.

C Change

Change refers to how a *place* is altered due to shifts in the environment or to meet the needs of humans. Change can be positive or negative, and can occur over short or long term periods of time. In this *place*, humans have *changed* the *environment* by adding boardwalks, handrails and access points so that tourists can view the waterfall.

E Environment

An *environment* can be defined by its **geographic characteristics**. Some environments are largely natural and are untouched by humans, such as coastlines, islands and forests. Other environments have undergone significant change and are largely unnatural, such as cities and other urban areas. Within environments we can observe processes, interconnections between **phenomena** and change over time. This image is an example of tourists visiting a natural environment.

Source 1

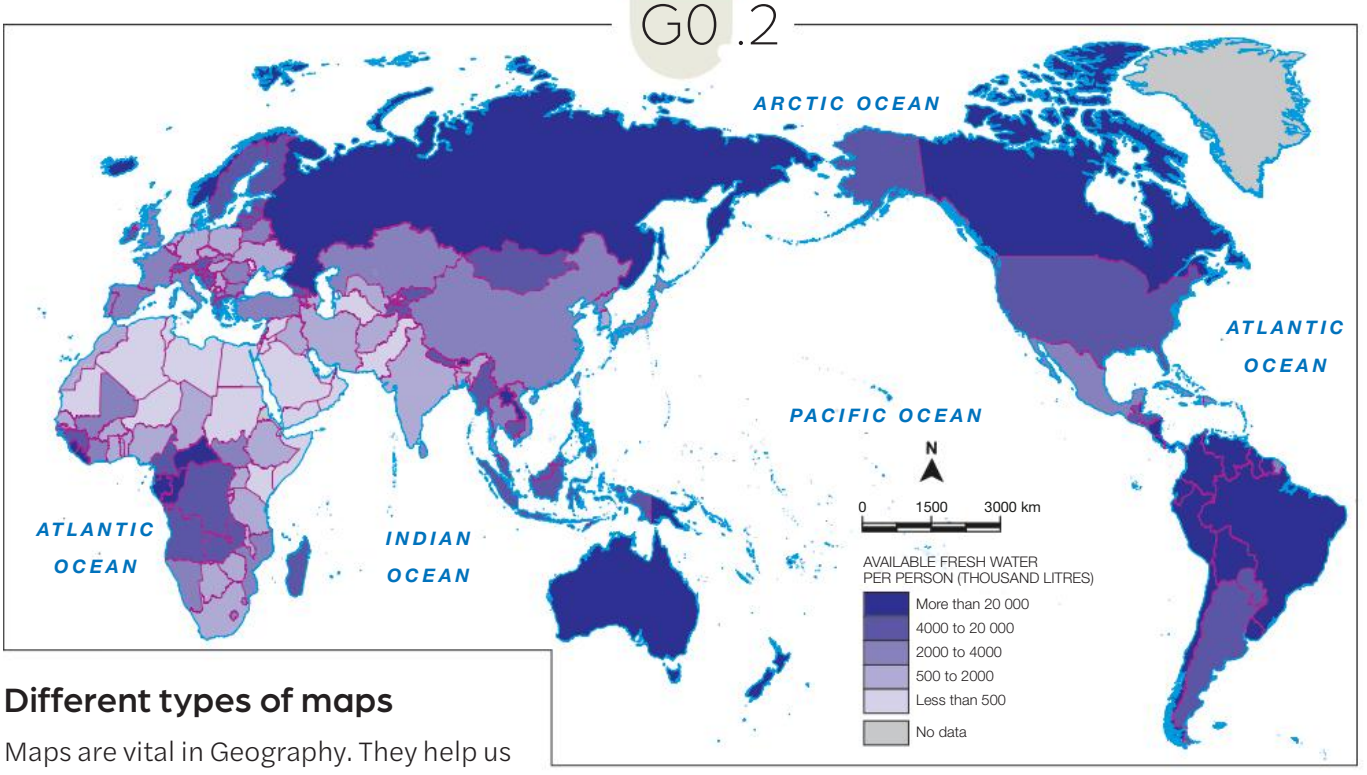
Huangguoshu Waterfall National Park in Guizhou province, China. This is one of the largest waterfalls in China and East Asia.

S Scale

Scale usually refers to the size of something. Scale can be literal, such as a scale on a map using data to show you how big something is in real life. It can also be used as a word when describing a region. For example, patterns can exist on a local, regional, national or global *scale*. This image is an example of tourism on a local scale.

S Sustainability

Sustainability is the concept of maintaining and preserving resources and environments for future generations. This could be through the use of sustainable, **renewable energy** such as hydropower or wind-generated electricity. In this image, the boardwalk has been added so tourists do not damage the environment, so it can be sustained for the pleasure of future visitors.



Source: Matilda Education Australia

Source 2

A choropleth map showing predicted water availability per capita on a global scale in 2025

Different types of maps

Maps are vital in Geography. They help us to visualise spatial patterns and identify **interconnections**. There are many different types of maps, which all have slightly different uses. The Geo How-To section on pages 151–167 will be a handy reference as you begin to work with maps. Make sure you refer to it frequently.

Choropleth maps

Choropleth maps are among the most common maps used to learn Geography.

Choropleth maps use dark and light shades of colour so that the reader can instantly see a pattern. The choropleth map in Source 2 uses darker shades to represent the areas with the highest levels of available water and lighter shades to represent the areas with the lowest levels of available water. It is best to use the same colour in different shades, to clearly show the pattern, rather than different colours. Can you identify how much water will be available to people in Australia in 2025?

Climate map

In Geography, **climate** is important for determining land cover and how liveable a place is. While weather is what we observe day to day, climate refers to the average conditions (usually temperature and **precipitation**) within a region over a period of time. Climate is important when studying water, as it gives us an indication of expected rainfall.

Source: Matilda Education Australia

Source 3

A map of the Australian climate

Political maps

Political maps show the boundaries of different countries. Over time, these boundaries change as wars and treaties have determined where different people live.

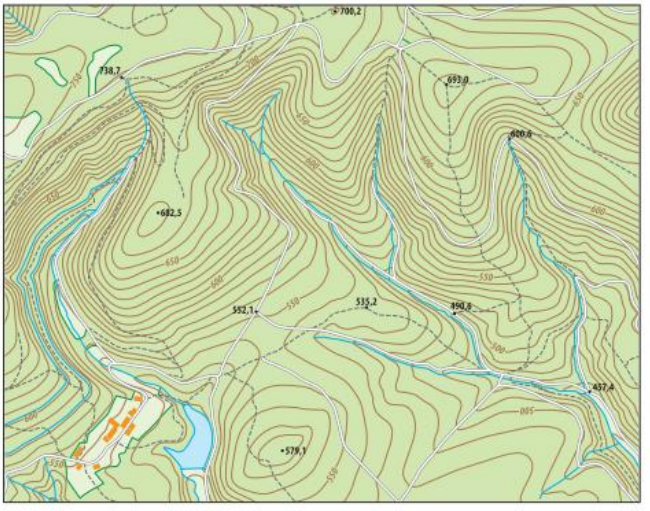
Source: Matilda Education Australia

Source 4

An Asia political map showing country borders

Topographic maps

Topographic maps show how mountainous a region is. Topographic maps have a series of wiggly lines with numbers along them. These are known as **contour lines**. The closer together the contour lines, the steeper the slope is. The numbers indicate how far above sea level that particular point is. On this topographic map, we can see steep slopes on either side of the rivers. This indicates that the rivers are located in valleys.



Source 5

An extract of a topographic map showing a river valleys

Learning Ladder G0.2

1 How are maps used in Geography?

2 Why do geographers present data on different kinds of maps?

3 Download an outline map of Australia that shows the states and territories. Survey your classmates to see how many people have travelled to each Australian state or territory. As a class, review your results and create a suitable legend. It may look something like this:

	Number of people in my class who have travelled to a state or territory
	0–2 people have travelled here
	3–5 people have travelled here
	6–8 people have travelled here
	9–11 people have travelled here
	12 or more people have travelled here

Using coloured pencils, illustrate your findings as a choropleth map.

4 Research online to find a few examples of topographic maps. In pairs, annotate the following features on one of the maps:
- the steepest terrain shown in the map
- the location with the highest altitude
- geographical features such as lakes, valleys, volcanoes or ridges.

5 Look at Source 3 – the Australian climate map.
- a In small groups, discuss how this map may be useful in determining which regions in Australia would be most 'liveable' (refer to page 86).
- b What other information could we gain from these types of maps? Make a list to share with the rest of your class.

Mapping with BOLTSS, page 152
Mapping skills, page 154

HOW TO

How do I use this book?

Good Geography has been built to help you thrive as you move through the Level 7 Geography curriculum and to enable you to demonstrate your progress in every single lesson. This book explores two geographical topics: Water, and Place and Liveability. You will also find a Fieldwork section and a Geo How-To skills section. The Geo How-To section is vital and you should refer to it often.

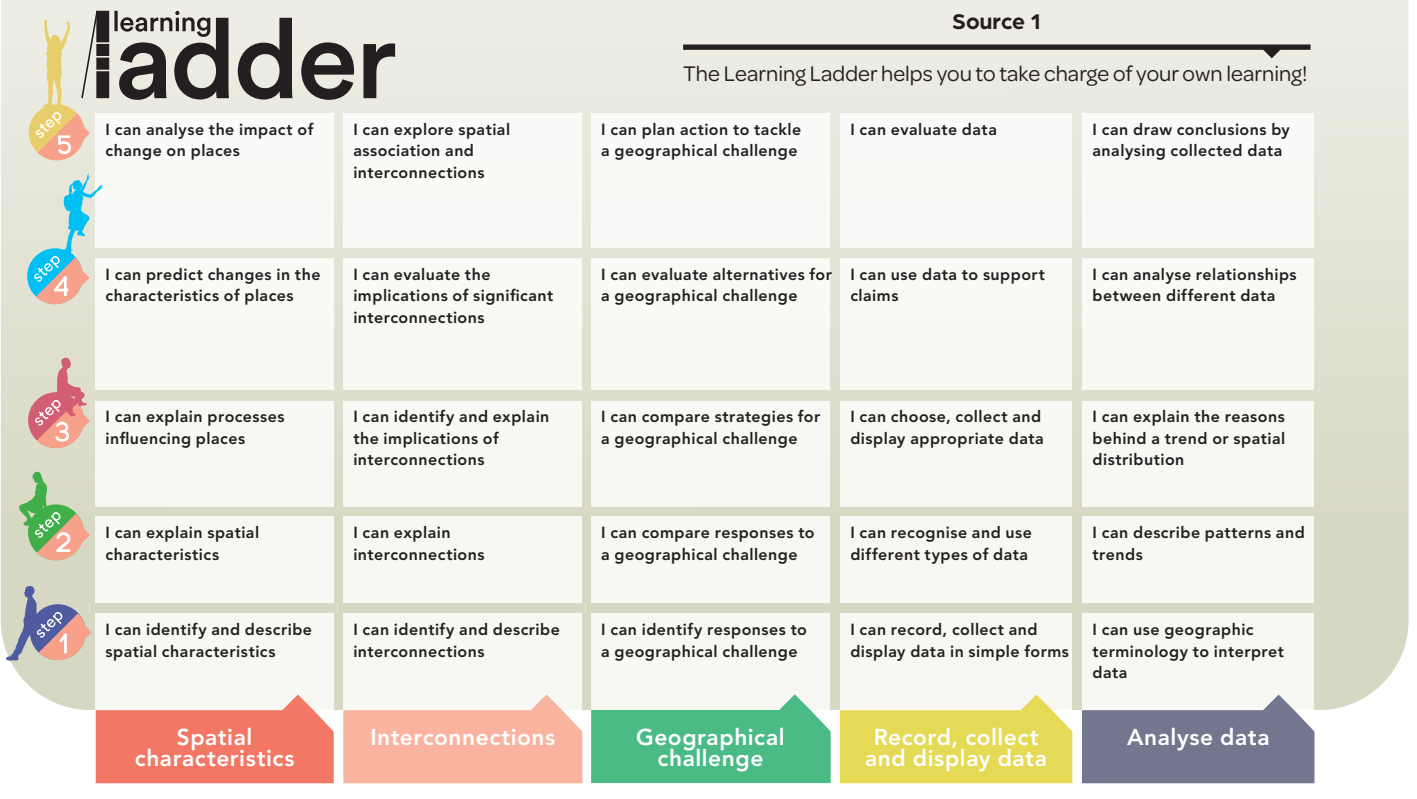
Climb the Learning Ladder

Geography is a skills-based subject, so learning content alone does not mean that you have geographical understanding. In order to be a geographer, you need to be able to interpret spatial data and conduct and communicate your own research.

Each chapter begins with a Learning Ladder. The Learning Ladder is your 'plan of attack' for the skills you will practise in each chapter. It lists the five geographical skills you will be learning, and has five levels of progression for each of those skills.

Each skill described in the Learning Ladder is of a higher difficulty than the one below it. To be able to achieve the higher-level skills, you need to be able to master the lower ones. Practising activities at the earlier levels will help you develop the skills to complete more involved tasks, such as evaluating. This approach is called 'developmental learning' and it puts you in charge of your own learning progression!

Read the ladder from the bottom to the top. As you progress through the chapter, you will climb up the Learning Ladder.



Check your progress

Each chapter is divided into about 12 sections. Each section is designed to cover one lesson, but sometimes your teacher might decide to spend more time (or less time) on a particular section. A section is usually two pages long – but some are four pages long.

At the end of every section, you will find a block of questions called 'Learning Ladder', which has two different types of questions or activities:

1 Show what you know:

These questions ask you to look back at the content you have read and viewed, and to show your understanding of it by listing, describing and explaining.

2 Learning Ladder:

These activities are linked to the Learning Ladder. You can complete one of the questions or all of them. In each chapter you will complete at least one activity for each level of the Learning Ladder. This will sharpen your geographical skills.

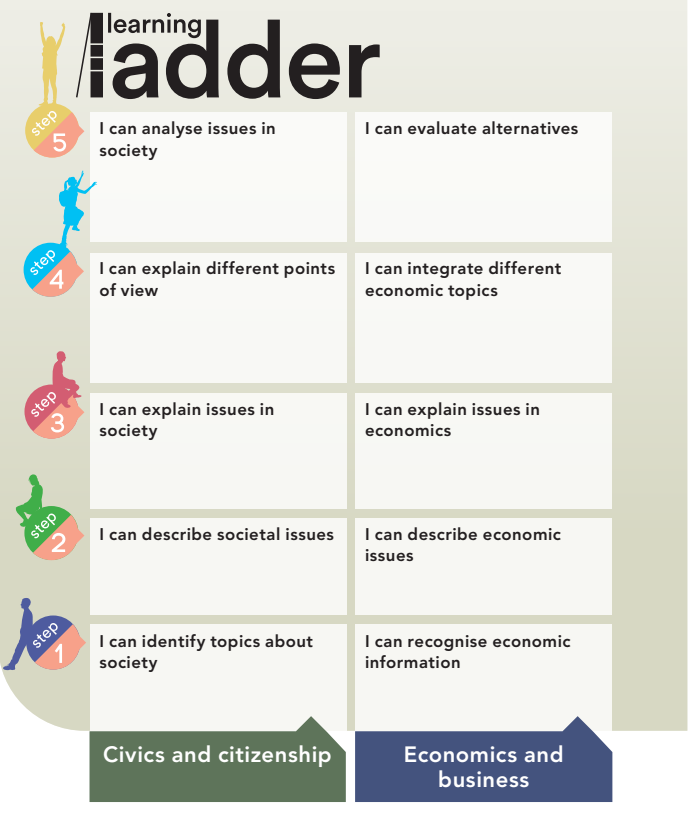
Source 2

Check your progress regularly. You can attempt one or all of the Learning Ladder questions.

civics+ citizenship economics+ business

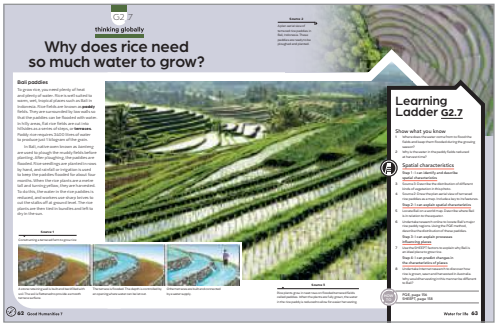
The study of Geography can be complemented by the study of Civics and citizenship, and Economics and business. In every chapter of this book you will discover either a Civics and citizenship lesson or an Economics and business lesson. School is busy and you have a lot to cover, so designing a textbook where the important Civics and citizenship and Economics and business content is placed meaningfully next to relevant Geography lessons makes good sense, and will help you to connect your learning.

As you work through the Civics and citizenship and Economics and business sections in this book, you will also be working your way up a Learning Ladder for these subjects too!



Case studies

Throughout every chapter, you will discover a variety of case studies that explore local, national and global places, issues and events. A case study is an in-depth exploration of a single subject (the case) and is usually based on data or research. The local case studies are focused on Victorian contexts. The national case studies explore other parts of Australia and the global case studies describe places and events in other countries.



Source 3

Case studies are an important part of your Geography course.

Geo How-To

At the end of the book, you will find a skills section called 'Geo How-To'. In this section, there are explanations about how to perform each skill. There are *lots* of examples. Refer to it often, especially when answering the Learning Ladder questions.

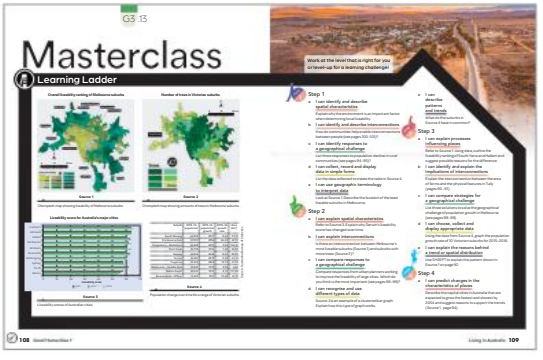
The Fieldwork section of your textbook explains all the skills you need for hands-on research, as well giving you several suggested tasks.

Source 4

The Geo How-To section is your key to success – refer to it often!

Masterclass

Masterclass is a review section at the end of each chapter. The questions here are organised by the steps on the Learning Ladder. You can complete all the questions, or you might be directed by your teacher to complete just some of them.

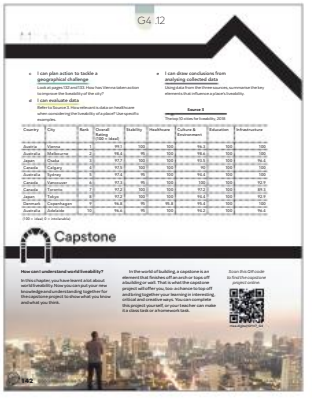


Source 5

You did it! We knew you could! The Masterclass is your opportunity to show your progress. Take charge of your own learning and see if you can extend yourself.

Capstone

After you complete a chapter, it's time to put your new knowledge and understanding together for the capstone project to show what you *know* and what you *think*. In the world of building, a capstone is an element that finishes off an arch, or tops off a building or wall. That is what the capstone project will offer you, too: a chance to top off and bring together your learning in interesting and creative ways. It will ask you to think critically, to use key concepts and to answer 'big picture' questions. The capstone project is accessible online; scan the QR code to find it quickly.



Source 6

The capstone project brings together the learning and understanding of each chapter. It provides an opportunity to engage in creative and critical thinking.

Learning Ladder G0.3

1. How can you use the Learning Ladder to monitor your progress in Year 7 Geography?
2. As a class, discuss the idea of 'monitoring your own progress'. Why is this important?
3. Read through the steps of the Geography Learning Ladder and consider where you might already be up to for each skill, based on your prior learning.

G1

Water on Earth

WHERE IS THE WORLD'S WATER? page 18

interconnection

page 20

HOW DOES WATER MOVE?

thinking globally

page 24

WHY IS MAWSYNRAM THE WORLD'S WETTEST PLACE?

economics + business

page 40

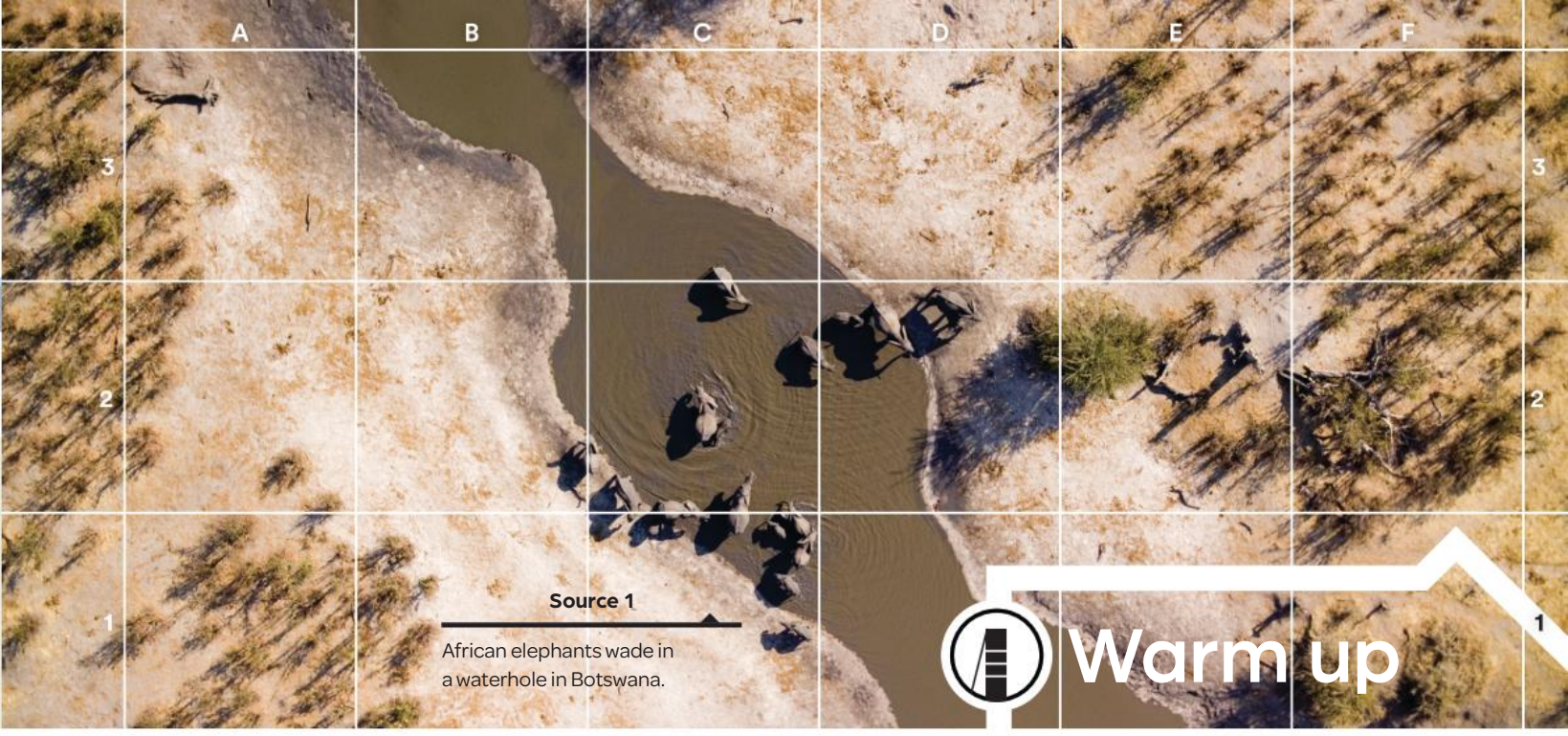
WHAT ARE THE COSTS OF FLOODS?

How can I understand water on Earth?

Without water, no living thing can survive. Two-thirds of Earth is covered in water, but just 2.5 per cent of this water is fresh water. Most of Earth's fresh water is locked up as ice. Fresh water is one of our most precious environmental resources, but increases in population are putting the quality and availability of water at risk.

learning ladder

	Spatial characteristics	Interconnections	Geographical challenge
step 5	**I can analyse the impact of change on places** I can analyse and evaluate the implications of changing climatic conditions at different scales and calculate its impact on people and environments.	**I can explore spatial association and interconnections** I can compare distribution patterns and the interconnections between them; e.g. land uses such as farms and sporting fields on floodplains.	**I can plan action to tackle a geographical challenge** I can frame questions, evaluate findings, plan actions and predict outcomes to tackle a water-based geographical challenge.
step 4	**I can predict changes in the characteristics of places** I can predict changes in the characteristics of places over time due to variations in climate.	**I can evaluate the implications of significant interconnections** I can identify, analyse and explain key water-based interconnections within and between places, and evaluate their implications over time and at different scales.	**I can evaluate alternatives for a geographical challenge** I can weigh up alternative views and strategies on a water-based geographical challenge using environmental, social and economic criteria.
step 3	**I can explain processes influencing places** I can explain the series of actions leading to change in a place, such as the development of rainfall.	**I can identify and explain the implications of interconnections** I can identify, analyse and explain water-based interconnections and explain their implications.	**I can compare strategies for a geographical challenge** I can compare strategies for a geographical challenge, taking into account a range of factors and predicting the likely outcomes.
step 2	**I can explain spatial characteristics** I can identify concepts of Space, Place, Interconnection, Change, Environment, Sustainability and Scale (SPICESS) when I read about water on Earth.	**I can explain interconnections** I can describe and explain interconnections and their effects, such as the formation and use of aquifers.	**I can compare responses to a geographical challenge** I can identify and compare responses to a geographical challenge and describe its impact on different groups.
step 1	**I can identify and describe spatial characteristics** I can talk about spatial characteristics at a range of scales; e.g. drainage basins of the world.	**I can identify and describe interconnections** I can identify and explain simple interconnections involved in phenomena such as the water cycle and flooding.	**I can identify responses to a geographical challenge** I can find responses to a geographical challenge such as flooding and understand the expected effects.



Source 1

African elephants wade in a waterhole in Botswana.

Warm up

I can evaluate data
I can determine whether data presented about water on Earth is reliable and assess whether the methods I used in the field or classroom were helpful in answering a water-based research question.

I can draw conclusions from analysing collected data
I can summarise findings and use collected data to support key patterns and trends I have identified for water-based research.

I can use data to support claims
I can select or collect the most appropriate data and create specialist maps and information using ICT to support investigations into water and its use on Earth.

I can analyse relationships between different data
I can use multiple data sources, overlays and GIS to find links and relationships that exist in patterns of water use on Earth.

I can choose, collect and display appropriate data
I can select useful sources of water data and represent them to conform with geographic conventions.

I can explain the reasons behind a trend or spatial distribution
I can identify Social, Historical, Economic, Environmental, Political and Technological (SHEEPT) factors to help me explain patterns in data.

I can recognise and use different types of data
I can define the terms primary, secondary, qualitative and quantitative data and represent data in more complex forms.

I can describe patterns and trends
I can identify Patterns, Quantify them and point out Exceptions (PQE) to describe the patterns I see.

I can collect, record and display data in simple forms
I can identify that maps and graphs use symbols, colours and other graphics to represent data.

I can use geographic terminology to interpret data
I can identify increases, decreases or other key trends on a map, graph or chart about water.

Collect, record and display data

Analyse data

Spatial characteristics

1 What place is shown in Source 1?

2 Is this place natural or built?

Interconnections

3 *Interconnection* is the idea that two things or phenomena are related, interact or are linked in some way. Why might there be an interconnection between herds of animals and waterholes?

Geographical challenge

4 Illegal poaching is a huge threat to elephants. Why might there also be an interconnection between poachers and waterholes?

Collect, record and display data

5 a How many elephants are located at this waterhole?

b Is this quantitative or qualitative data? (Quantitative data is a measurement; qualitative data is a description.)

6 What survey method might you use to count smaller animals, such as frogs?

Analyse data

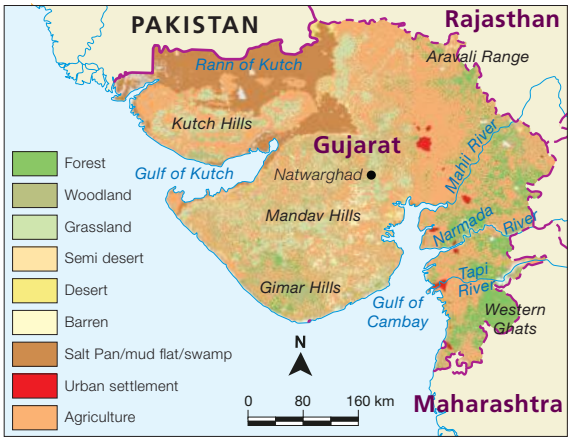
7 Use the grid references in Source 1 to describe the location of the elephants. Refer to page 152 to help you do this.

8 Why are the elephants located here?

Why does water matter?

Water connects places around the world as people settle near **fresh water** resources to access water for drinking, cleaning, farming, industry, power generation, transport and recreation. Human activity clusters around the available fresh water in rivers, lakes and underground sources. These water resources need to be shared by communities and carefully managed.

Gujarat: Environments



Source: Matilda Education Australia

Source 1

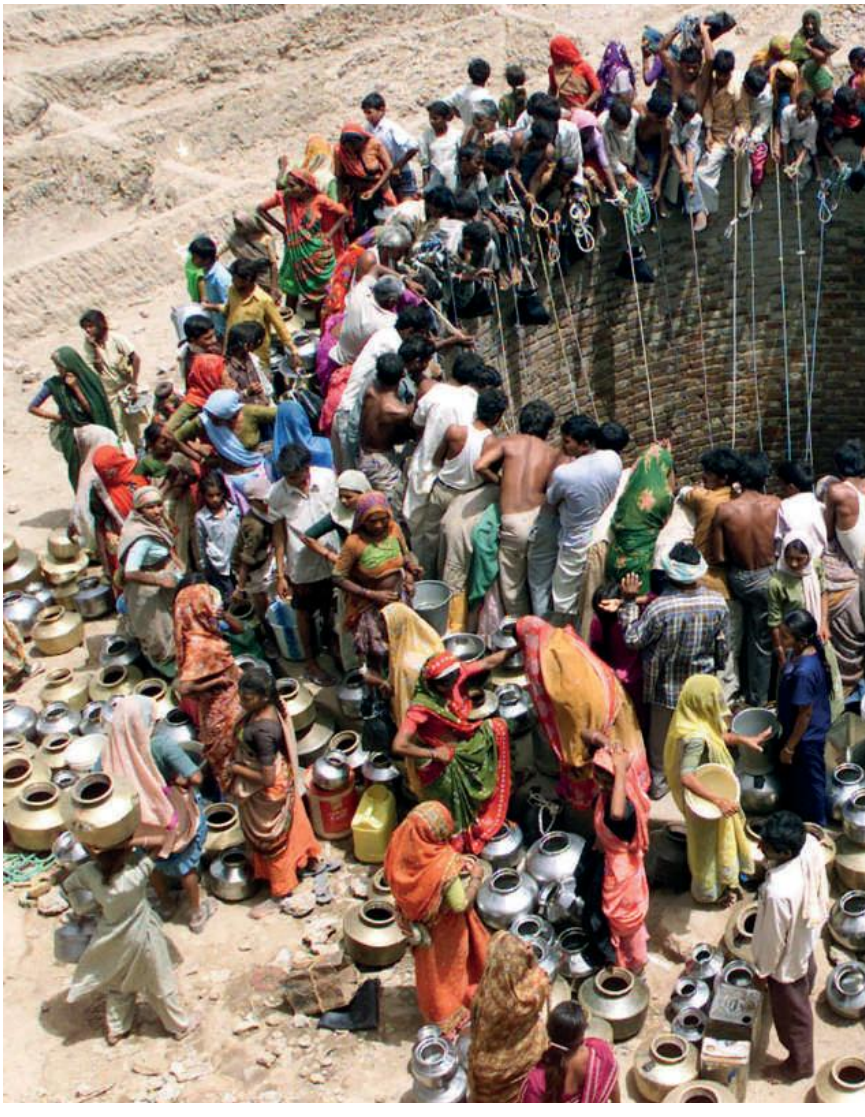
A map showing different environments in the state of Gujarat, India

Gujarat: Population distribution

Source: Matilda Education Australia

Source 2

A dot map showing **population density** in the state of Gujarat, India



Source 4

Heavy water containers are balanced on the head.

Source 3

People crowd to get water from a large well in the village of Natwarghad in the Indian state of Gujarat in June 2003. The state was facing its worst drought in over a decade. Dams, wells and ponds dried up as the region sweltered in temperatures over 44°C. People were forced to walk long distances and wait for hours around village ponds for water tankers to arrive.

Learning Ladder G1.1

Show what you know

1 Explain what is happening in Source 3.

2 Why is water such an important resource?

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

3 Source 3: What is the location of this place and why have so many people gathered here at this time?

Step 2: I can explain spatial characteristics

4 Source 2: Do the least number of people in the state of Gujarat live in the north, south, east or west of the state?

Step 3: I can explain processes influencing places

5 Sources 1 and 2: Compare the two maps. How does the availability of water impact where people live in Gujarat?

Step 4: I can predict changes in the characteristics of places

6 Create a photo essay to illustrate how one of the following processes has changed the characteristics of a place:

- drought
- flood
- irrigation.

HOW TO Photo essays, page 163

Will we always have water?

Humans depend on the Earth's **environmental resources**: water from rainfall; food from the land and oceans; and energy from the atmosphere, land and water. Some environmental resources will last forever (they are perpetual) and others are renewable. But some resources are not renewable – if we overuse them, they will run out.

Types of environmental resources

1 Renewable resources

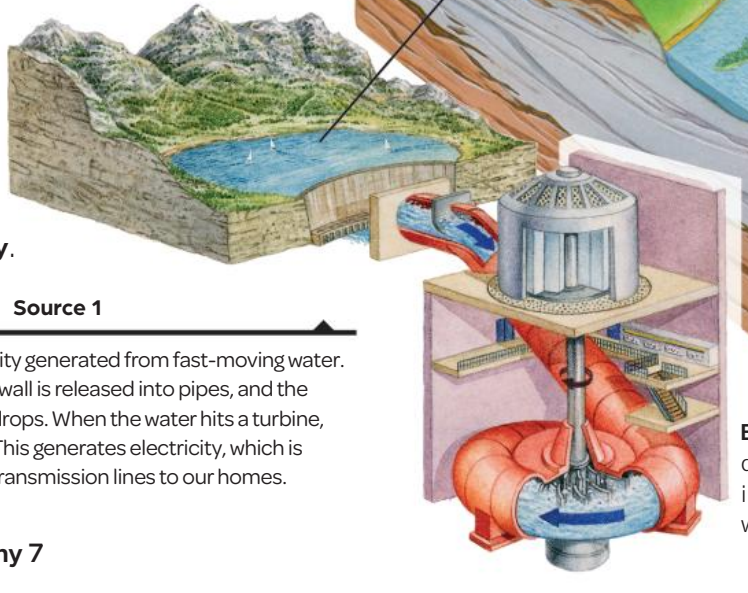
Renewable resources will naturally renew themselves if we do not use them too quickly. We need to manage renewable resources to ensure they have a chance to recover (or regenerate).

Fresh water is considered to be a renewable resource, but this does not mean that it is an unlimited resource. Water pollution and population increases can put our fresh water resources at risk.

2 Perpetual resources

Perpetual resources are renewable resources that don't run out, regardless of how much they are used. Examples of perpetual resources include:

- wind energy
- solar energy
- waves and tides
- **geothermal energy**
- **hydroelectricity**.



Source 1

Hydroelectricity is electricity generated from fast-moving water. Water held back by a dam wall is released into pipes, and the water gathers speed as it drops. When the water hits a turbine, it makes the turbine spin. This generates electricity, which is then transferred through transmission lines to our homes.

Bores are dug to tap into underground water storages.

3 Non-renewable resources

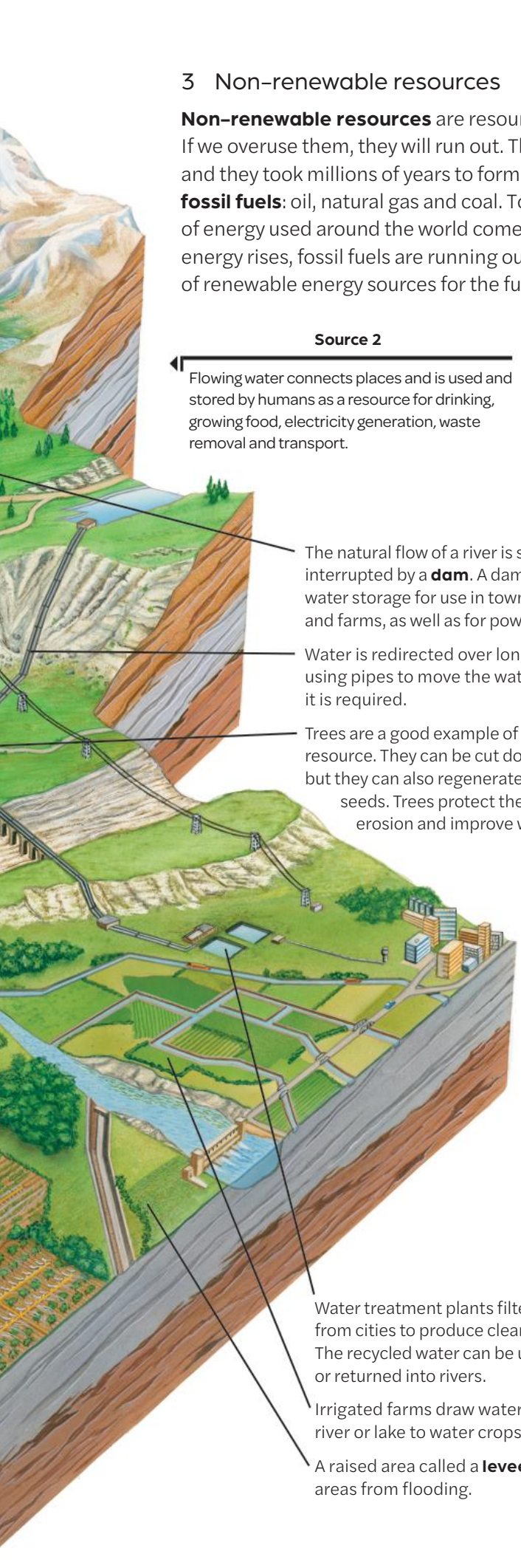
Non-renewable resources are resources that are only available in limited amounts. If we overuse them, they will run out. These resources are found inside Earth and they took millions of years to form. Non-renewable resources include the **fossil fuels**: oil, natural gas and coal. Today, 84 per cent of the total amount of energy used around the world comes from fossil fuels. As demand for energy rises, fossil fuels are running out. Scientists are exploring the potential of renewable energy sources for the future, such as solar and wind power.

Source 2

Flowing water connects places and is used and stored by humans as a resource for drinking, growing food, electricity generation, waste removal and transport.

Source 3

Floating platforms are used to extract fossil fuels such as oil from beneath the surface of Earth. Massive drills up to 2.5 kilometres long are used. Oil is drawn up to the surface, then pumped into tanker ships that take it to be processed.



The natural flow of a river is sometimes interrupted by a **dam**. A dam provides water storage for use in towns, industry and farms, as well as for power generation.

Water is redirected over long distances using pipes to move the water to where it is required.

Trees are a good example of a renewable resource. They can be cut down for timber, but they can also regenerate through seeds. Trees protect the soil from erosion and improve water quality.

Water treatment plants filter waste water from cities to produce clear, fresh water. The recycled water can be used by humans or returned into rivers.

Irrigated farms draw water from a river or lake to water crops and pastures.

A raised area called a **levee** protects areas from flooding.

Learning Ladder G1.2

Show what you know

1 Is fresh water an unlimited resource?

2 Study Source 2. Give three examples of how humans change the river for their own use.

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

3 Draw a table to record examples of renewable and non-renewable resources.

Step 2: I can recognise and use different types of data

4 Sources 1-3 are block diagrams. Why are block diagrams useful when showing water resources? (see also page 162).

Step 3: I can choose, collect and display appropriate data

5 Conduct a field sketch or use the internet to find a photo of an environment in your local community.

a Label the key elements in this environment that are linked with water.

b Highlight any renewable or non-renewable resources in the environment.

Step 4: I can use data to support claims

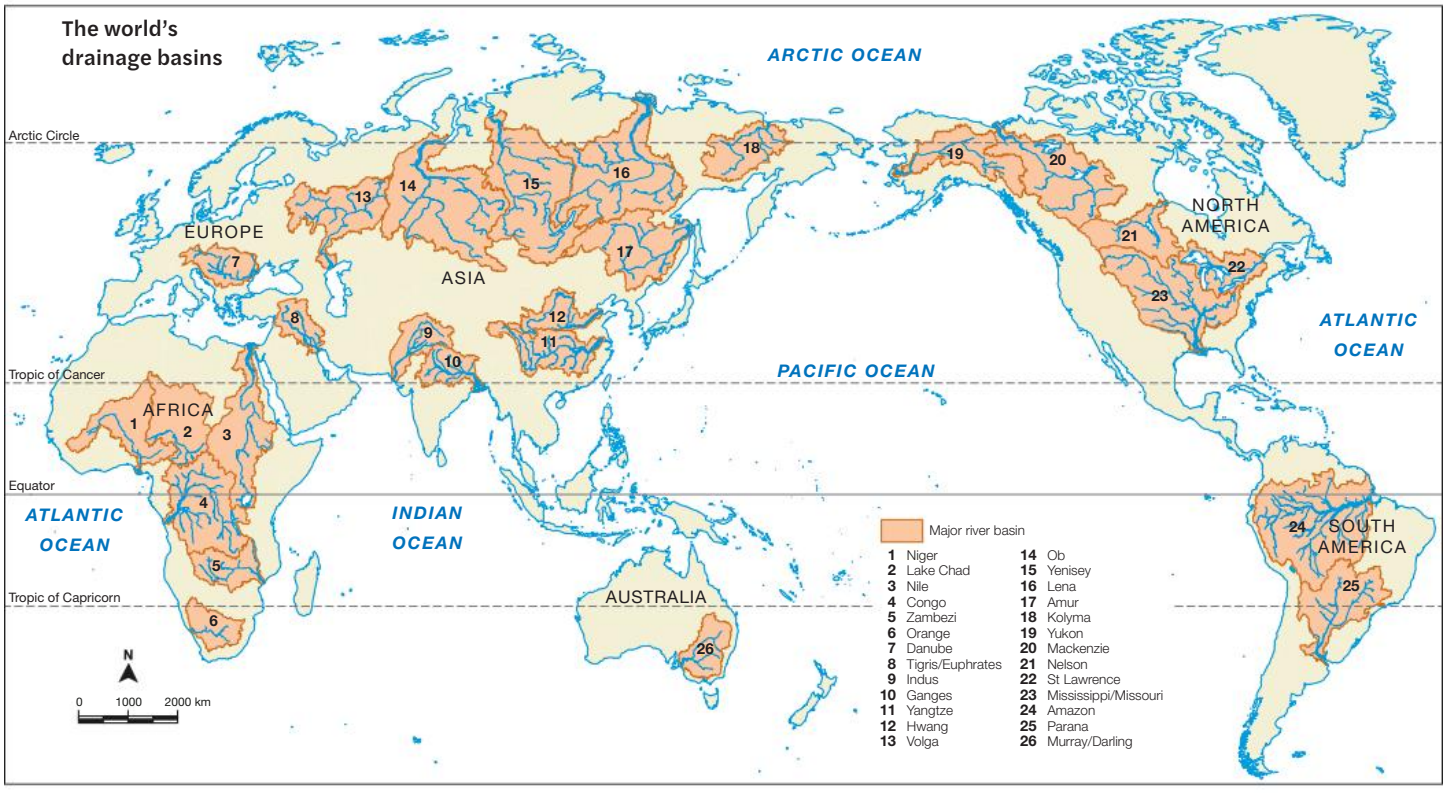
6 Research the top 10 renewable energy-using nations in the world and present this in a visual form.

HOW TO

Sketches and annotating, page 160
Block diagrams, 162

Where is the world's water?

Earth is referred to as the 'blue planet' because 70 per cent of its surface is covered in water. Just 2.5 per cent of all water is fresh water – a key resource we need to survive. Most of that fresh water is frozen, and locked up in glaciers and ice caps.



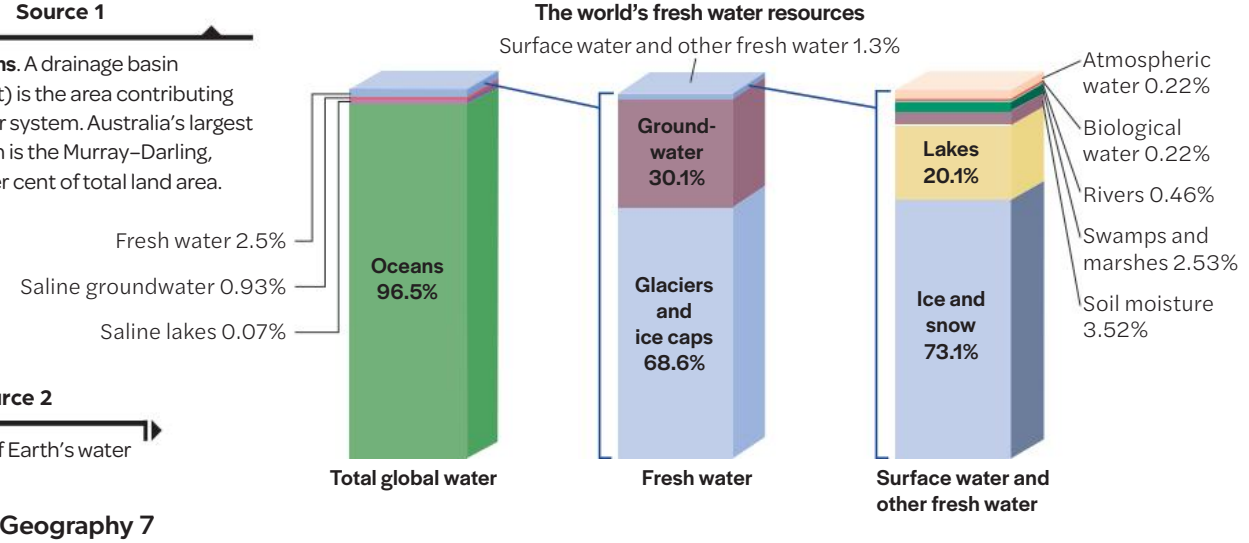
Source: Matilda Education Australia

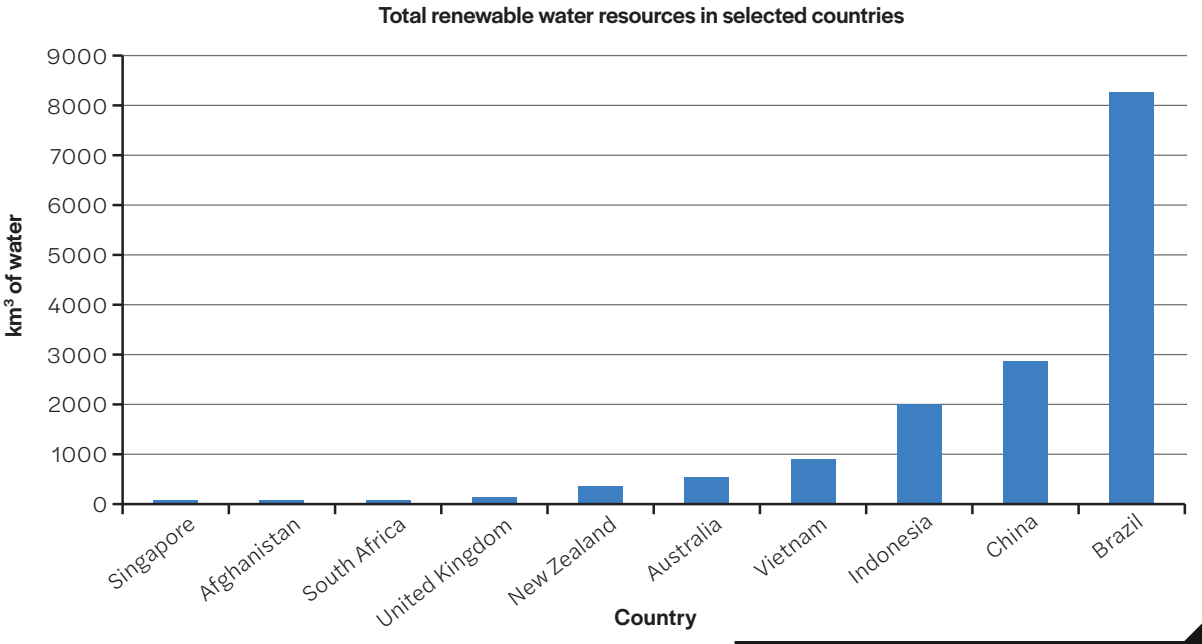
Source 1

Drainage basins. A drainage basin (or catchment) is the area contributing water to a river system. Australia's largest drainage basin is the Murray–Darling, covering 14 per cent of total land area.

Source 2

Distribution of Earth's water





Source 3

Fresh water distribution by country. Fresh water is not evenly distributed across the planet, as some countries have more water than others. These countries are **water rich**. Water-rich countries are those with high rainfall, such as Indonesia, or with large river systems, such as the Amazon River in Brazil. Dry countries, such as Australia and Afghanistan, are **water poor**.

Water on Earth

Water is an essential resource that we need to survive. It is also a renewable resource that occurs naturally on Earth. The same amount of water that was available in the time of the dinosaurs is still available today.

Water constantly changes state and moves through oceans, rivers and the atmosphere in a system known as the water cycle (see pages 20 and 21). To say water 'changes state' means that it changes from being a solid (ice), to a liquid (water), to a gas (vapour).

Water is a renewable resource because of the water cycle, which continually returns water to rivers, lakes and underground storage for humans to use.

Over 70 per cent of the Earth's surface is covered in water, but 96.5 per cent of that is salt water in our oceans.

The fresh water that all living things need to survive makes up only 2.5 per cent of our total water resource. Only a tiny amount of all fresh water is easily accessible in rivers, lakes, ice and snow – just 1.3 per cent. The rest of the fresh water is locked away underground or frozen in **glaciers** and **ice caps**.

Learning Ladder G1.3

Show what you know

1 Why can't we easily access all of Earth's fresh water?

2 Define what is meant by 'water poor' and 'water rich'.

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

3 What data does Source 1 display?

Step 2: I can recognise and use different types of data

4 Source 2: Is this a primary or secondary piece of data? Explain your answer.

Step 3: I can choose, collect and display appropriate data

5 Source 3: As a class, list how the data for this source may have been collected.

Step 4: I can use data to support claims

6 Source 2: How do each of these percentages help explain the amount of fresh water on Earth:
- fresh water 2.5%
- surface water and other fresh water 1.3%.

HOW TO

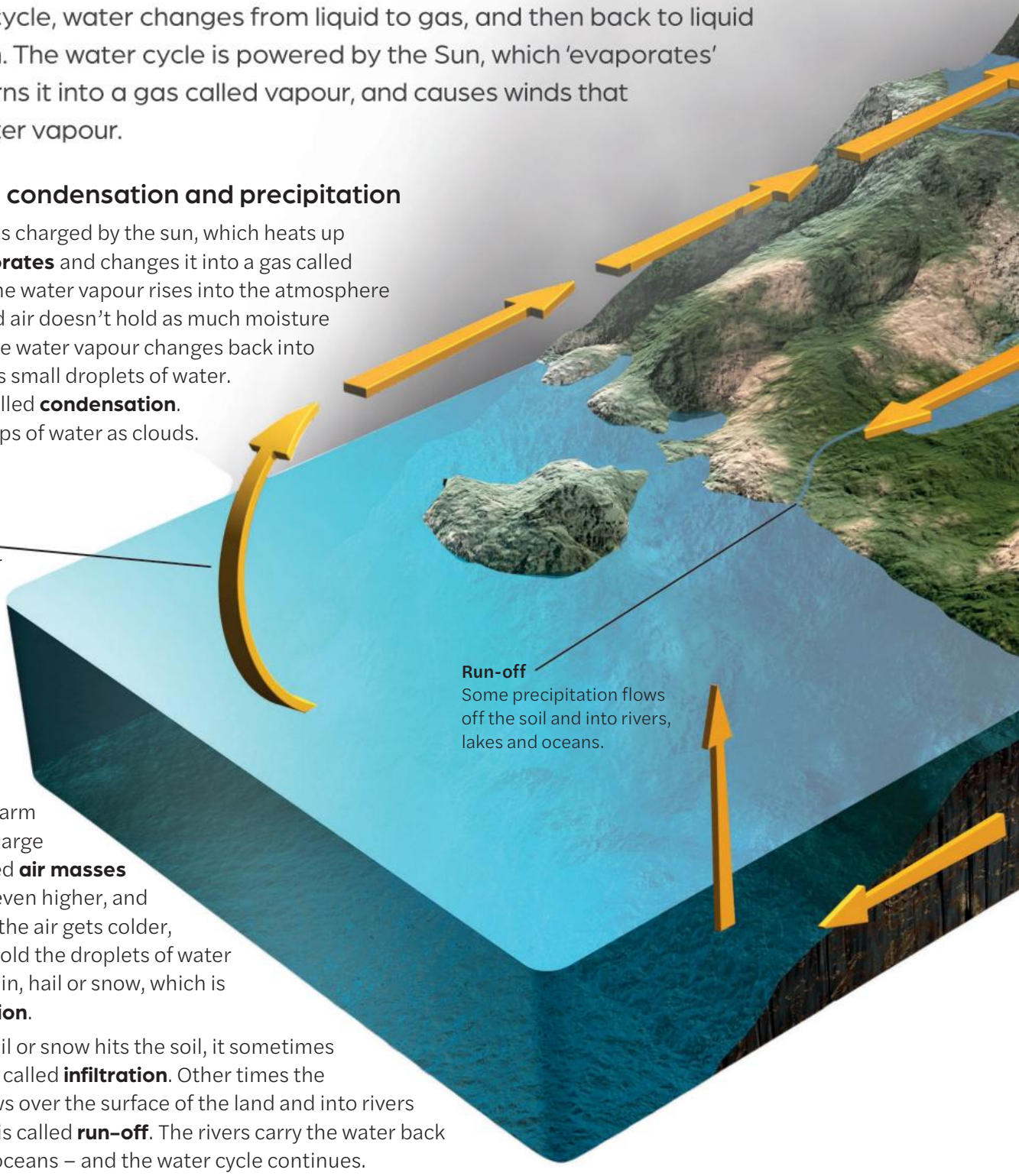
PQE, page 156
Sketches and annotating, page 160

How does water move?

In the water cycle, water changes from liquid to gas, and then back to liquid or solid again. The water cycle is powered by the Sun, which 'evaporates' water and turns it into a gas called vapour, and causes winds that move the water vapour.

Evaporation, condensation and precipitation

The **water cycle** is charged by the sun, which heats up water so it **evaporates** and changes it into a gas called **water vapour**. The water vapour rises into the atmosphere until it cools. Cold air doesn't hold as much moisture as warm air, so the water vapour changes back into a liquid and forms small droplets of water. This process is called **condensation**. We see these drops of water as clouds.

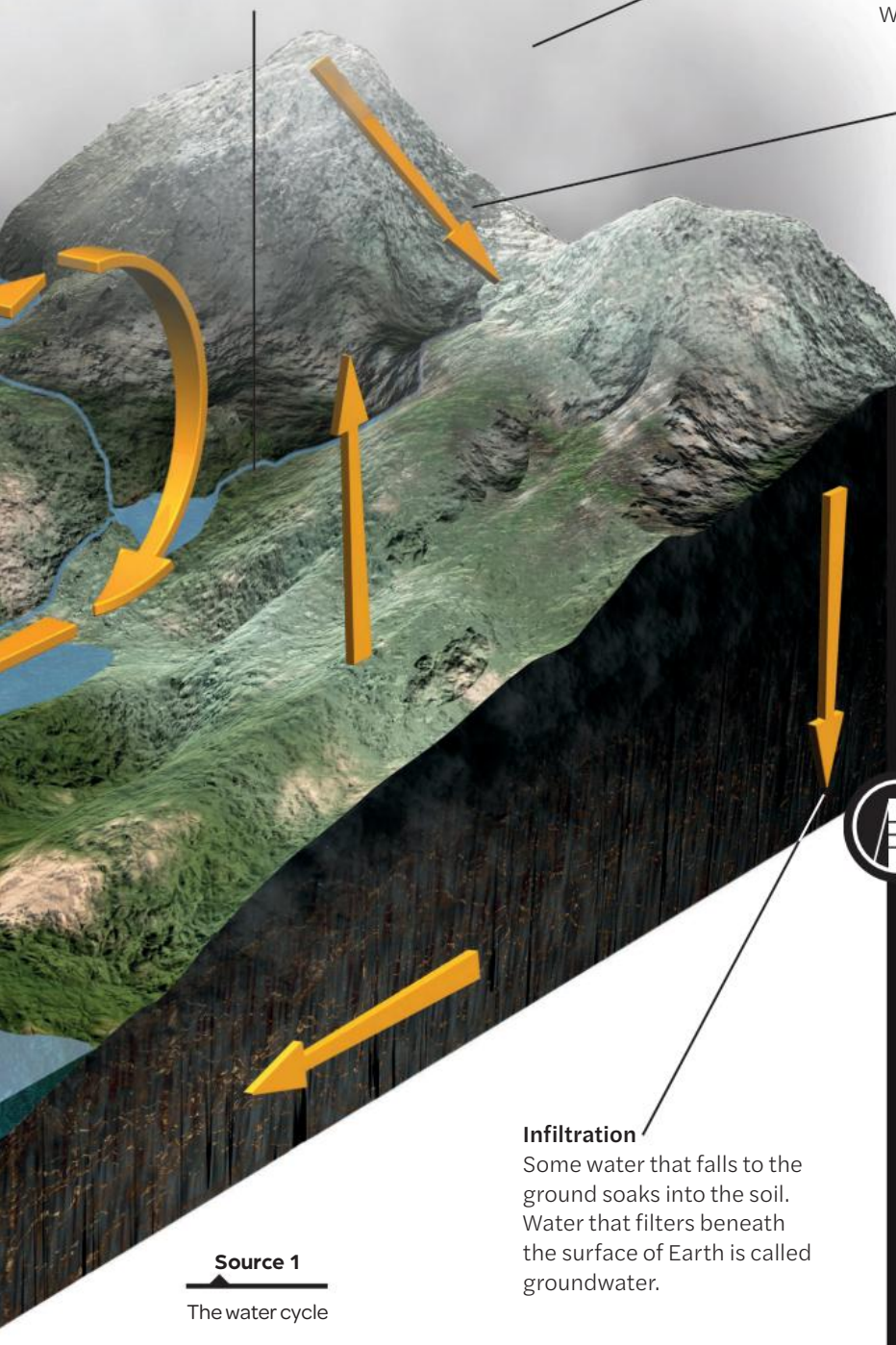


Evaporation
The Sun heats water on the surface of Earth and turns it into a gas called water vapour, which rises into the air.

Run-off
Some precipitation flows off the soil and into rivers, lakes and oceans.

Mountains, warm temperatures or large bodies of air called **air masses** can push the air even higher, and it cools again. As the air gets colder, it can no longer hold the droplets of water and they fall as rain, hail or snow, which is called **precipitation**.

When rain, hail or snow hits the soil, it sometimes soaks in, which is called **infiltration**. Other times the precipitation flows over the surface of the land and into rivers and lakes, which is called **run–off**. The rivers carry the water back to the lakes and oceans – and the water cycle continues.



Source 1

The water cycle

Water balance

The water cycle has a **water balance**. If there is too much precipitation on land, it is returned to the oceans by run-off. If there is too much **evaporation**, it is returned to the land by winds that blow the moist air from the sea onto the land.

Learning Ladder G1.4

Show what you know

1 How does the Sun power the water cycle?

2 What causes air to rise?

Interconnections

Step 1: I can identify and describe interconnections

3 Outline the process of water turning from a liquid to a gas and to a solid as a series of steps.

Step 2: I can explain interconnections

4 Construct a flow diagram to show how water moves through the environment. Use these labels: evaporation, condensation, precipitation, transpiration, run-off.

Step 3: I can identify and explain the implications of interconnections

5 Source 1: Look carefully at the dam in the diagram.

- a Why has the flow of the river been interrupted?
- b Suggest two ways that water can enter the dam.
- c Suggest two ways that water can leave the dam.

Step 4: I can evaluate the implications of significant interconnections

6 Give an example to explain how the water cycle has a water balance.

HOW TO

Flow diagrams, page 161
Geographic concepts, page 4

Where does rain occur?

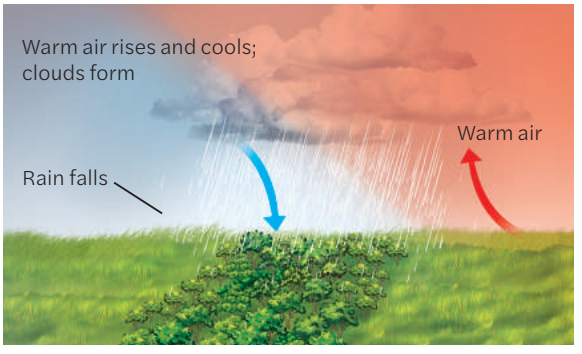
Rain occurs when warm moist air cools and condenses into water droplets. Warm air can hold more water than cool air, so when warmer air rises and cools, it eventually reaches a point where it cannot hold any more water. This is called the dew point.

When warm air cools above its **dew point**, the water vapour it is holding condenses into a liquid and it rains. There are three different ways of forcing air to rise and cool and condense into rain:

- **frontal rainfall**: when cold air meets warm air
- **orographic rainfall**: when warm air is lifted over a mountain
- **convectional rainfall**: when land heats the air above it.

1 Frontal rainfall

Frontal rain occurs when a warm air mass meets a cold air mass. The lighter warm air is less dense, and is pushed up over the heavier cold air. This creates a 'front'. As the warm air mass rises, it cools. Then the water vapour in the air mass condenses into water and falls as raindrops along the front.

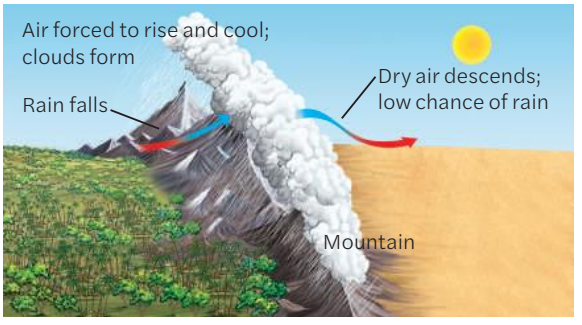


Source 1

How frontal rainfall occurs

2 Orographic rainfall

Orographic rainfall is when moist air meets high land and is forced to rise. As it rises, the air cools and condenses into raindrops on the side of the mountain the wind is blowing from (the windward side). As the air descends from the high land on the other side of the range (the leeward side), it warms and creates dry regions. The **deserts** of central Australia are located on the leeward side of the Great Dividing Range.

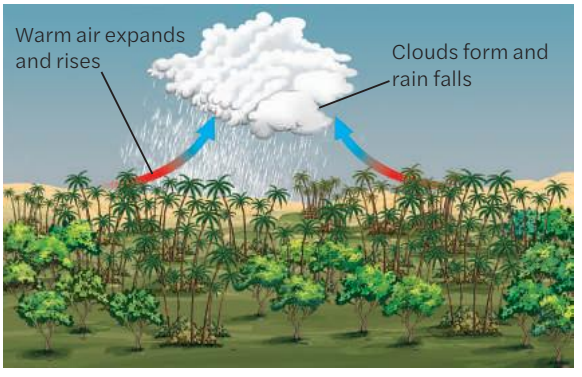


Source 2

How orographic rainfall occurs

3 Convectional rainfall

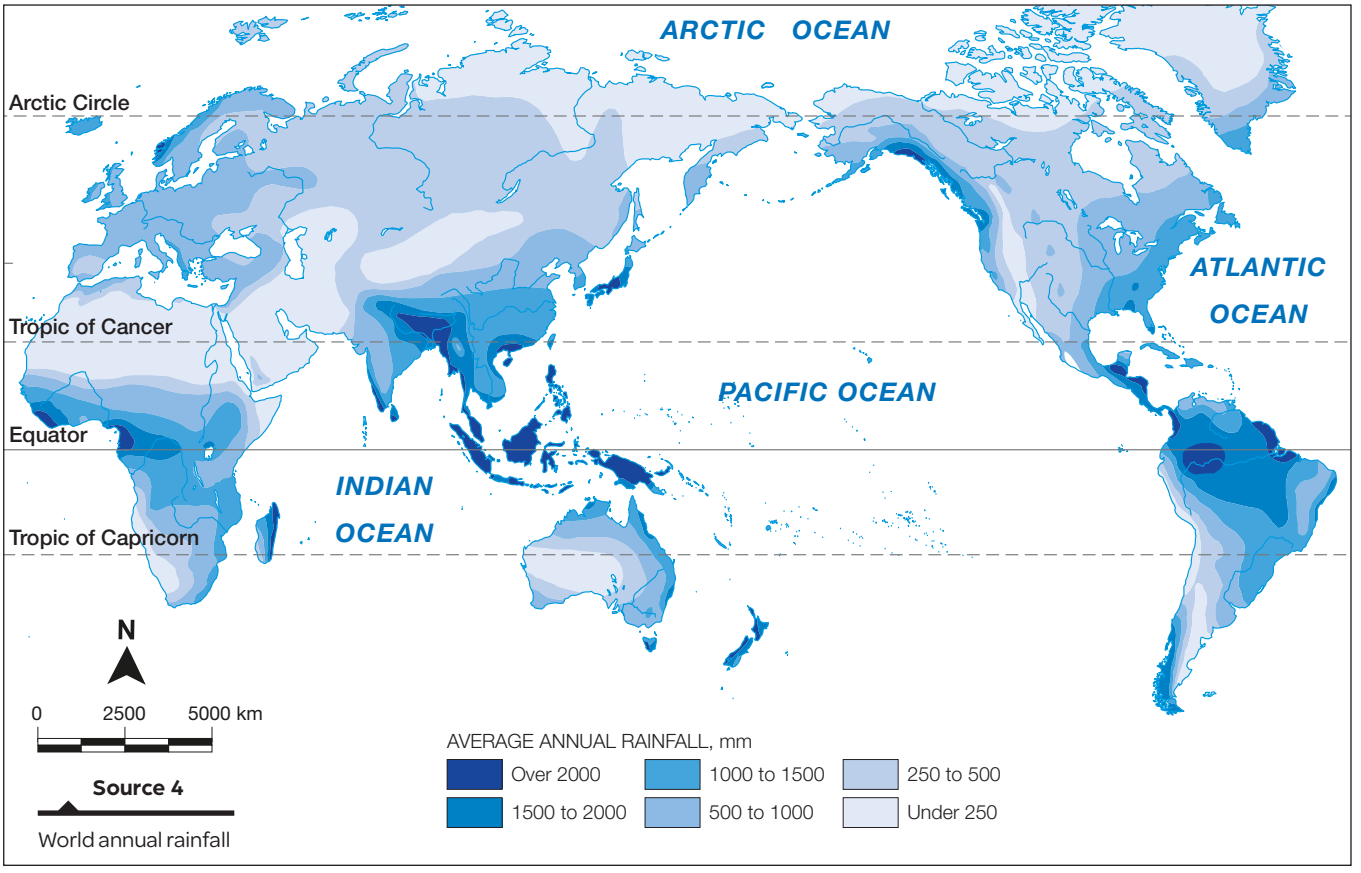
Convectional rainfall is common in **tropical** areas where the ground is heated by the hot sun. The sun heats the land and, as the moisture from the ground evaporates, the heat from the ground heats the air above it. The warm air rises rapidly, then condenses to form clouds as it starts to cool. Convection can produce towering **cumulonimbus clouds**, which produce heavy rainfall, thunderstorms and lightning.



Source 3

How convectional rainfall occurs

World average annual rainfall



Source 4

World annual rainfall

Source: Matilda Education Australia

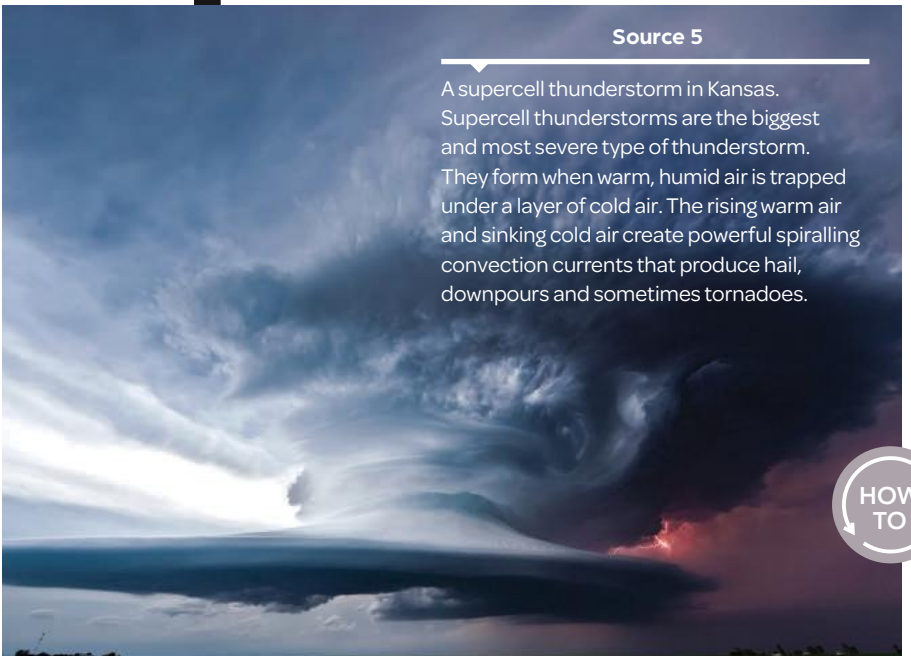
Learning Ladder G1.5

Show what you know

1 When does rainfall occur?

2 Outline the key similarities and differences between frontal and orographic rainfall.

3 Source 5: Create a diagram or download an image from the internet of a supercell thunderstorm. Add labels to show how it causes rainfall.



Source 5

A supercell thunderstorm in Kansas. Supercell thunderstorms are the biggest and most severe type of thunderstorm. They form when warm, humid air is trapped under a layer of cold air. The rising warm air and sinking cold air create powerful spiralling convection currents that produce hail, downpours and sometimes tornadoes.

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

4 Source 4: Use the PQE method to describe the pattern of world rainfall.

Step 2: I can explain spatial characteristics

5 Explain why Australia's deserts are located where they are.

Step 3: I can explain processes influencing places

6 Source 2: How does orographic rainfall cause high rainfall areas on the windward side of mountains but deserts on the leeward side?

Step 4: I can predict changes in the characteristics of places

7 Each day we see a weather map showing the state of the weather for a region. The maps show air masses that meteorologists use to predict the weather over the next few days. Research weather maps and provide an example of a weather map with labels to show how it works.

HOW TO

PQE, page 156

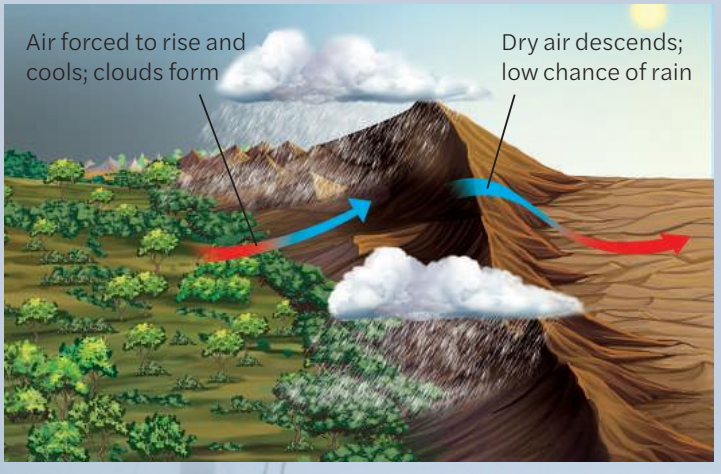
Why is Mawsynram the world's wettest place?

Mawsynram in India has an annual rainfall of 11 871 mm, and is the wettest inhabited place in the world. Cherrapunji, just 15 kilometres from Mawsynram, is the second-wettest place in the world. Mawsynram and Cherrapunji are both located in north-eastern India, about 1400 metres above **sea level**.

During the rainy season, or **monsoon**, much of India receives heavy rainfall. The monsoon months from June to September produce the heaviest rainfall in the north-eastern part of India, on the foothills of the Himalayan Mountains. Winds coming from the Indian Ocean absorb moist air and are forced to rise as they meet the mountains. The air cools and condenses into raindrops, in a process known as orographic rainfall (see page 22). On the other side of the Himalayas it is dry and warm.

Source 1

The monsoon season in Mawsynram produces heavy rain over an extended period. People plan for its arrival by stocking up on food. Women make body umbrellas, called *knups*, from bamboo, grass and plastic.



Source 2

Orographic rainfall brings heavy rainfall to Mawsynram.

Source 3

Mawsynram in India is the world's wettest place.

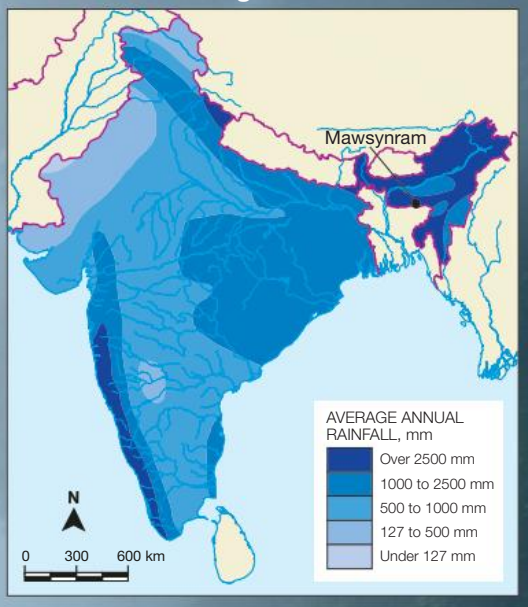
India: Monsoon onset

Source: Matilda Education Australia

Source 4

The onset of monsoons in India

India: Average annual rainfall

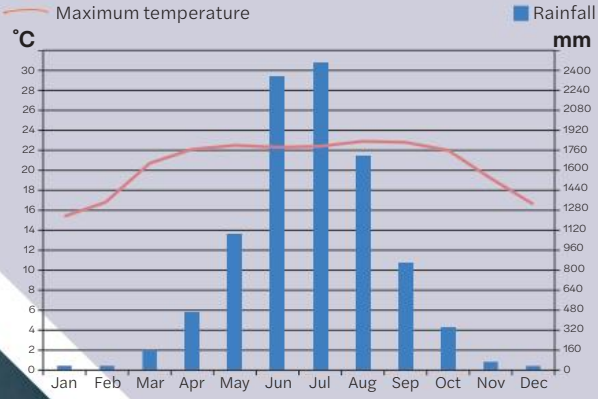


Source: Matilda Education Australia

Source 5

India's annual average rainfall

Mawsynram climate graph Source: Climate-Data.org, 2019



Source 6

Rainfall and temperature in Mawsynram, by month

Learning Ladder G1.6

Show what you know

1 How does orographic rainfall deliver so much rain to Mawsynram?

2 Give two examples of how climate affects the lives of people living in Mawsynram.

Analyse data

Step 1: I can use geographic terminology to interpret data

3 Define the term 'monsoon'.

Step 2: I can describe patterns and trends

4 Source 5: Look at the map of India's average rainfall. Use compass points to describe the driest and wettest regions in India.

Step 3: I can explain the reasons behind a trend or spatial distribution

5 Source 6: Look at the Mawsynram climate graph.
- a Compare the similarities and differences in the patterns of rainfall and temperature over the year.
- b What is the connection between the highest rainfall months and the monsoon (Source 4)?

6 Source 1: Using SHEEPT, explain the factors that people in Mawsynram would use to plan for the monsoon.

Step 4: I can analyse relationships between different data

7 Compare Source 4 and Source 6: Why do you think the north-westerly winter winds don't bring much rain to Mawsynram?

HOW TO

SHEEPT, page 158
Block diagrams, page 162
Climate graphs, page 165

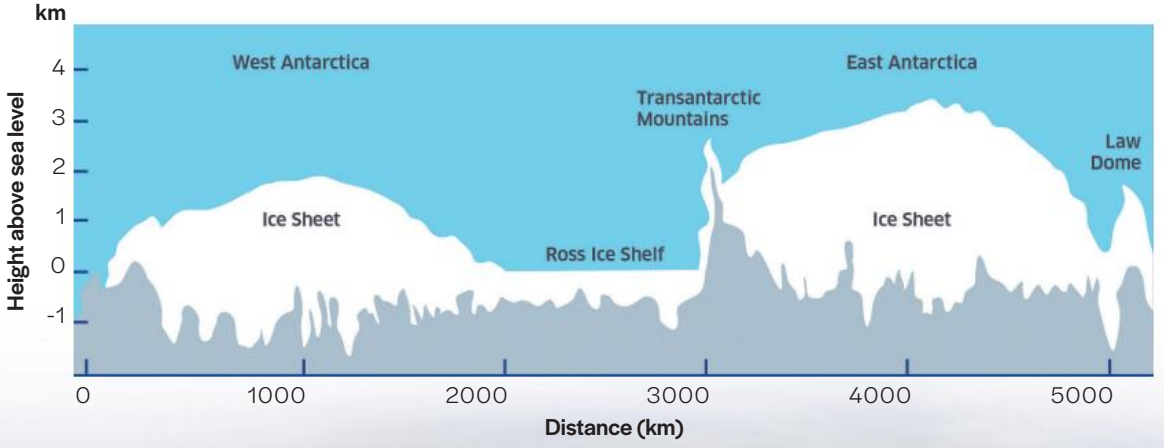
How is water stored?

Fresh water is an essential renewable resource that we need to survive. Only a tiny percentage of all water on Earth is fresh water – just 2.5 per cent. Most of the fresh water is frozen and locked up in glaciers and ice sheets, or stored beneath the surface as groundwater.

Frozen water

Nearly 70 per cent of all fresh water on Earth is stored in **ice sheets**, **ice shelves**, **glaciers** and **icebergs**. In Antarctica, a huge ice sheet with an average thickness of 2.5 kilometres covers the solid rock below.

The freezing Antarctic temperatures prevent most of the snow from melting and the ice sheet it has formed is up to 4.7 kilometres deep at its deepest level. If the Antarctic ice sheet were to melt completely, the world's sea levels would rise by up to 60 metres.



Source 1

A cross-section through the Antarctic continent

Source: Discovering Antarctica, British Antarctic Survey, 2019

Source 2

Most of the world's fresh water is stored as ice. Huge ice sheets move and break off into icebergs when they reach the sea in a process known as calving. These Adelie penguins are on an iceberg that calved from Antarctica's Cape Adare peninsula.

Groundwater

Groundwater is water that is located under Earth's surface. It is fed by surface water from rainfall and rivers. Groundwater can appear on the surface at low points as a **spring** or in dry areas as an **oasis**.

Groundwater fills spaces between grains of soil or rock. In an area way below the soil, called the **saturated zone**, all the spaces between soil and rock particles are filled with water. The top of this zone is called the **water table**.

Australia is the driest inhabited continent on Earth, and surface water resources are limited. Groundwater is a very important renewable resource, and it provides a third of Australia's total water consumption. About 90 per cent of the Northern Territory's water is sourced from groundwater.

Farmers sink bores to pump water to the surface from underground rocks that hold water, called **aquifers**. Windmills use wind energy to pump water to the surface.

Building dams

Humans create their own water storages, called **dams** or **reservoirs**, which collect and retain water. Large dams on rivers provide a reliable water supply for **irrigation**, hydroelectricity or for urban use.

To build a dam, the flow of a river is stopped by the dam wall (see page 29). Water builds up behind the wall and floods the valley. The release of water in front of the dam wall is then regulated to make sure there is enough river water for people and for the river ecosystem.

Learning Ladder G1.7

Show what you know

1 Why can't we use 70 per cent of the fresh water on Earth?

2 What geographic challenge would the world have if the Antarctic ice sheet were to melt?

Geographical challenge

Step 1: I can identify responses to a geographical challenge

3 How do humans make their own water storages?

Step 2: I can compare responses to a geographical challenge

4 Where is most of the usable fresh water on Earth stored and how is it accessed?

Step 3: I can compare strategies for a geographical challenge

5 Look at Source 3 and discuss:
- a How is an aquifer like a river?
- b How do aquifers help connect human settlements in deserts?

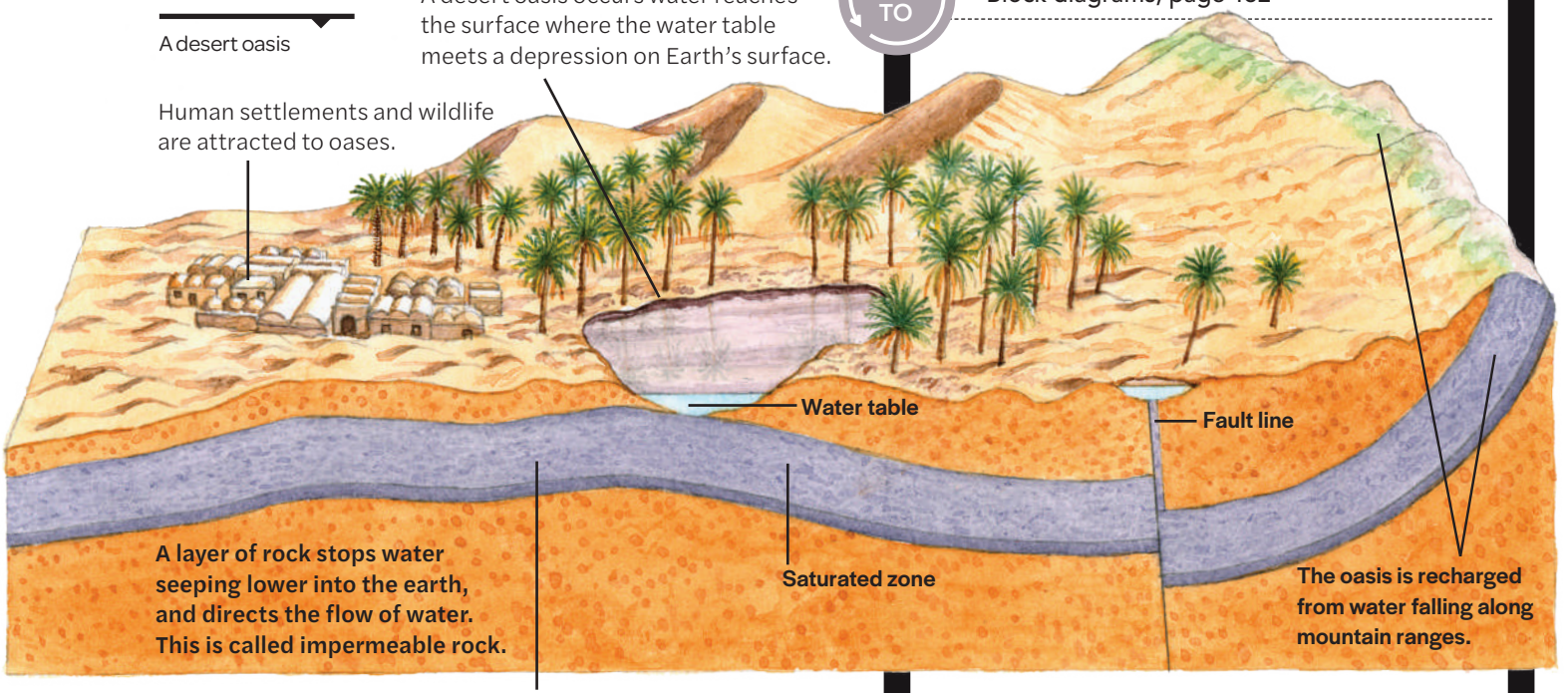
Step 4: I can evaluate alternatives for a geographical challenge

6 Create an experiment to show what happens when a dam wall blocks river flow. What happens to the environments on the land behind the wall? What alternative could give humans a reliable water supply?

HOW TO Block diagrams, page 162

Source 3

A desert oasis



G1.8

thinking nationally

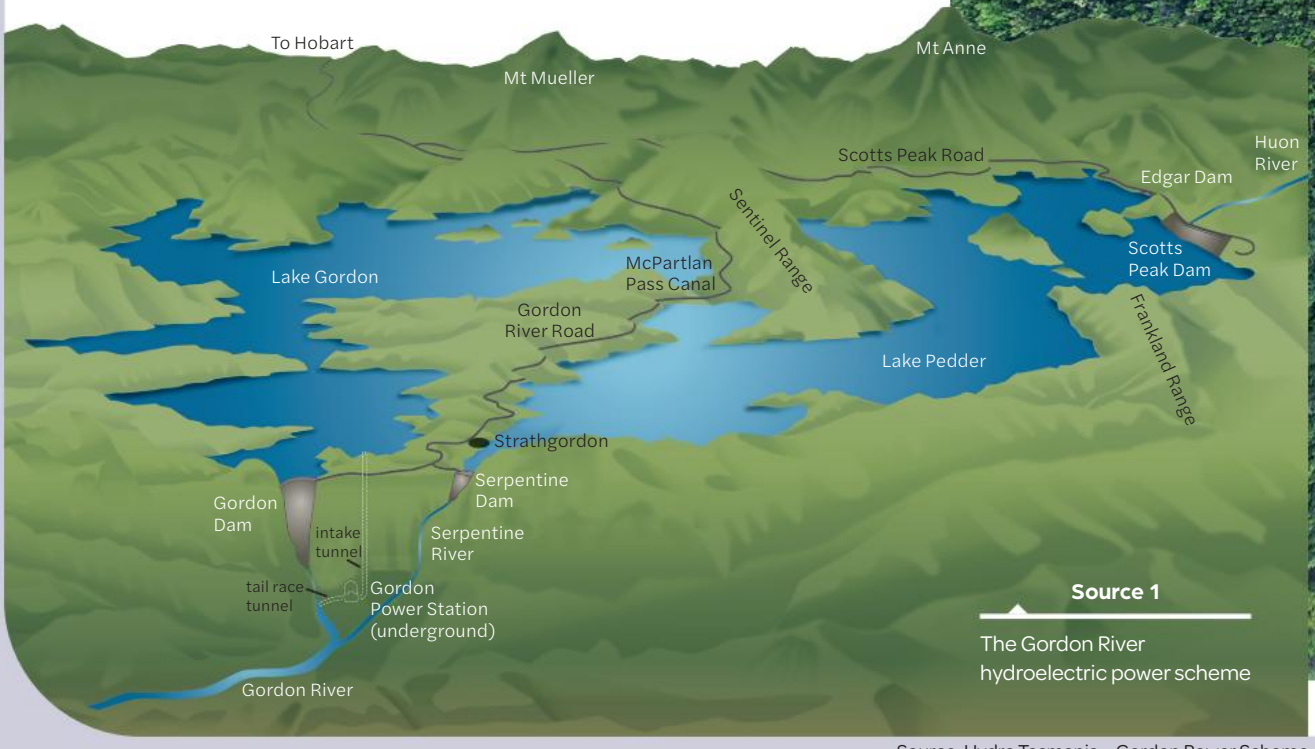
What is the purpose of the Gordon Dam?

Lake Gordon in south-west Tasmania contains up to 12 359 040 megalitres of water (a megalitre is one million litres), making it Australia's largest reservoir. The combination of Lake Gordon and Lake Pedder is by far Australia's largest water storage.

How was Australia's largest water storage formed?

Lake Pedder used to be much smaller. It was flooded in 1972 to make a larger lake as part of the Gordon **hydroelectric** power scheme. The water in Lake Pedder flows to Lake Gordon via the McPartlan Pass Canal, providing 40 per cent of the water used in the Gordon Power Station.

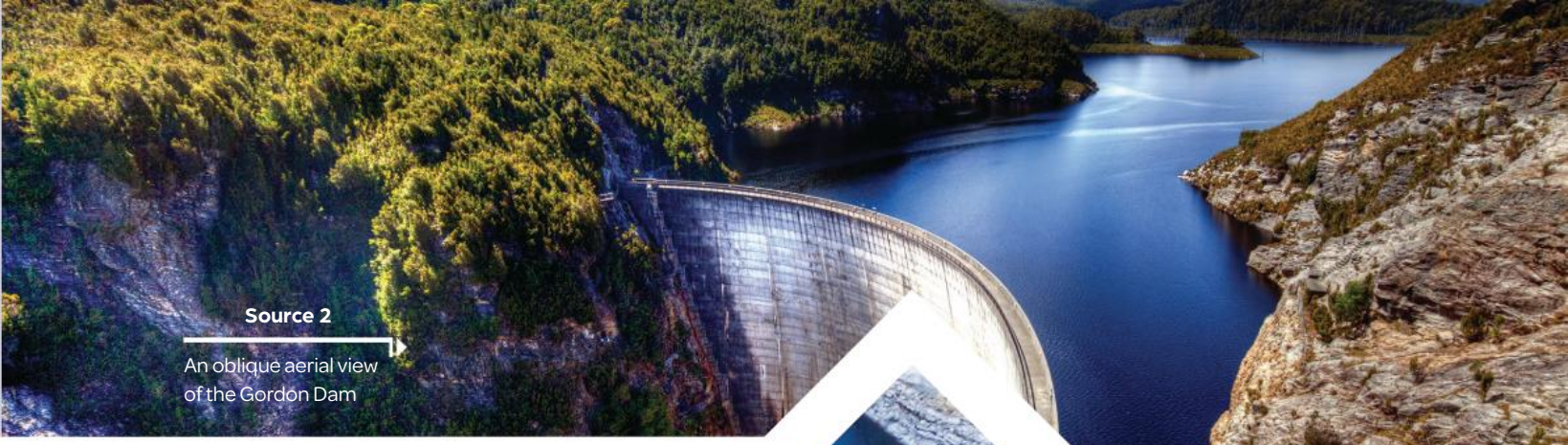
The Gordon Power Station is located on the Gordon River. The power station and the dam were constructed and are now operated and maintained by Hydro Tasmania. Water from the combined water reservoir falls 173 metres through a vertical shaft into the power station. The force of the moving water turns **turbines** and a shaft connected to a rotor and a stator where electrons are stimulated, resulting in the generation of electricity. The Gordon Power Station provides 13 per cent of Tasmania's electricity or 450 megawatts from three turbines.



Source 1

The Gordon River hydroelectric power scheme

Source: Hydro Tasmania – Gordon Power Scheme

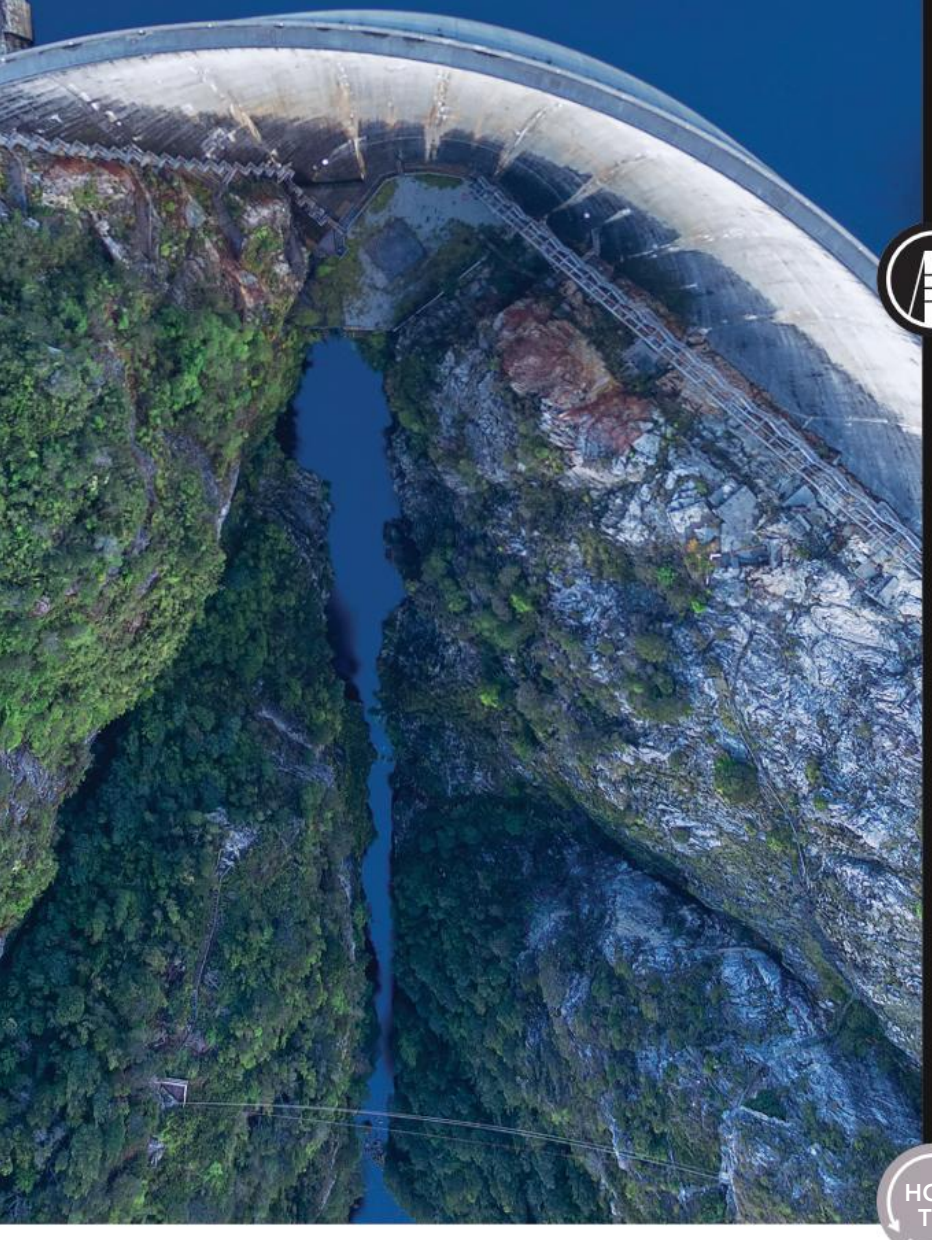


Source 2

An oblique aerial view of the Gordon Dam

Source 3

A plan aerial view of Gordon Dam



Learning Ladder G1.8

Show what you know

1 How do humans construct dams? Use the information on page 27 to help you answer this.

2 How is electricity produced from dams?

Analyse data

Step 1: I can use geographic terminology to interpret data

3 Sources 2 and 3: Look carefully at the photos.
- a One photo is taken directly above and one is taken from an angle. What names do geographers use for these two views?
- b Which view is more like a map? Why?
- c What extra information does an oblique view give you?

Step 2: I can describe patterns and trends

4 Look at the diagram in Source 1.
- a Identify the dams that have been built and the rivers that have been dammed to create the water storage.
- b Where has the power station been built? Why does it need to be in this location?

Step 3: I can explain the reasons behind a trend or spatial distribution

5 Redraw Source 1 as it might have looked before the rivers were dammed. Using SHEEPT, explain how has the area changed.

Step 4: I can analyse relationships between different data

6 Use Sources 1–3 to explain how the Gordon River Dam wall has formed Lake Gordon.

HOW TO

SHEEPT, page 158

How do businesses set goals?

Successful businesses set clear goals to ensure all the staff have a clear idea of what they are striving to achieve. The Thankyou project had the goal of selling fresh water to customers to fund the provision of clean water to countries where millions die because of unsafe water. The key objective of most businesses is to make a profit, but there are other types of goals that businesses aim for. These include financial goals and organisational goals.

Financial goals

Financial goals are directly related to money, such as sales, costs and profits. These goals might be to increase sales, improve efficiency or increase profits by reducing costs.

Organisational goals

Organisational goals are goals that will help the business to become (or remain) successful, but are not measured in dollars. For example, training staff, having satisfied customers or improving safety in the work environment.

Businesses set strategies (or plans) to help them achieve goals. They review the success of these plans at regular intervals.

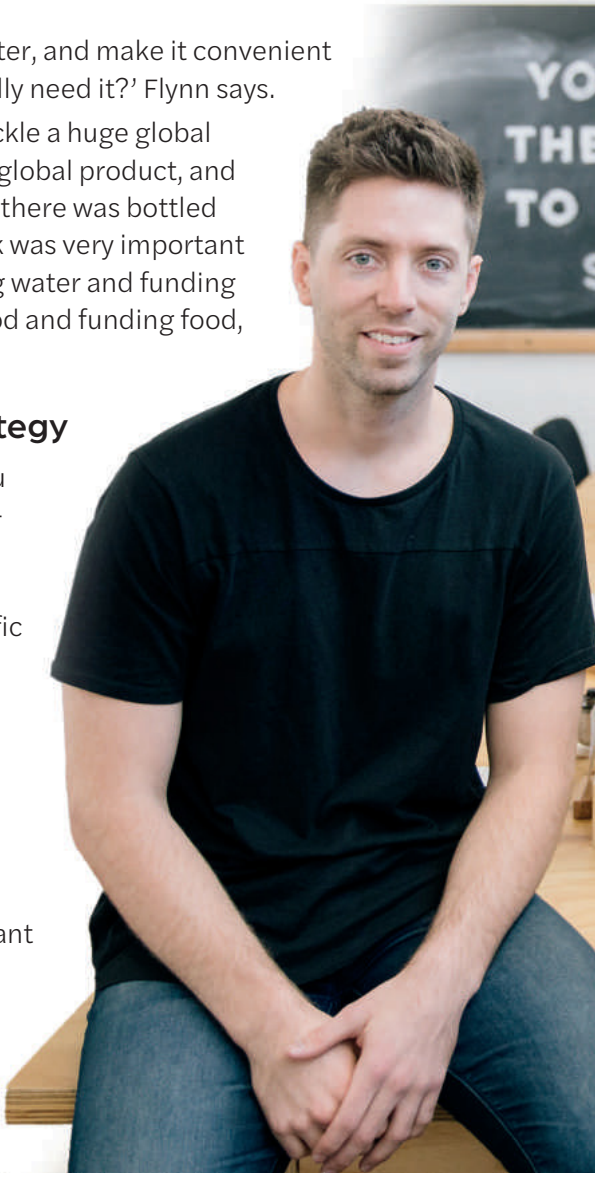
Thankyou

Thankyou is an Australian **social enterprise** with very clear business goals. Its original financial goals were to tap into the global billion-dollar bottled water business. To compete with large multinational corporations such as Coca-Cola, Thankyou promised consumers that 100 per cent of the profits from the business would go to helping the 700 million people around the world without access to safe water.

Setting the goals

One of the co-founders of Thankyou is Daniel Flynn. Flynn had a very clear organisational goal for the business. 'What if we could turn bottled water into getting clean water, and make it convenient for people who actually need it?' Flynn says.

'We wanted to tackle a huge global problem with a huge global product, and the product to get us there was bottled water. We felt the link was very important for customers: buying water and funding water, and buying food and funding food, and so on.'



Setting the strategy

Turning the Thankyou idea into a business – and competing with large corporations – required a very specific strategy. Thankyou used social media to show retailers there was a demand for a product that would help people in need around the world.

Before an important meeting with the 7-Eleven chain of convenience stores, Thankyou asked its Facebook followers to jump on to

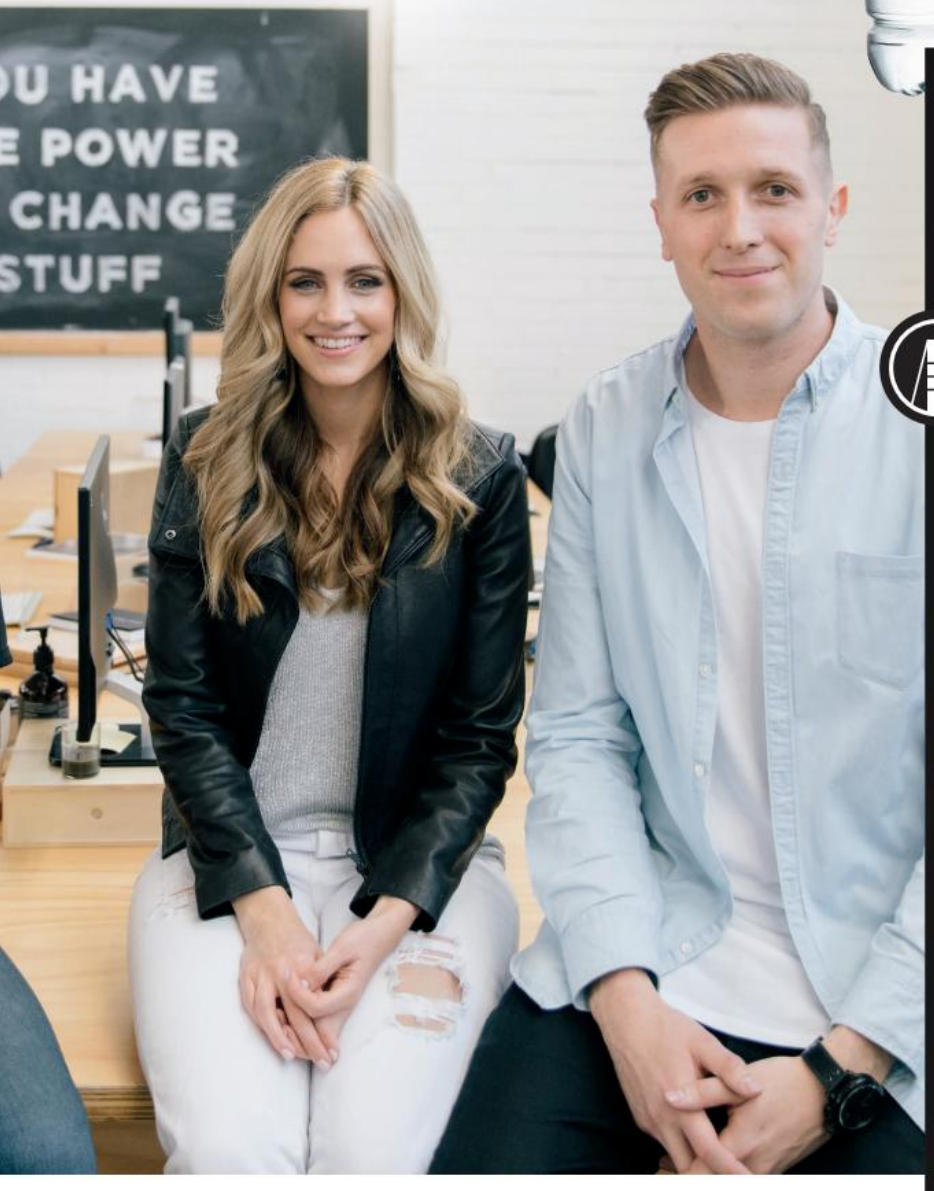
Source 1

Thankyou co-founders Jarryd Burns (left), Daniel Flynn (right) and his partner Justine Flynn (centre). Thankyou had a very clear business goal. Profit from the sale of every bottle of Thankyou water is used to fund water wells, filters, safe toilets and hygiene education in countries that need help. Thanks to a following of 300 000 people across social media, Thankyou is stocked in retail stores such as Coles and 7-Eleven, and it has raised more than $6.2 million to help over 857000 people to access safe water, sanitation and maternal and child health services in 20 countries.

Source 2

The key goal of the Thankyou project is to help people in need around the world. Thankyou customers can track the specific project they are helping through a unique code on the bottle's label.

7-Eleven's Facebook wall and tell them that if they stocked Thankyou water, the followers would buy it. Within a day, 7-Eleven was inundated with Facebook posts – and within weeks Thankyou water was on their shelves.



Learning Ladder G1.9

Economics and business

Step 1: I can recognise economic information

1 What financial goals does Thankyou have?

Step 2: I can describe economic issues

2 Why is it important for businesses to have clear goals?

Step 3: I can explain issues in economics

3 How did Thankyou compete with large distributors of bottled water such as Coca-Cola?

Step 4: I can integrate different economic topics

4 Interview someone you know who works in a business to help answer these questions.
- a What financial goals does your business have?
- b What organisational goals does your business have?
- c What strategies do you have to help you reach your business goals?

Step 5: I can evaluate alternatives

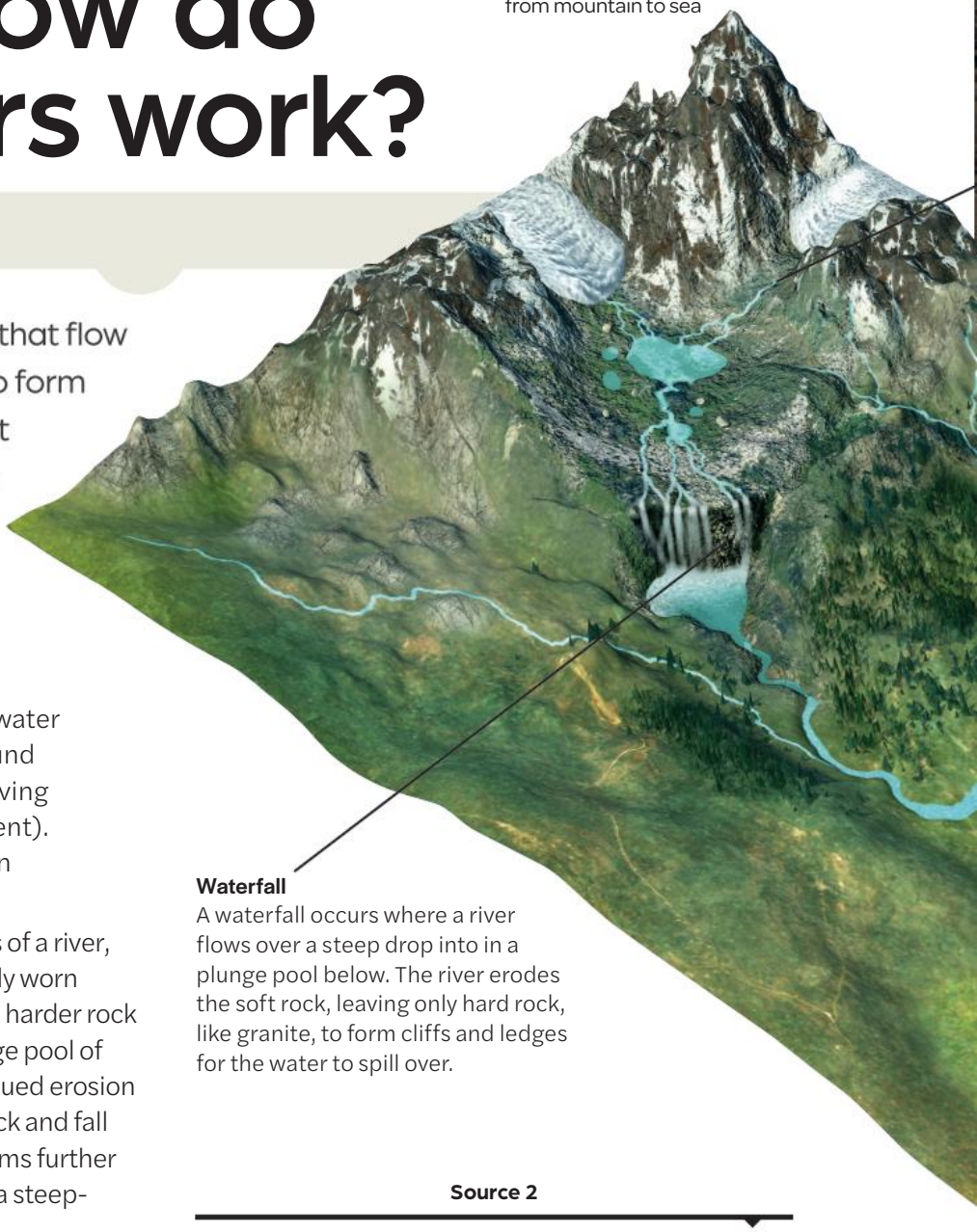
5 Thankyou used the market for bottled water to help those without access to safe water. Develop a plan for a social enterprise of your own. Outline your financial goals, organisational goals and strategy.

How do rivers work?

Rivers are moving bodies of water that flow quickly downhill, eroding the land to form a valley. Rivers slow and spread out as they reach flatter land and then finally flow into the ocean, lake or larger river.

Source 1

The movement of water from mountain to sea



Waterfall
A waterfall occurs where a river flows over a steep drop into in a plunge pool below. The river erodes the soft rock, leaving only hard rock, like granite, to form cliffs and ledges for the water to spill over.

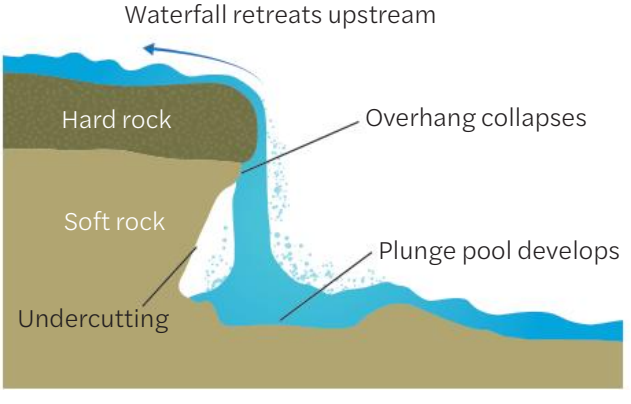
Rivers in mountains

When a river is near its source, the force of water moving down a steep slope erodes the ground vertically to form v-shaped **valleys**. The moving water picks up rocks and soil (called sediment). The sediment erodes the riverbed further, in a process called **abrasion**.

Waterfalls often form in the upper stages of a river, where rivers meet harder rock that is not easily worn away, or eroded. Instead, water spills over the harder rock and erodes the soft rock below, forming a large pool of water called a **plunge pool**. Eventually, continued erosion will undermine the harder rock, and it will crack and fall into the plunge pool. Then a new waterfall forms further upstream. As the process continues, it forms a steep-sided valley, called a **gorge**.

Source 2

Cross-section of a waterfall



Rivers on flatter land

As the river reaches lower, flatter land, the eroded stones, sand and soil carried in the river begin to wear away the floor and sides of the valley. On the flatter land (called a floodplain, because it floods when there is too much water), rivers slow down and erode horizontally, creating snake-like **meanders**. The water speed is greatest on the outside of a bend, which is where erosion takes place. Water speed is slowest on the inside of a bend, and that's where eroded rock and soil is dropped, in a process called **deposition**.

Headwaters
The source or **headwater** of a river is on high land where rainfall or melting snow begins to travel downhill.

Tributaries
Smaller rivers known as tributaries contribute water to larger rivers.

Meanders
When the speed of the water slows, rivers can form big loops called meanders. The river erodes the outside of the meander and deposits material on the inside of the curve.

Delta
As water reaches the river mouth, the river slows and drops sediment, such as mud. This dropped sediment forms a **delta**. As the river blocks its own exit, it splits into a number of finer channels that find their way to the sea.

Learning Ladder G1.10

Show what you know

1 Where do rivers begin and end?

2 Give two examples of a river depositing silt. Why do rivers deposit eroded material?

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

3 Source 3: Draw a block diagram of Seljalandsfoss waterfall. Add labels to show its features and how it formed.

Step 2: I can explain spatial characteristics

4 Using examples, explain why rivers flow fast in their early stages, then slow as they get closer to the river mouth.

Step 3: I can explain processes influencing places

5 Using examples, explain how rivers erode differently on steep land and on flat land.

Step 4: I can predict changes in the characteristics of places

6 Source 1: Draw a plan view map of all of the rivers on the diagram to show the impact of the movement of water from source to end. Include a legend.

HOW TO
Block diagrams, page 162
Mapping with BOLTSS, page 152

Source 3
The Seljalandsfoss waterfall in Iceland falls 62 metres over a hard rock shelf into a plunge pool.

How do we use the Murray River?

At 2508 kilometres, the Murray River is Australia's longest single river. It connects places on its banks that rely on water for farming, industry and town water. In the 20th century, a large number of dams, **locks** and **weirs** were constructed along the river to control its flow. These changes made more water available for transport, and for farmers to **irrigate** their crops. This made the Murray River valley Australia's most productive agricultural region – but it also seriously damaged **ecosystems** along the river.

Upstream gates open as a vessel enters the lock chamber.

Upstream gates close. Water is released downstream through butterfly valves. Water in lock chamber lowers.

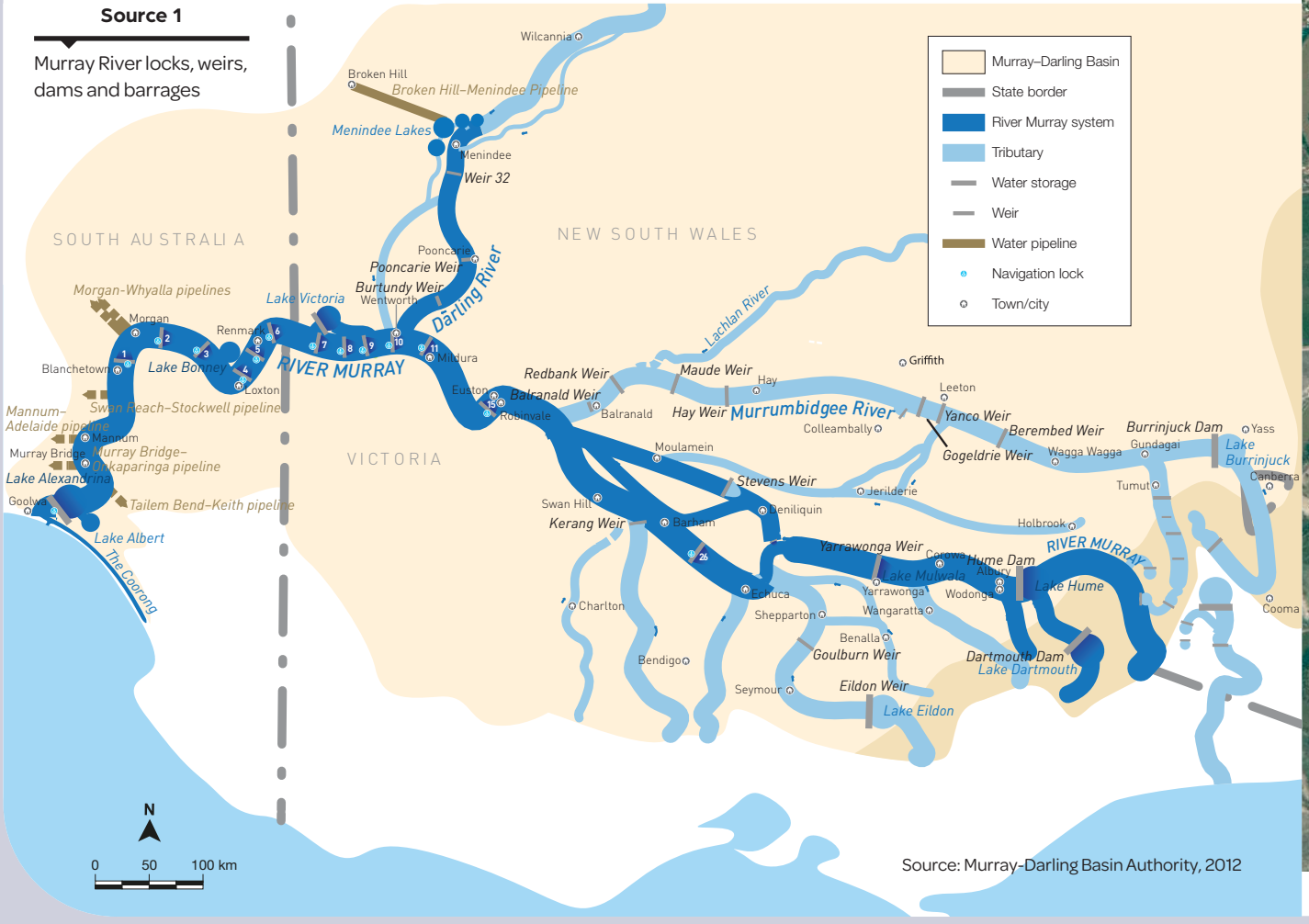
When water levels are equal downstream, gates open.

Source 2

How a lock works

Source 1

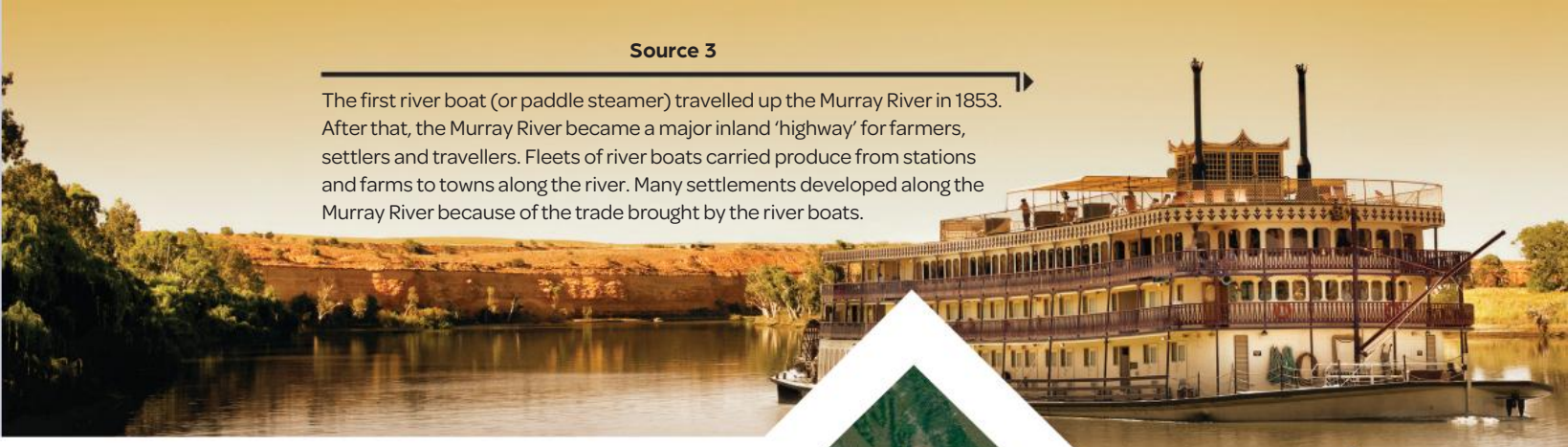
Murray River locks, weirs, dams and barrages



Source: Murray-Darling Basin Authority, 2012

Source 3

The first river boat (or paddle steamer) travelled up the Murray River in 1853. After that, the Murray River became a major inland 'highway' for farmers, settlers and travellers. Fleets of river boats carried produce from stations and farms to towns along the river. Many settlements developed along the Murray River because of the trade brought by the river boats.



Source 4

A satellite image of the Murray River at Renmark

Learning Ladder G1.11

Show what you know

1 Where does the Murray River flow?

2 Why did people build weirs and dams along the Murray River?

Interconnections

Step 1: I can identify and describe interconnections

3 Source 4: Draw a map of the area shown in this satellite image using BOLTSS. Then create a key to show activities that are interconnected with the Murray River – irrigated farmland and towns.

4 On the map you prepared in question 3, label the following:

- the large town of Renmark on the north bank of the river
- Paringa on the south bank
- the weir that crosses the Murray River to the south-west of Renmark

Step 2: I can explain interconnections

5 Source 4: Places and their people are interconnected with other places. How does the satellite image show that rivers connect communities?

Step 3: I can identify and explain the implications of interconnections

6 Source 2: How do locks help improve interconnection along the Murray River?

Step 4: I can evaluate the implications of interconnections

7 Source 1: How has the building of weirs helped and hindered interconnection along the Murray River?

HOW TO

Mapping with BOLTSS, page 152

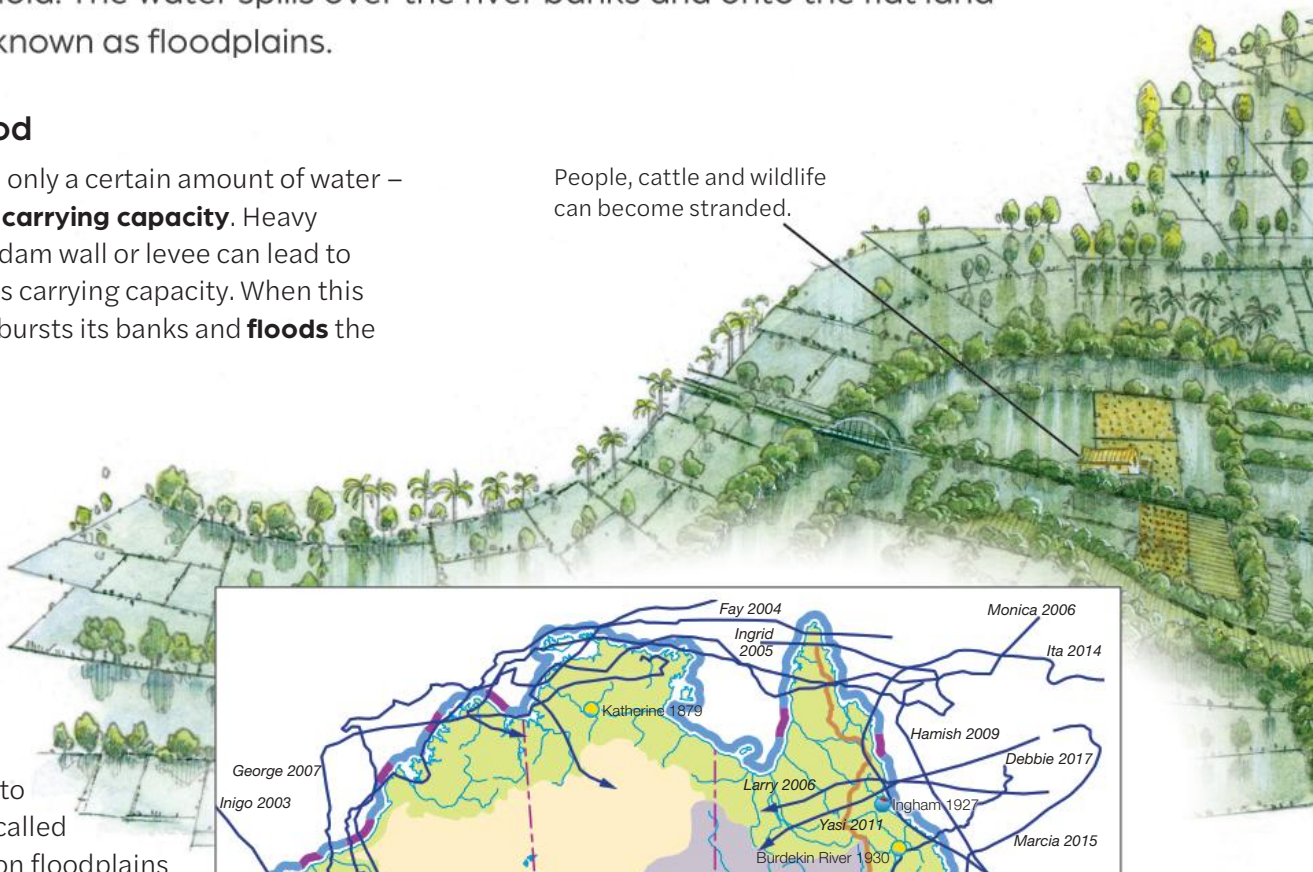
Why do floods occur?

Floods are caused by heavy rains that force rivers to carry more water than their channels can hold. The water spills over the river banks and onto the flat land next to rivers, known as floodplains.

Why rivers flood

Each river can hold only a certain amount of water – this is known as its **carrying capacity**. Heavy rain or a collapsed dam wall or levee can lead to a river exceeding its carrying capacity. When this happens, the river bursts its banks and **floods** the surrounding land.

People, cattle and wildlife can become stranded.

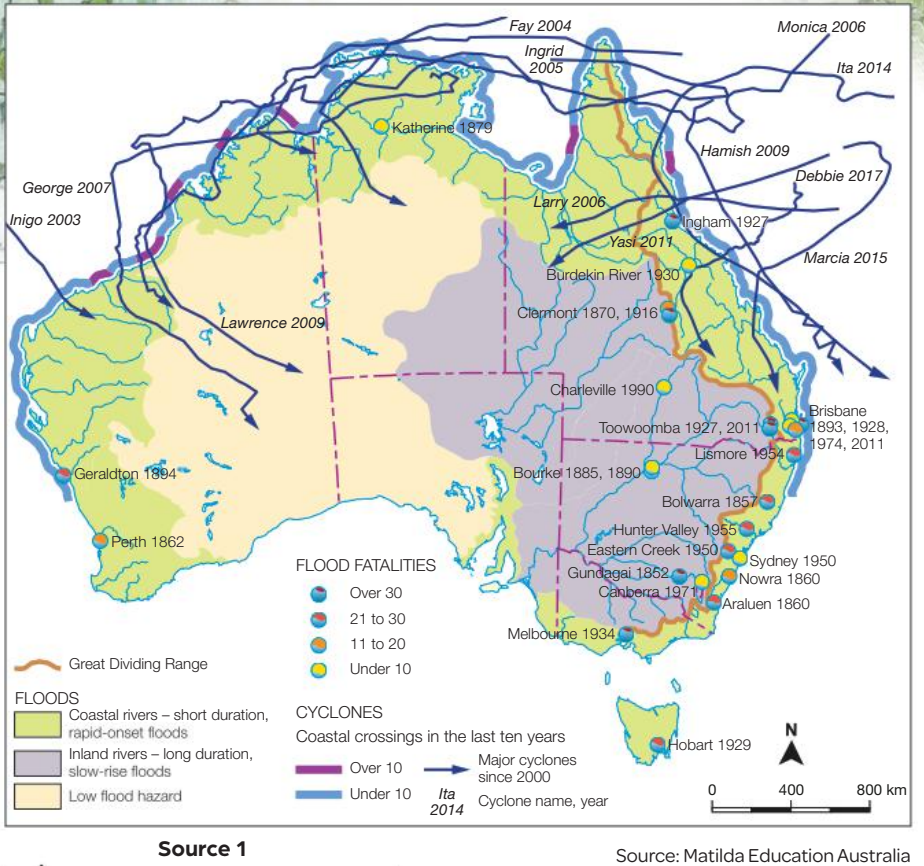


Floodplains

The flat lands next to river channels are called **floodplains**. Land on floodplains is usually reserved for parks, golf courses and farmland, with few permanent buildings.

Floodplains are some of the richest and most productive land in the world. The soil carried by floodwaters is spread over the surrounding land. After each flood, more and more soil is **deposited** on the floodplain.

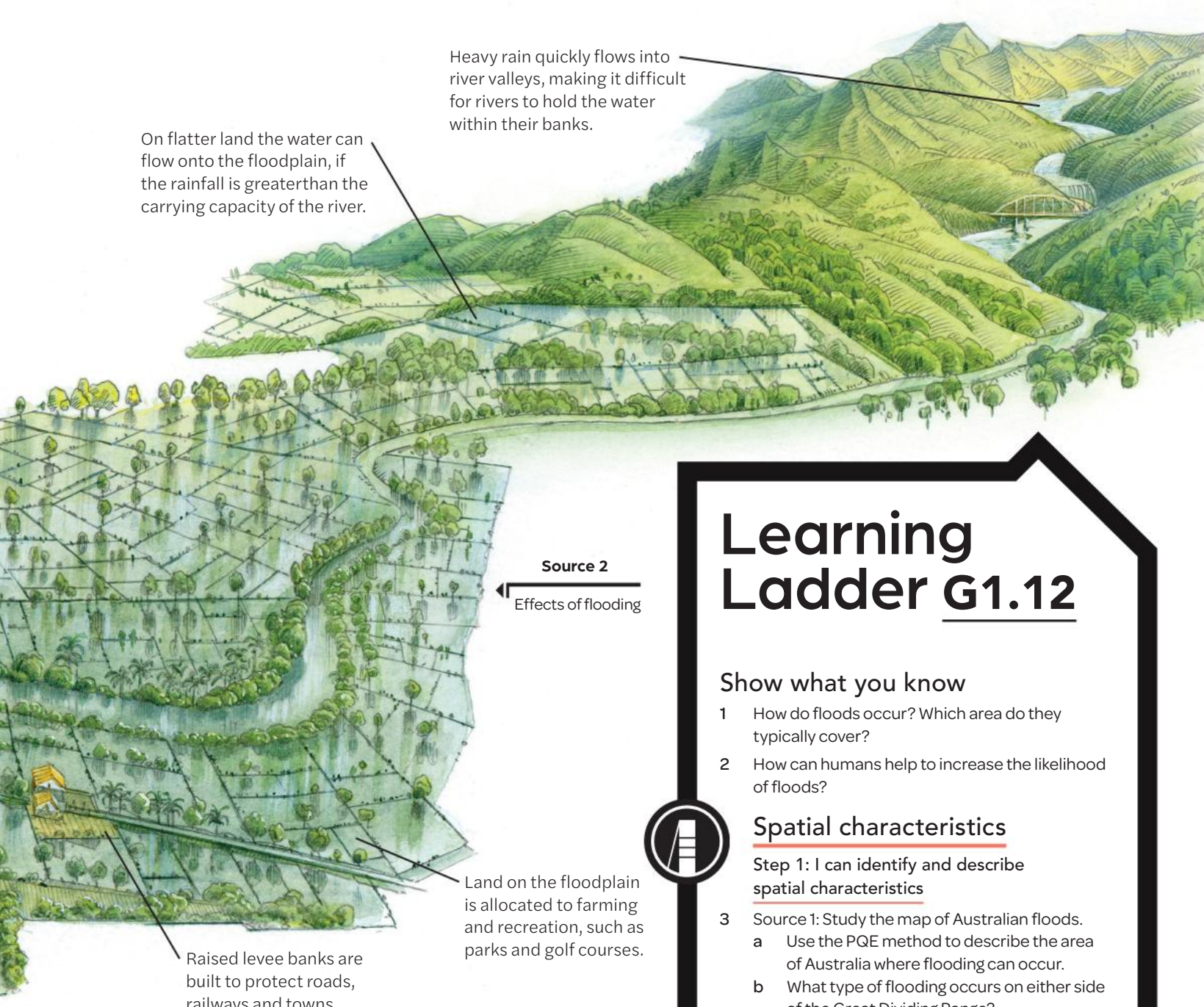
Billions of people around the world live on floodplains because their fertile soil and direct access to fresh water make it easy to live there and grow food.



Source 1

Map of Australian flood and cyclone areas

Source: Matilda Education Australia



Source 2

Effects of flooding

Humans cause flooding

When humans clear vegetation, the plants and trees no longer bind the soil together and absorb the water. Instead, water flows into rivers, putting pressure on their carrying capacity. Removing vegetation also leads to increased soil **erosion**.

When we build towns and cities, we replace natural environments with hard surfaces – such as concrete and roads – that prevent water from soaking into the ground. When we build levee banks along rivers, we stop floodwaters, but we also increase the carrying capacity of the river. With levees, the river runs faster and deeper, and carries more water.

Learning Ladder G1.12

Show what you know

1 How do floods occur? Which area do they typically cover?

2 How can humans help to increase the likelihood of floods?

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

3 Source 1: Study the map of Australian floods.
- a Use the PQE method to describe the area of Australia where flooding can occur.
- b What type of flooding occurs on either side of the Great Dividing Range?
- c Where have most of Australia's major floods and flood deaths occurred?

Step 2: I can explain spatial characteristics

4 What types of land use are normally allowed on floodplains? Why?

Step 3: I can explain processes influencing places

5 Use a container to create your own flood experiment, showing how levees are used to protect properties from flooding.

Step 4: I can predict changes in the characteristics of places

6 Source 1: Use the legend to locate the cyclone prone areas on the map. Is there an interconnection between these areas and floods in Australia?

HOW TO

PQE page 156

How can we plan for floods?

Flooding costs Australians an average of $400 million each year in reconstruction, loss of business and compensation to flood victims. We can help reduce the impact of flooding by predicting when and where a flood will hit, building protective structures and practising emergency drills.

Preparing for floods

Flooding occurs naturally for many rivers, so it is almost impossible to stop floods altogether. However, there are three steps we can take to reduce the impact of floods.

1 Predicting floods

Flood forecasters predict when and where floods will occur, giving people time to prepare and evacuate. Forecasters use a network of **rain gauges** that monitor rainfall along the river **catchment**, and use **stream gauging stations** along the rivers to measure river heights.

Forecasters use computer models to estimate how much rainfall will run off the catchment, and how long the run-off will take to reach the river and travel downstream.

2 Preparing communities

Flood engineers study past flood records to design flood protection strategies. Sometimes large raised banks, called levees, are built in flood-prone areas to deflect the flow of water and make it run in a certain direction. During large floods, levees sometimes help the river to run faster and deeper, which transfers the flood problem downstream.

Local councils map flood-prone areas, and make and enforce rules about building in these zones. Sporting fields and farming are allowed on flood-prone land, but housing and industry are not, and are usually zoned for development on higher land or in areas protected by levees.

3 Responding effectively

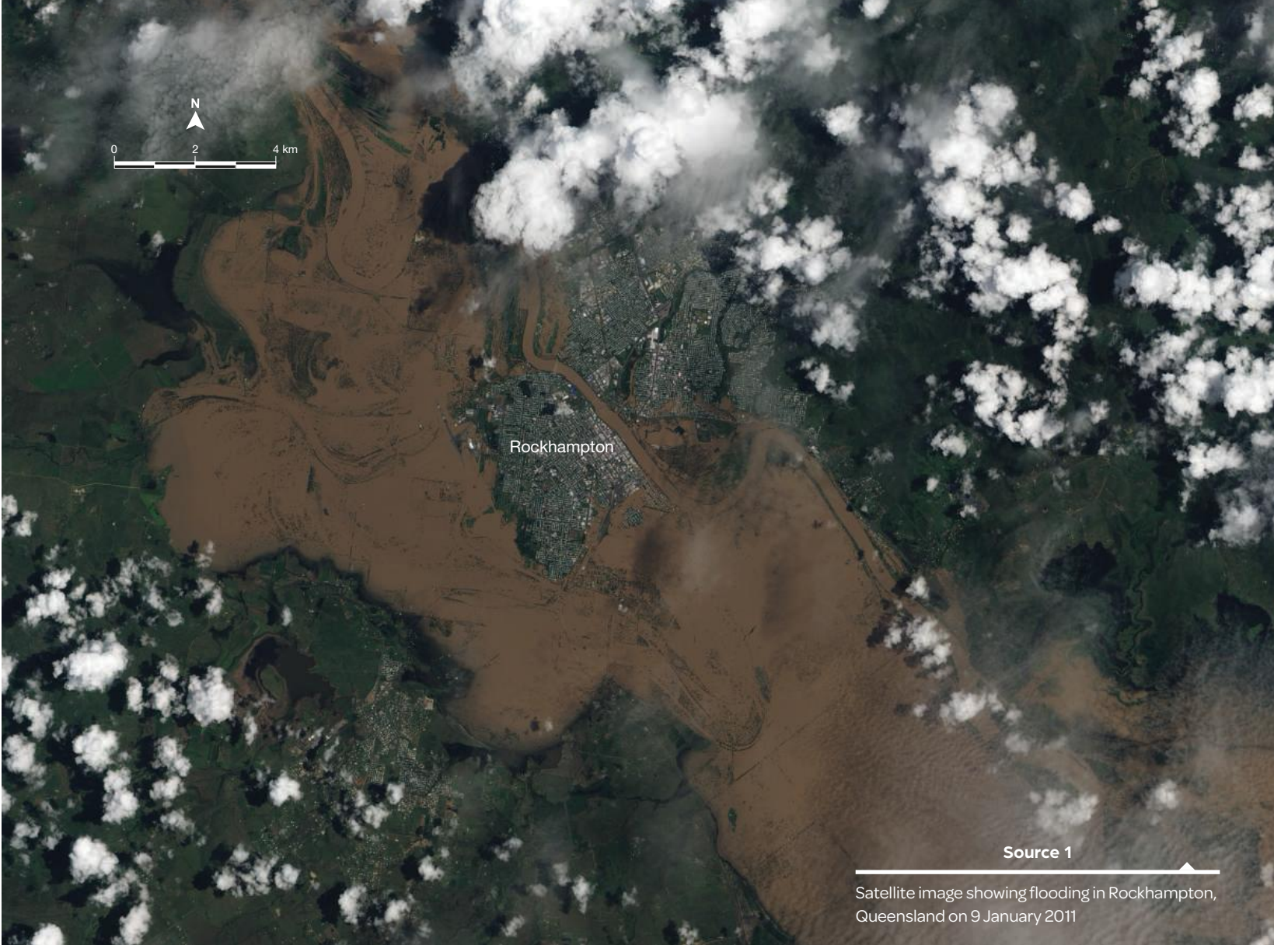
Planning for a flood emergency means that we can respond quickly to save lives and make the flooded area safe. Critical facilities, such as emergency hospitals and evacuation shelters, are located in areas that will not flood. Evacuation plans, emergency drills and education programs are conducted to help communities get ready for a flood emergency.

During a flood emergency, warnings are sent to mobile phones, and spread via social media networks such as Facebook and Twitter.

Using spatial technology

In Geography, we rely on maps and other visual representations of our landscape to make decisions and to understand patterns. These maps and images are made using digital software and hardware, which is referred to as **spatial technology**.

Maps and satellite images can be used during emergencies, such as floods, to help plan, prepare for and manage the situation. For example, emergency vehicles can use digital maps to know which roads have been flooded and need to be avoided. Global positioning systems (**GPS**) are also used to locate missing people or to pinpoint rescue operations. Spatial technology is very helpful for geographers – it can be constantly updated, and data is usually free for users.



Source 1

Satellite image showing flooding in Rockhampton, Queensland on 9 January 2011

Learning Ladder G1.13

Show what you know

1 What data do we collect to help predict floods?

2 Define the term 'spatial technology'.

Geographical challenge

Step 1: I can identify responses to a geographical challenge

3 Why are floods a geographic challenge for humans?

Step 2: I can compare responses to a geographical challenge

4 What rules do local councils enforce about building in flood-prone areas? Why?

Step 3: I can compare strategies for a geographical challenge

5 Look carefully at Source 1. Use Google Maps to help you prepare a sketch map of this area. Mark in the flooded area using the information shown on the satellite image. Explain why satellite images are useful in managing and predicting flooding events.

Step 4: I can evaluate alternatives for a geographical challenge

6 Make a list of the types of data collection methods useful in planning for floods and predicting them. Put an asterisk next to each of the methods that involve spatial technologies.

Satellite images, page 167

HOW TO

What are the costs of floods?

Floods have social, economic and environmental consequences. As an economic issue, floods are responsible for increasing costs around the world. This includes costs directly related to the flooding, such as stock losses and damage to property, and the cost to the economy from having business disrupted.

Economics of flooding

A flood is an **economic issue** that brings both **benefits** and **costs**. The reason that large numbers of people live on floodplains is because of the rich soil deposited on them during floods. The fertile land on floodplains supports the healthy growth of pasture and crops.

However, because so many people are attracted to living on or near floodplains, the economic cost of floods is increasing every year. Flooding affects around 250 million people in the world each year.

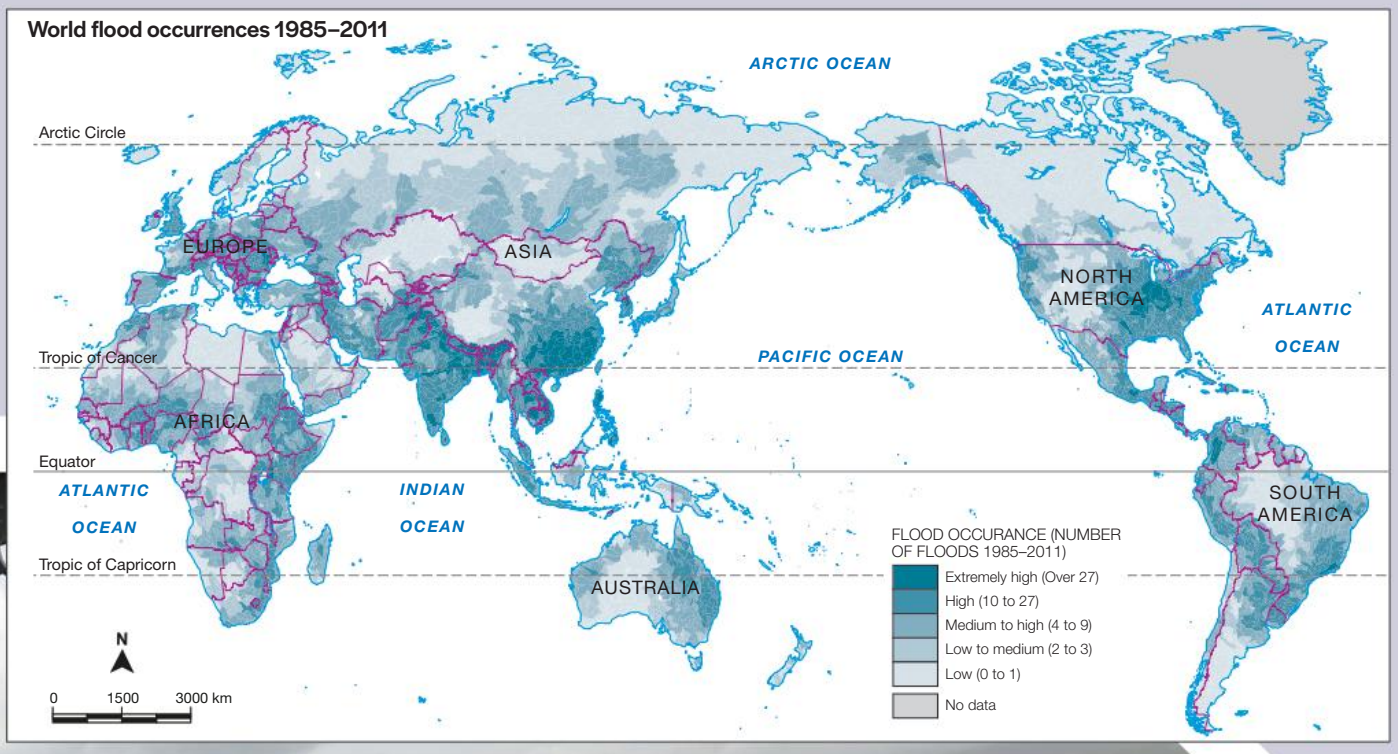
Floods are Australia's most expensive natural disaster, with the economic cost estimated at $400 million dollars each year. The costs can be divided into direct costs and indirect costs.

- *Direct costs* are caused by damage to buildings and contents, vehicles, livestock and crops crops, as well as damage to **infrastructure** such as roads, bridges and powerlines.
- *Indirect costs* include disruption to transport and business, loss of income and legal costs.

As a result of these costs, the **flow-on effect** for consumers is higher prices caused by a shortage of supply. For example, in March 2017, the price of bananas soared after banana plantations in north-east Queensland were destroyed by Cyclone Debbie and flood damage.

Source 1

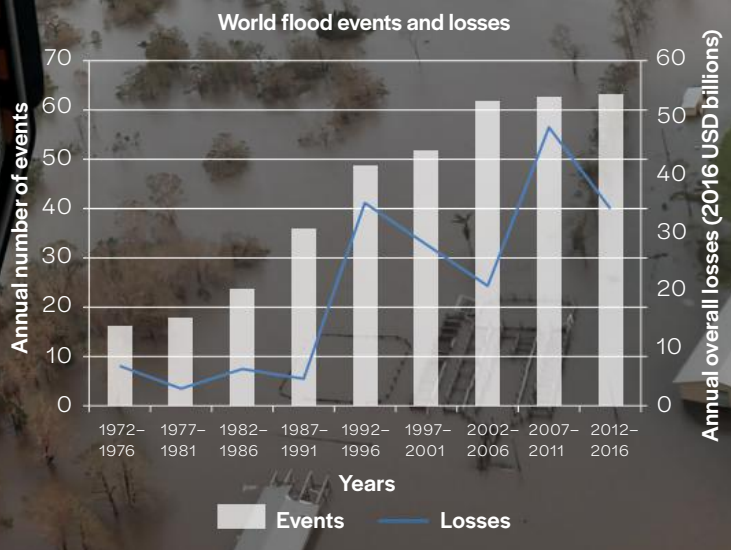
Former Prime Minister Malcolm Turnbull surveying the flooded areas in Bowen, Queensland, after Cyclone Debbie dumped record rains in March 2017. The damage bill was estimated at $2 billion.



Source: Matilda Education Australia

Source 2

World floods 1985–2011



Source: Organisation for Economic Co-operation and Development, 2017

Source 3

Annual flood events and losses

Learning Ladder G1.14

Economics and business

Step 1: I can recognise economic information

1 What are the direct and indirect costs of floods?

Step 2: I can describe economic issues

2 How can a flood have both benefits and costs?

Step 3: I can explain issues in economics

3 Source 2: Use the PQE method to describe the regions of the world that are most affected by flooding.

Step 4: I can integrate different economic topics

4 Source 3: Refer to the graph. Describe how the financial impact of floods has changed over time.

Step 5: I can evaluate alternatives

5 Source 1: Imagine you are the prime minister in the photo. List the economic issues you need to consider so you can help the flooded communities. Group your list into the following three categories: immediate issues, short-term issues and long-term issues.

HOW TO

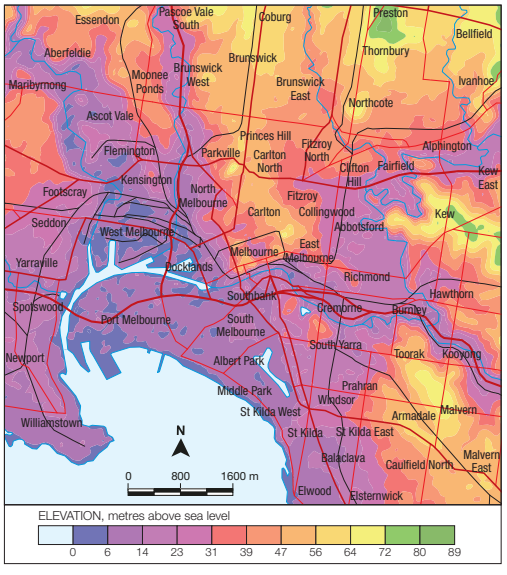
PQE, page 156

Masterclass

Learning Ladder

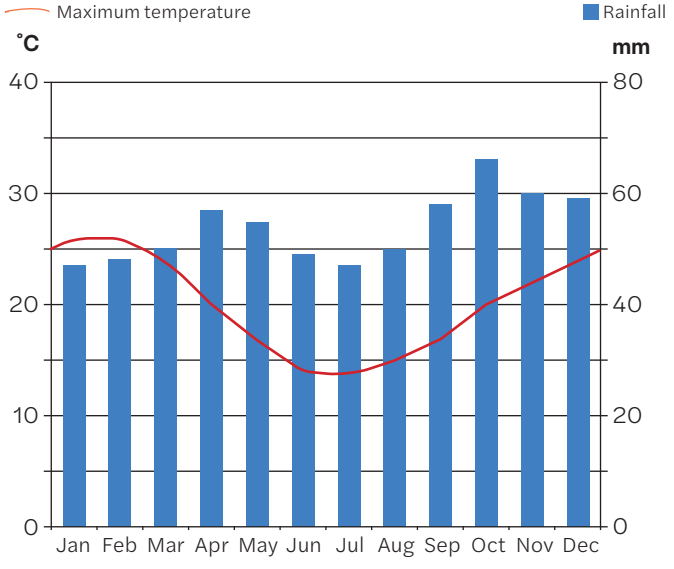
Work at the level that is right for you or level-up for a learning challenge!

Melbourne flood elevations



Source 1

Melbourne climate



Source 2

Step 1

a **I can identify and describe spatial characteristics**

Look at Source 3. Where have floods caused the most deaths in Australia?

b **I can identify and describe interconnections**

Using Source 1, identify whether these local areas are at risk of flooding. What are their elevations?

a Spotswood b Brunswick c Kew

c **I can identify responses to a geographical challenge**

Study Source 1. Can you recognise five key impacts of this flood *environment*? How can we prepare for floods to reduce impact on *places*?

d **I can collect, record and display data in simple forms**

Using Source 2, identify what the bars and lines on the graph represent.

e **I can use geographic terminology to interpret data**

Look at Source 1. Use compass points to describe the areas with the highest elevation in Melbourne.

Step 2

a **I can explain spatial characteristics**

Source 3: Which areas of Australia are most affected by cyclones?

b **I can explain interconnections**

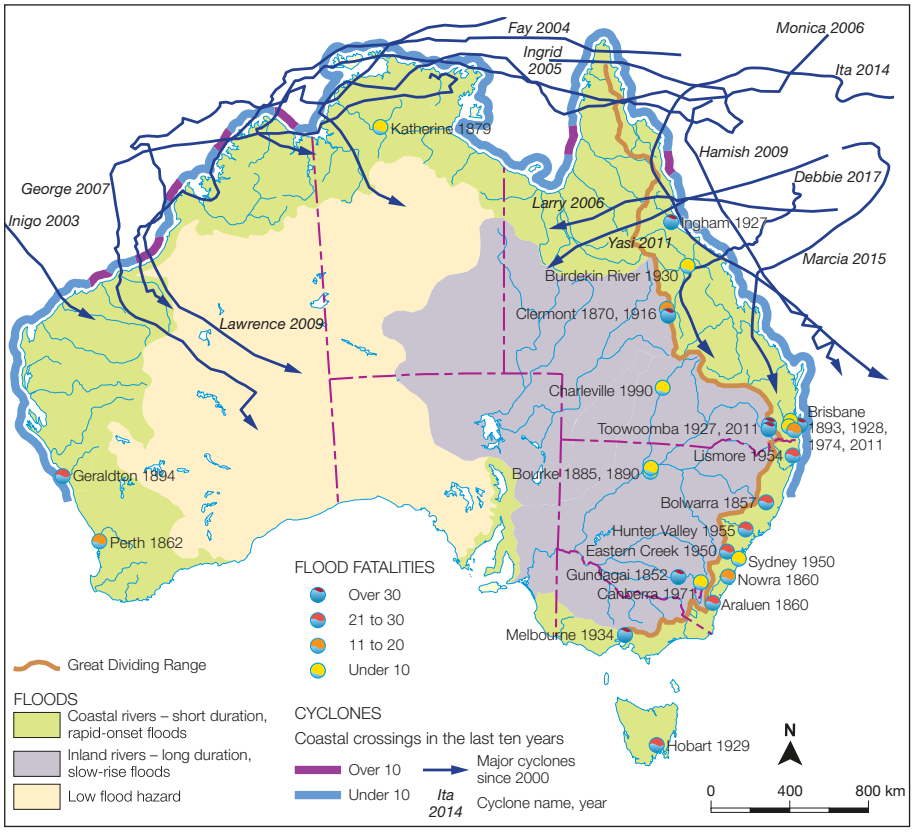
How is the term *interconnection* used in Geography?

c **I can compare responses to a geographical challenge**

Refer to Source 2. At which times are people in Melbourne most at risk of floods? At which times are they most at risk of bushfires?

Source 4

Floods in Kerala, India



Source 3

d **I can recognise and use different types of data**

Create a table with the column headings 'Primary data collection methods' and 'Secondary data collection methods'. List three methods for each.

e **I can describe patterns and trends**

Refer to Source 1. Using your knowledge of elevation and water movement, suggest which regions in Melbourne are most at risk of flooding.

Step 3

a **I can explain processes influencing places**

What processes led to the change in the place in Source 4?

b **I can identify and explain the implications of interconnections**

What are the implications of the interconnection between cyclone paths and coastal communities in northern Australia?

c **I can compare strategies for a geographical challenge**

How do desert communities tackle the geographical challenge of providing enough water to live?

d **I can choose, collect and display appropriate data**

Create a step-by-step guide explaining how to successfully carry out a field sketch.

Masterclass

e I can explain the reasons behind a trend or spatial distribution

Source 2: Which seasons in Melbourne have the lowest and highest rainfall?

Step 4

a I can predict changes in the characteristics of places

Predict what would happen to the place in Source 4 if the floodwaters were to rise by another two metres.

b I can evaluate the implications of significant interconnections

How has the building of weirs on the Murray River helped and hindered interconnection along the Murray River?

c I can evaluate alternatives for a geographical challenge

During construction, what happens to the land behind a dam wall? Is there an alternative to give humans a reliable water supply?

d I can use data to support claims

Design a fieldwork project based on this question: 'How does water connect people and places?' Outline and justify one primary and one secondary method to help answer this question.

e I can analyse relationships between different data

Source 4: Compare the relationship between coastal river flooding and flood deaths.

Step 5

a I can analyse the impact of change on places

Source 1: Climate change models suggest that by 2070 rainfall intensity will increase by 6%, making flooding more common. What impact could this have on Melbourne's largest new growth area around Port Melbourne?

b I can explore spatial association and interconnections

Find a distribution map of world population from a reliable source. Compare the map to Source 2 on page 41. Consider the spatial association between population density and the number of floods and describe a region of the world where deaths from flooding is likely to be higher.

c I can plan action to tackle a geographical challenge

Make a list of the types of data collection methods useful in planning for floods and predicting them.

d I can evaluate data

Which form of data is most useful when investigating spatial patterns and distributions: quantitative or qualitative? Justify your answer.

e I can draw conclusions from analysing collected data

Climate change models suggest that by 2070 Melbourne's rainfall will decrease by 11% and extreme heat days will increase from 9 days to 26 days per year. What challenges will this pose for planners?

Capstone

How can I understand water on Earth?

In this chapter, you have learnt a lot about water on Earth. Now you can put your new knowledge and understanding together for the capstone project to show what you know and what you think.

In the world of building, a capstone is an element that finishes off an arch or tops off a building or wall. That is what the capstone project will offer you, too: a chance to top off and bring together your learning in interesting, critical and creative ways. You can complete this project yourself, or your teacher can make it a class task or a homework task.

Scan this QR code to find the capstone project online.

mea.digital/GHV7_G1

G2

Water for life

HOW IS WATER USED?

page 48

geographic challenge

page 64

IS ALL WATER SAFE TO DRINK?

thinking locally

page 72

HOW CAN WE MAKE FRESH WATER?

analyse data

page 74

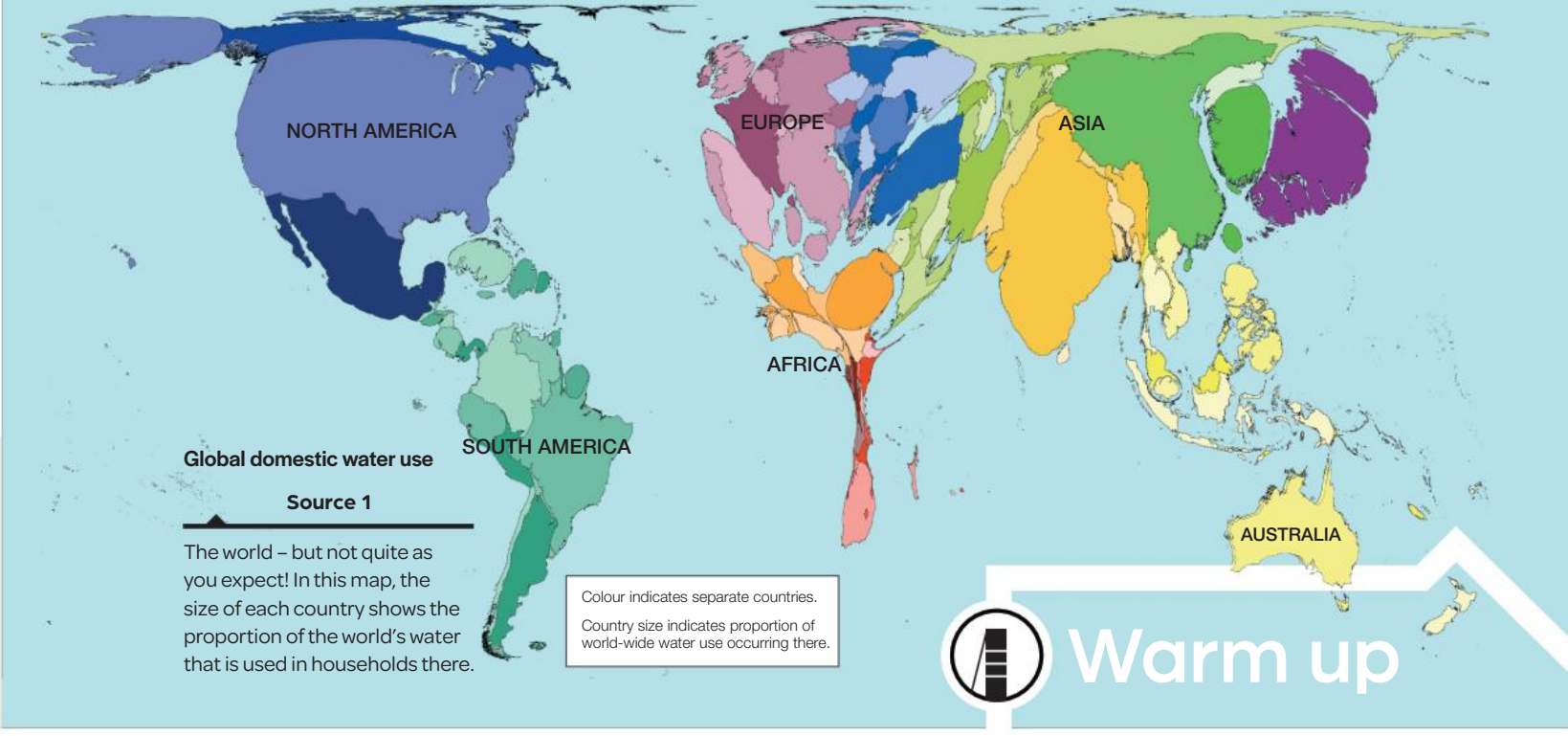
HOW CAN WE SAVE WATER AT HOME?

How can I understand water for life?

Water is an essential part of life. Without water, life as we know it could not exist on Earth. Furthermore, we would not be able trade products using ships, and there would be no marine or fresh water habitats. The way we use and preserve water is important to ensure a sustainable future.

learning ladder

	Spatial characteristics	Interconnections	Geographical challenge
step 5	**I can analyse the impact of change on places** I can analyse and evaluate the implications of changing water use over time and at different scales and calculate its impact on people and environments.	**I can explore spatial association and interconnections** I can compare distribution patterns and the interconnections between them; e.g. the distribution of high rainfall or irrigation and rice production.	**I can plan action to tackle a geographical challenge** I can frame questions, evaluate findings, plan actions and predict outcomes to tackle a water-based geographical challenge.
step 4	**I can predict changes in the characteristics of places** I can predict changes in the characteristics of places over time due to variations in water supply and use.	**I can evaluate the implications of significant interconnections** I can identify, analyse and explain key water-based interconnections within and between places, and evaluate their implications over time and at different scales.	**I can evaluate alternatives for a geographical challenge** I can weigh up alternative views and strategies on a water-based geographical challenge using environmental, social and economic criteria.
step 3	**I can explain processes influencing places** I can explain the series of actions leading to change in a place, such as drought or overuse of water.	**I can identify and explain the implications of interconnections** I can identify, analyse and explain water-based interconnections and explain their implications.	**I can compare strategies for a geographical challenge** I can compare strategies for a geographical challenge, taking into account a range of factors and predicting the likely outcomes.
step 2	**I can explain spatial characteristics** I can identify concepts of Space, Place, Interconnection, Change, Environment, Sustainability and Scale (SPICESS) when I read about water for life.	**I can explain interconnections** I can describe and explain interconnections and their effects, such as the multiple uses of a river from source to mouth.	**I can compare responses to a geographical challenge** I can identify and compare responses to a geographical challenge and describe its impact on different groups.
step 1	**I can identify and describe spatial characteristics** I can talk about spatial characteristics at a range of scales; e.g. rainfall distribution patterns for Australia and the world.	**I can identify and describe interconnections** I can identify and explain simple interconnections involved in the phenomena such as the water cycle and flooding.	**I can identify responses to a geographical challenge** I can find responses to a geographical challenge such as using safe water or flooding and understand the expected effects.



Global domestic water use

Source 1

The world – but not quite as you expect! In this map, the size of each country shows the proportion of the world's water that is used in households there.

Colour indicates separate countries.

Country size indicates proportion of world-wide water use occurring there.

Warm up

Spatial characteristics

1 What does the geographic concept of *space* look at (see page 4)?

2 Why are the actual sizes of countries in Source 1 changed?

Interconnections

3 *Interconnection* is the idea that two things or phenomena are related, interact or are linked in some way. Suggest what other thing might be interconnected with India and China's high domestic water use.

Geographical challenge

4 What responses have Australian governments made to the geographical challenge of providing water for the population in a dry country like Australia?

Collect, record and display data

5 What raw data is shown as a map in Source 1?

6 What are the advantages and disadvantages of using maps like Source 1?

Analyse data

7 Looking at Source 1:

a Why do you think that household water use in North America is so great?

b Why do you think that the household water use in Africa is so small?

I can evaluate data
I can determine whether data presented about water on Earth is reliable and assess whether the methods I used in the field or classroom were helpful in answering a water-based research question.

I can draw conclusions from analysing collected data
I can summarise findings and use collected data to support key patterns and trends I have identified for water-based research.

I can use data to support claims
I can select or collect the most appropriate data and create specialist maps and information using ICT to support investigations into water and its use on Earth.

I can analyse relationships between different data
I can use multiple data sources, overlays and GIS to find relationships that exist in patterns of water use on Earth.

I can choose, collect and display appropriate data
I can select useful sources of water data and represent them to conform with geographic conventions.

I can explain the reasons behind a trend or spatial distribution
I can identify Social, Historical, Economic, Environmental, Political and Technological (SHEEPT) factors to help me explain patterns in data.

I can recognise and use different types of data
I can define the terms primary, secondary, qualitative and quantitative data and represent data in more complex forms.

I can describe patterns and trends
I can identify Patterns, Quantify them and point out Exceptions (PQE) to describe the patterns I see.

I can collect, record and display data in simple forms
I can identify that maps and graphs use symbols, colours and other graphics to represent data.

I can use geographic terminology to interpret data
I can identify increases, decreases or other key trends on a map, graph or chart about water.

Collect, record and display data

Analyse data

How is water used?

Clean water is essential for survival. Yet the access people have to water varies greatly, depending on where in the world they live. Most of the world's supply of fresh water is used to grow food. More than 785 million people around the world don't have access to a safe supply of water.

Supplying the world with water

In the 1900s, the world's population tripled and water usage increased by six times. Agriculture accounts for 70 per cent of all water consumed, compared to 20 per cent for industry and 10 per cent for home use.

Supplying the world with enough water is now a huge issue. In Australia in 2016, we used 16 000 gigalitres of water – that's enough water to completely fill the Melbourne Cricket Ground 10 000 times!

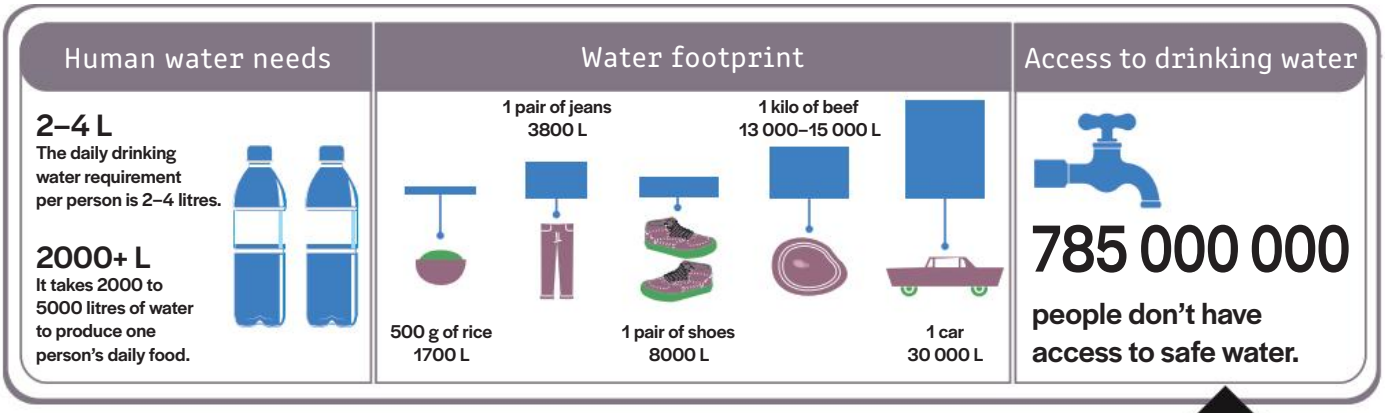
Throughout the world there are places that are **water rich** and places that are **water poor**. Australia is water poor. It is the world's driest inhabited **continent**, and the quantity of water resources varies greatly across the continent.

However, Australia is a wealthy country (referred to in Geography as a More Economically Developed Country (MEDC)), so nearly everyone can access **safe water** to drink. Many other countries in the world are not so lucky. One in nine people in the world don't have access to safe water, and millions of people get sick or die from drinking dirty water.

Per person, Australians are one of the biggest users of water in the world. We need to manage our valuable water resources carefully, so that we balance the needs of different users in homes and on farms, as well as the needs of industry. By making a few simple changes, we can all help save precious water resources.

Source 1

Children drinking from a tap at a primary school in a displaced people's camp in Nigeria. The school and the fresh water pump were supplied by UNICEF – the United Nations Children's Fund aid agency.



Source 2

This infographic displays some important facts about water on Earth, including human water needs, the water 'footprint' of various items and access to drinking water.

Learning Ladder G2.1

Show what you know

1 What is most fresh water used for?

2 Source 1: Look at the photo to answer these questions.
   - a What are the children queuing up to do?
   - b Why is it important that the children drink safe water?
   - c Who supplied this safe water?

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

3 Brainstorm a list of all the ways that water is:
- used in Australia
- transported to homes and farms
- stored for our use.

Step 2: I can recognise and use different types of data

4 Create a summary table listing key quantitative statistics about water use in Australia.

Step 3: I can choose, collect and display appropriate data

5 Prepare a graph that clearly shows the different amounts of water required to produce the following products.
- Toast: 650 litres
- Apple: 70 litres
- Cheese: 2500 litres
- Egg: 200 litres

Step 4: I can use data to support claims

6 Research the top 10 thirstiest products to produce and prepare an infographic like Source 2 to display the data.

HOW TO Simple graphs, page 162

Where is water in Australia?

Australia is almost the driest continent on Earth – the only continent with less rain is Antarctica. Most of Australia's rain falls in thin strips along the coast, with desert occupying much of the centre of the continent. Only 12 per cent of the rain that falls is collected in rivers, so 30 per cent of Australians need to use groundwater as their main water supply.

Rainfall in Australia

Australia is the driest populated continent on Earth. Two-thirds of the continent is classified as **desert** or **semi–desert**. This classification depends on the amount of rainfall.

- Desert: less than 250 mm rainfall per year.
- Semi-desert: 250–500 mm rainfall per year.

Most of Australia's rain falls on its northern, eastern and south-western coasts. Australia's north coast receives most of its tropical rainfall in summer with the arrival of the **monsoon** (see also page 24).

The Great Dividing Range runs the entire length of Australia's east coast and forces winds to drop their moisture as rain along the coastal strip. Then, having released moisture to the east of the range, the winds sink as dry air to the desert and semi-desert regions to the west of the Great Dividing Range. This process is known as **orographic rainfall** (see page 22).

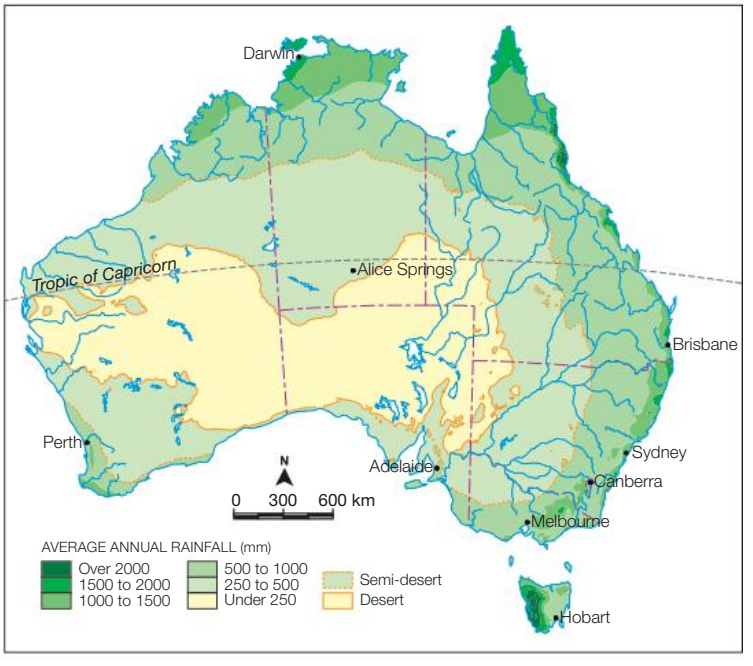
The wettest place in Australia is Bellenden Ker in north Queensland. Bellenden Ker averages 8312 mm of rainfall per year. It receives so much rain because of its tropical location on the eastern slopes of the Great Dividing Range.

The driest place in Australia is Kati Thanda (Lake Eyre) in South Australia. It averages only 125 mm of rainfall per year. **Air masses** have usually dropped their rain on the south-west corner of Western Australia, and are dry by the time they reach so far inland.

Australian rivers

Because Australia is such a dry continent, it doesn't have many large rivers or large permanent lakes. In fact, Australia has the lowest volume of water in rivers of any inhabited continent in the world. Just 12 per cent of Australia's rainfall is collected in rivers.

Australia: Average annual rainfall



Source: Matilda Education Australia

Source 1

Australian average rainfall per year

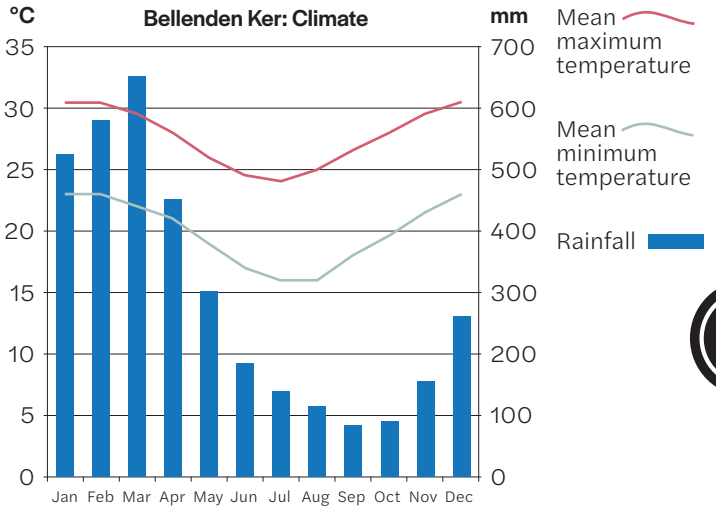
Australia's inland rivers are different to all other rivers in the world. The volume of water in most rivers increases the further the river courses, but Australia's inland rivers tend to lose water. The Darling River, which is Australia's longest river, loses enough water through **evaporation** each year to fill Sydney Harbour four times!

Many Australian rivers flow mainly – or only – when floods come down from far upstream. Heavy tropical rain falling in north Queensland is sometimes channelled through rivers to South Australia, where it floods the Kati Thanda **salt pan**.

Australian groundwater

One-third of Australia's residents rely on **groundwater** as their main source of water. Groundwater is water that is located in **aquifers** beneath Earth's surface. The aquifers are fed by surface water from rainfall and rivers. Communities access underground aquifers by drilling a well or bore and pumping water to the surface (see page 27).

The Great Artesian Basin in eastern Australia is the world's largest aquifer as it covers more than 1.7 million square kilometres – or 22 per cent of Australia's land mass. Water in an aquifer is trapped underground in a layer of sandstone covered by **sedimentary** rock, and can be more than one million years old.



Source 2

Climate graphs of the wettest and driest places in Australia

Learning Ladder G2.2

Show what you know

1 How much of Australia is desert or semi-desert?

2 How do Australian rivers differ to most other rivers in the world? Why?

3 Why are aquifers important to Australians?

4 Look carefully at Source 2:

- a How much rainfall does Bellenden Ker receive in February?
- b How much rainfall does Kati Thanda receive for the entire year?

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

5 Research and list four different weather recording instruments and what they measure.

Step 2: I can recognise and use different types of data

6 Is the information in Source 1 primary or secondary data to you? Why?

Step 3: I can choose, collect and display appropriate data

7 What primary and secondary data collection methods could you use to compare temperature and rainfall over a one-week period at your school?

Step 4: I can use data to support claims

8 What source on these pages would you select to show to an international corporation that is wanting to establish rice farms in Australia that require large amounts of water. List a further three pieces of data that the corporation would find useful in making a decision.

HOW TO Climate graphs, page 165

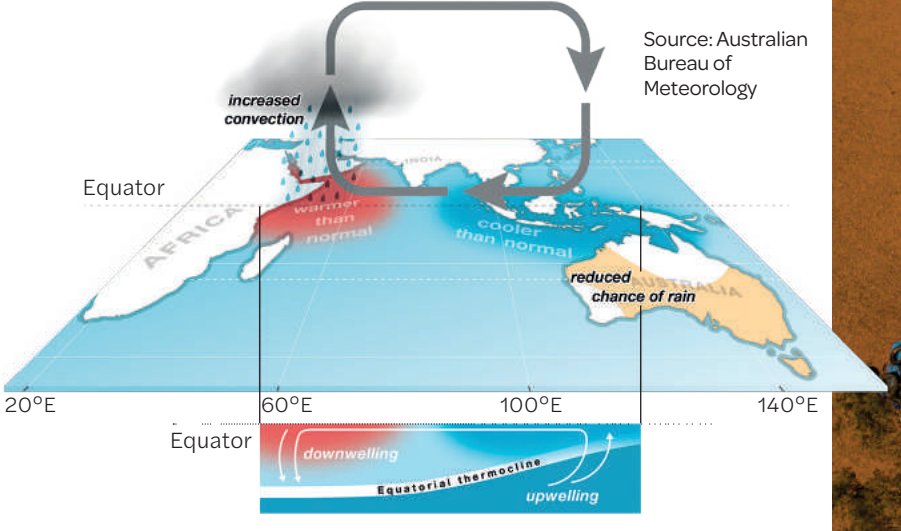
How do droughts and bushfires occur?

Record-breaking temperatures and severe drought led to massive bushfires across Australia in 2019 and 2020. Much of Australia had been in drought conditions for years, providing the dry conditions that make it easier for fires to begin and to spread. Scientists have warned that global warming is resulting in a hotter and drier climate in Australia, which will continue to drive more frequent and severe bushfires.

Australia in drought 2020

A **drought** is a prolonged period of water shortages caused by below-average rainfall, increased evaporation from higher temperatures or a reduction in surface water or groundwater supplies. A drought can last for months or years and is driven by not only lack of rainfall and high temperatures but also by overuse from growing populations.

The 2020 drought has been driven by a positive Indian Ocean Dipole; an event where temperatures on the sea surface are warmer in the western Indian Ocean, and cooler in the east. The difference between the two temperatures is the largest in 60 years, leading to high rainfall and floods in eastern Africa and droughts in Australia and south-east Asia.



Source: Australian Bureau of Meteorology

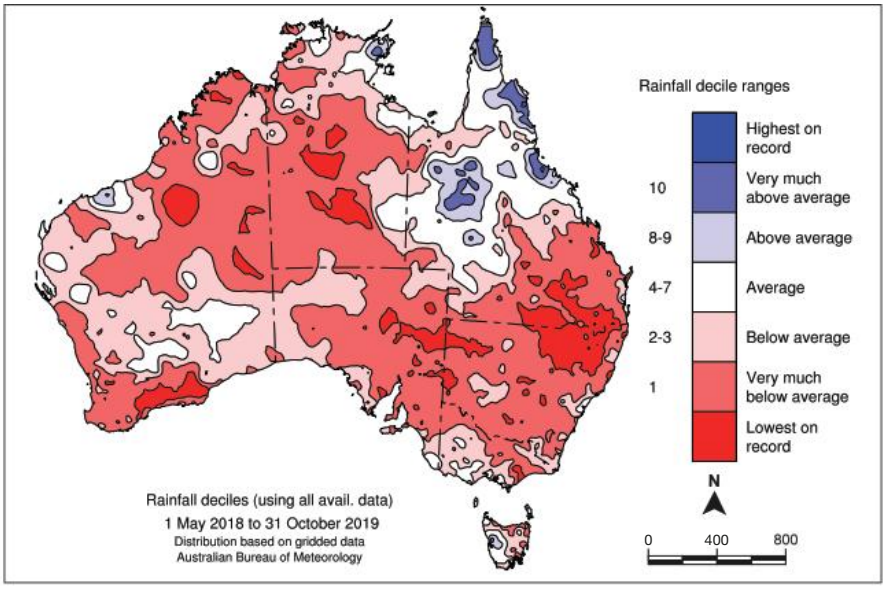
Source 1

Drought conditions caused by a positive Indian Ocean Dipole

Rainfall shortages

Lower than average rainfall has plunged most of New South Wales and Queensland into drought since early 2017. Rainfall shortages have been most extreme in the northern half of New South Wales and southern Queensland, where rainfall totals have been the lowest ever recorded.

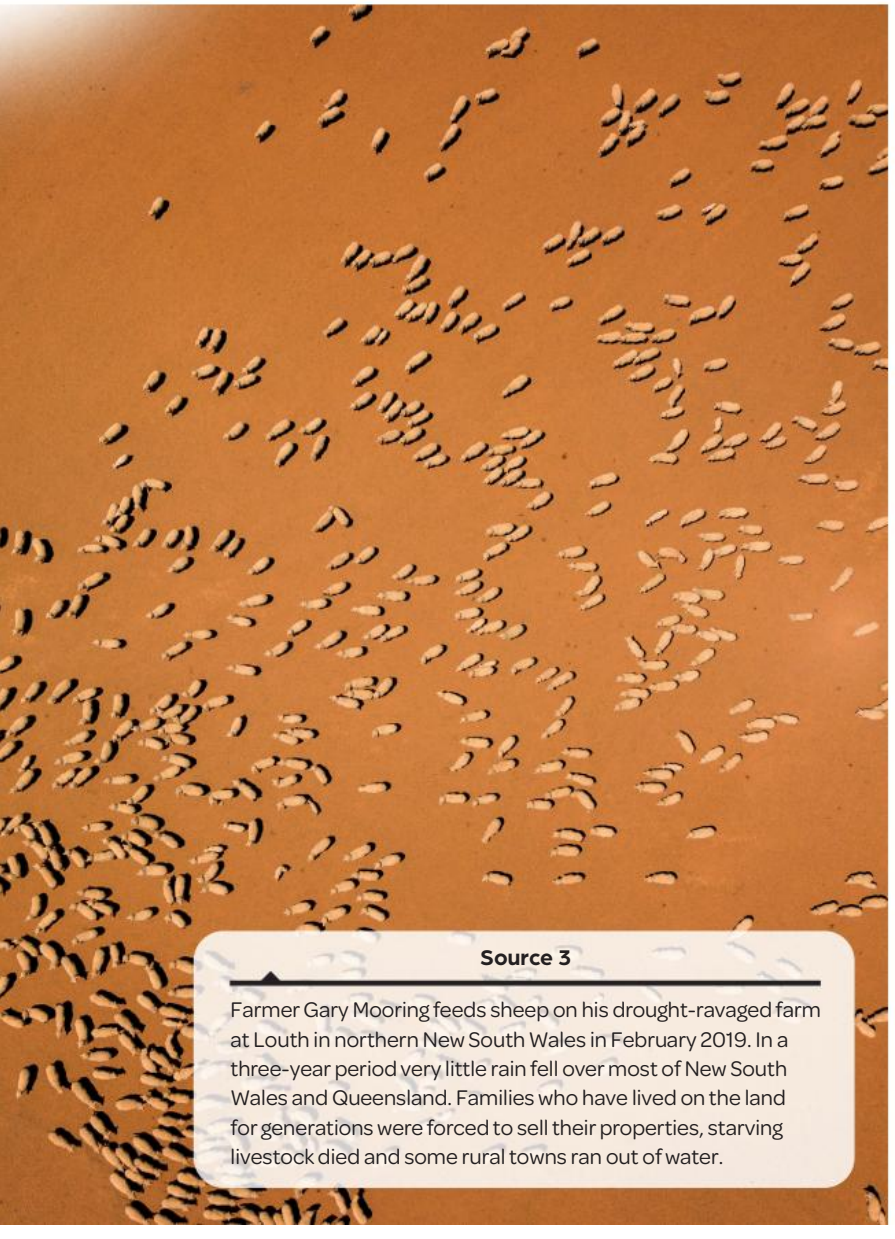
In 2019 Australia recorded its driest year ever, with the lowest annual rainfall the country has ever seen.



Source: Australian Bureau of Meteorology

Source 2

Australian rainfall shortages in 2018 and 2019



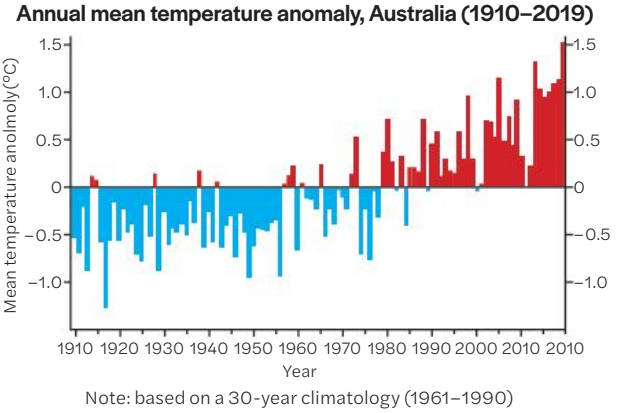
Source 3

Farmer Gary Mooring feeds sheep on his drought-ravaged farm at Louth in northern New South Wales in February 2019. In a three-year period very little rain fell over most of New South Wales and Queensland. Families who have lived on the land for generations were forced to sell their properties, starving livestock died and some rural towns ran out of water.

Australia is getting warmer

Since 1910 Australia's climate has warmed by more than one degree Celsius. **Climate change** is largely driven by increased carbon dioxide and other human-made emissions into the atmosphere. These gases trap heat just like the glass roof of a greenhouse. The greenhouse effect is expected to deliver even hotter and drier conditions to Australia.

Climate change is already leading to more severe heatwave conditions in Australia. Nine of the 10 warmest years on record have occurred since 2005. In 2019 Australia's annual mean temperature was 1.52 degrees Celsius above average — making 2019 the hottest year ever recorded in Australia.



Note: based on a 30-year climatology (1961–1990)

Source 4

Variations to the average annual temperature in Australia

Australian bushfires 2019–20

The combination of drought over much of Australia and heatwaves in New South Wales and Queensland combined to cause some of the worst fires in Australian history in the 2019-20 spring and summer period.

Bushfires occur when weather conditions are hot, dry and windy and there is enough dry fuel to burn. In these conditions it only takes a spark from a machine or a lightning strike for a fire to begin.

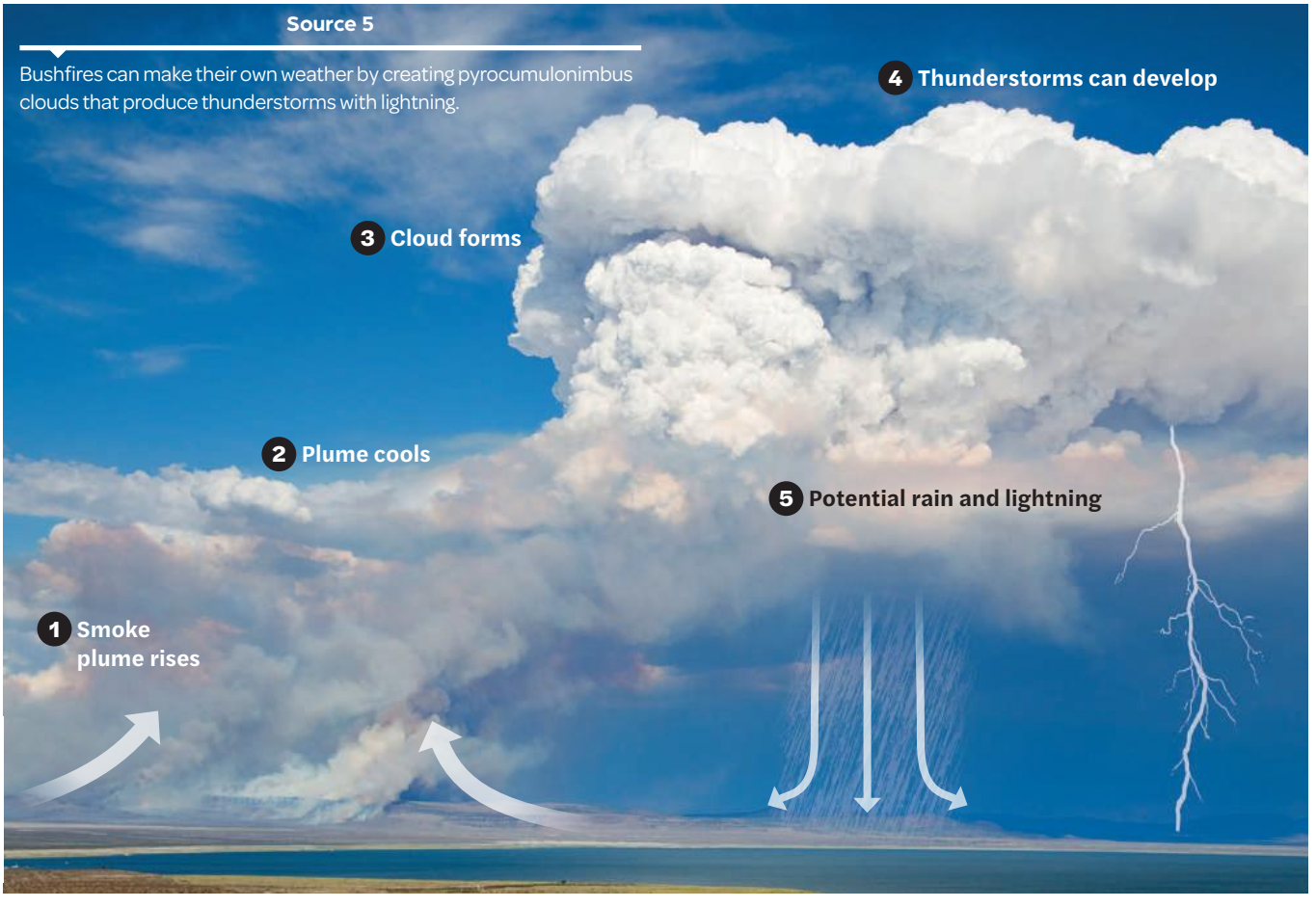
Once fires have started, wind fuels the fire with oxygen and moves the fire forward. Wind also carries burning leaves, twigs and bark, known as **embers**, ahead of the fire. Embers cause new **spot fires** to ignite. The intense heat from the 2019-20 bushfires caused rare **pyrocumulonimbus clouds** to form above them. These clouds can produce thunderstorms and lightning that can spark other bushfires or downpours to put them out.

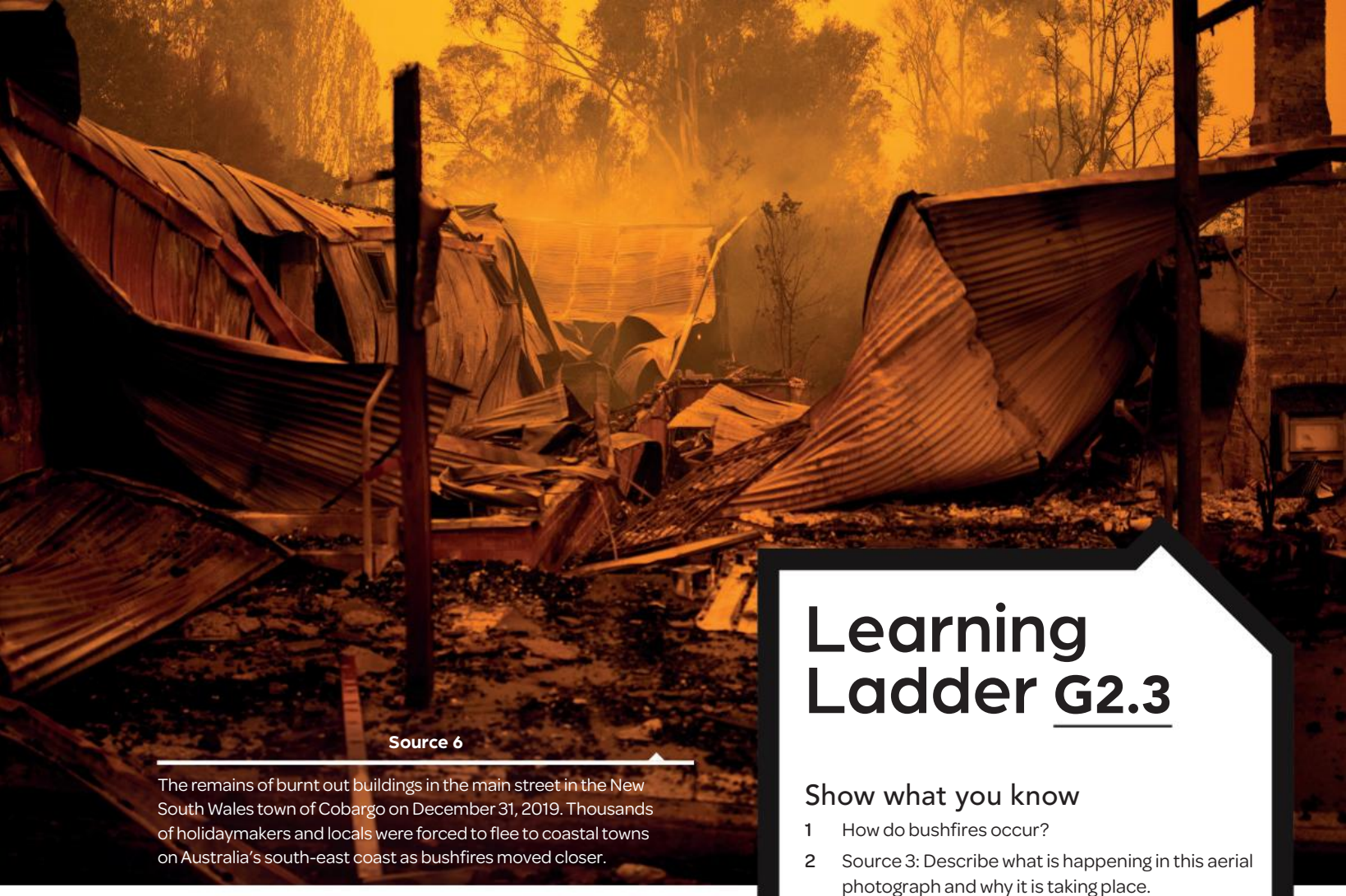
Record-breaking temperatures and months of severe drought created perfect conditions for bushfires to spread rapidly and difficult conditions for the thousands of firefighters called into action.

The 2019-20 bushfires affected all states of Australia except the Australian Capital Territory, although smoke from the fires blanketed the nation's capital. More than 10 million hectares of land burned, an area almost the size of England. At least 24 humans died, along with 100 000 head of cattle and 480 000 000 native animals and birds. More than 1600 homes were destroyed, forcing thousands of people to seek shelter elsewhere.

A state of emergency for all of New South Wales and affected areas of Victoria came into force. Parks, camping grounds and roads were closed and holidaymakers in the peak holiday season were told to leave coastal towns in danger along a 260-kilometre stretch of NSW coast.

In the holiday town of Mallacoota in far eastern Victoria, 4000 residents and tourists fled to the beach on new year's eve in 2019. Only a change in wind direction stopped the fire from reaching them on the foreshore. The stranded people were eventually evacuated by the Australian navy.

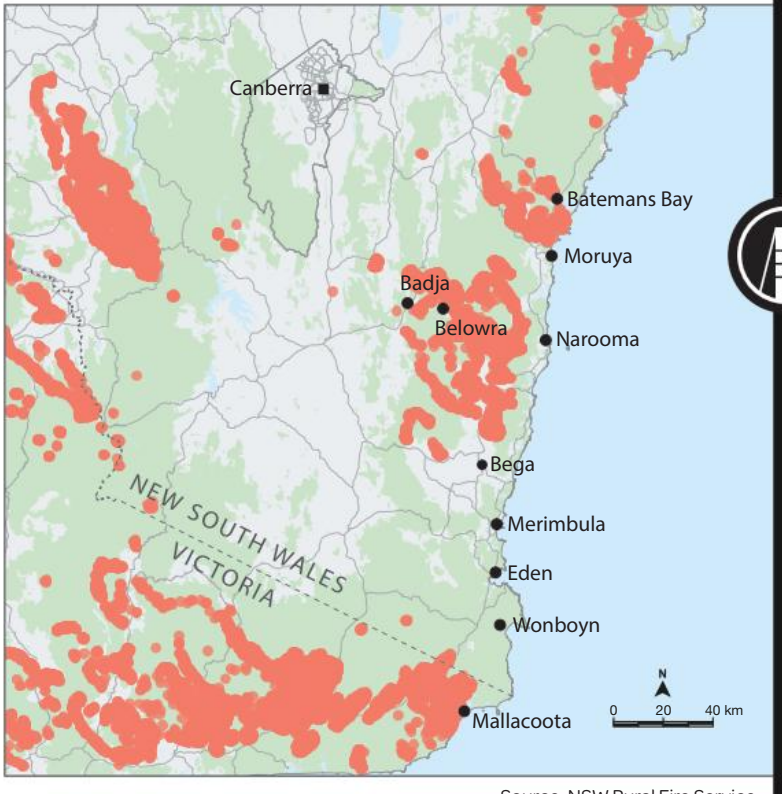




Source 6

The remains of burnt out buildings in the main street in the New South Wales town of Cobargo on December 31, 2019. Thousands of holidaymakers and locals were forced to flee to coastal towns on Australia's south-east coast as bushfires moved closer.

Major bushfires in eastern Australia, 2 January 2020



Source 7 Source: NSW Rural Fire Service

Bushfires in NSW and eastern Victoria, early January 2020

Learning Ladder G2.3

Show what you know

1 How do bushfires occur?

2 Source 3: Describe what is happening in this aerial photograph and why it is taking place.

3 Source 2: Which areas of New South Wales had the lowest rainfall on record in 2018-19?

4 Source 4: Describe the trend in variations to Australia's average annual temperature.

5 Source 7: Which areas of New South Wales and Victoria were burned and what was the impact of bushfires across Australia?

Interconnections

Step 1: I can identify and describe interconnections

6 Suggest two ways that pyrocumulonimbus clouds are interconnected to bushfires?

Step 2: I can explain interconnections

7 Source 1: Explain how the Indian Ocean Dipole is interconnected with drought conditions in Australia.

Step 3: I can identify and explain the implications of interconnections

8 Explain how drought and bushfires are interconnected.

Step 4: I can evaluate the implications of significant interconnections

9 Evaluate the implications of the interconnection between drought and hot, dry and windy conditions. What action can be taken to reduce the likelihood of this interconnection occurring?

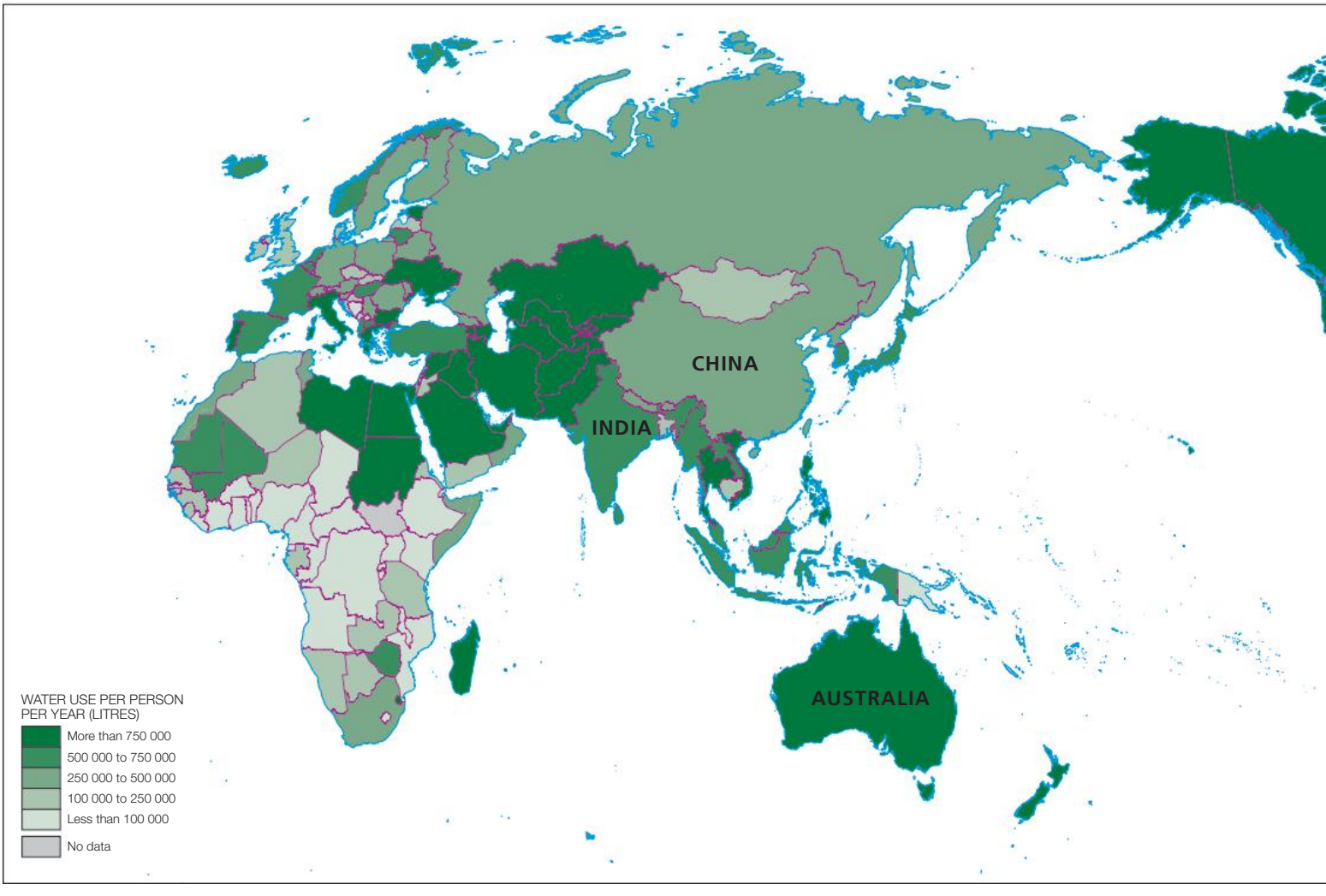
Who uses the most water?

In the last 50 years, the human population of Earth has grown to 7.6 billion people – and in that time, water use has doubled. India, China and the USA consume a third of all the water used globally. In total water use, Australia is a small water user, but per head of population we are one of the thirstiest nations on the planet. One in four people live in countries without the pipes, pumps and equipment to extract water.

Source 1

World water use per person per year

World water use



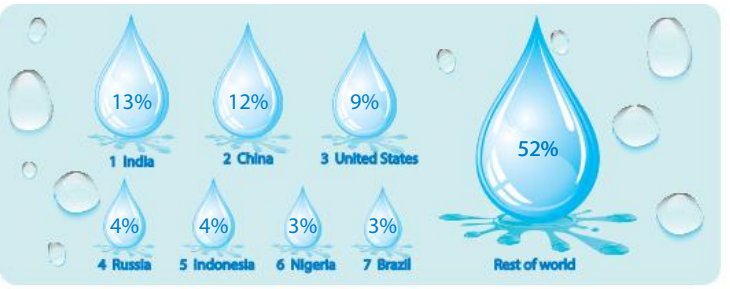
World water use

Nearly 4000 cubic kilometres of fresh water is taken from the world's lakes, rivers and aquifers each year. This amount of water would fill Victoria's Port Phillip Bay 25 times! World water withdrawals have doubled in the last 50 years. Most of the water used by humans is eventually returned to the environment – but the quality of this water may be less than when it was originally taken from the environment.

India, China and the USA consume 34 per cent of the water withdrawn for human use. India and China both use a lot of water to grow their food because they have the largest populations in the world.

The USA has the world's highest use of water per person, at 1550 cubic metres per year. Water used to produce meat – feeding the cattle that eventually become meat – accounts for one-third of American water use (see page 60). In India, where meat consumption is much lower, water use is only 1089 cubic metres per person per year.

Source: Matilda Education Australia



Source 2

The world's largest water consumers

Learning Ladder G2.4

Show what you know

1 How have world water withdrawals changed in the last 50 years?

2 Source 2: Which three countries consume more water than any others, and why?

Analyse data

Step 1: I can use geographic terminology to interpret data

3 Source 1: Compare the difference in water use per person in the northern and southern hemispheres.

Step 2: I can describe patterns and trends

4 Source 1: Use the PQE method to describe the global pattern of water use per person.

Step 3: I can explain the reasons behind a trend or spatial distribution

5 Source 1: Look at the map of water withdrawals per capita.

- a How do Australia and New Zealand compare with the rest of the world?
- b Which continent has the smallest water withdrawals per head of population and why?
- c As a class, discuss why some countries use more water per person than others.

Step 4: I can analyse relationships between different data

6 Compare Source 1 with Source 2. Give reasons to explain why India is high in one category and low in the other.

HOW TO

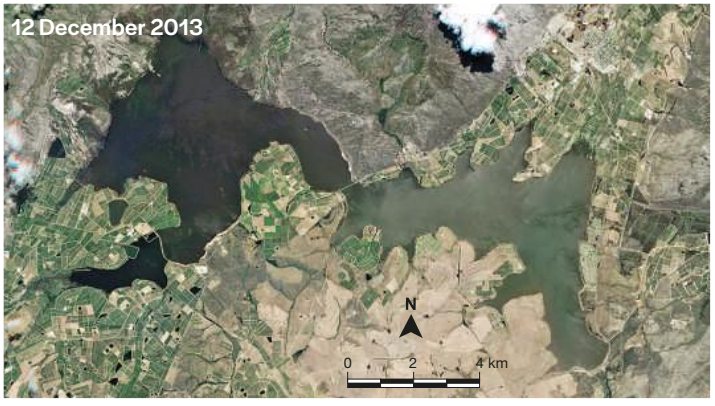
PQE, page 156

What happens when the water runs out?

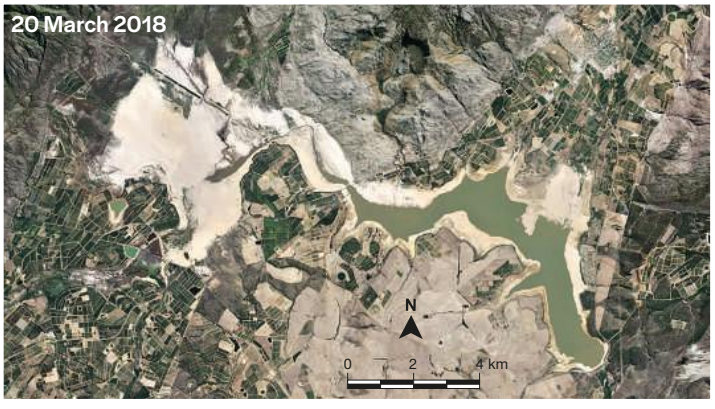
Cape Town's water supply running dry

Friday, 23 February 2018

Cape Town in South Africa will become the first major city to run out of water. If drought-saving rains don't arrive, the taps will be turned off on 'Day Zero': 4 June 2018. Despite harsh water restrictions, dam levels are predicted to decline to critically low levels, with the city's largest water reservoir looking more like a desert.



Source: Planet Labs Inc.



Source: Planet Labs Inc.

Source 1

Satellite images of Theewaterskloof Dam in 2013, and during drought in 2018

Source 2

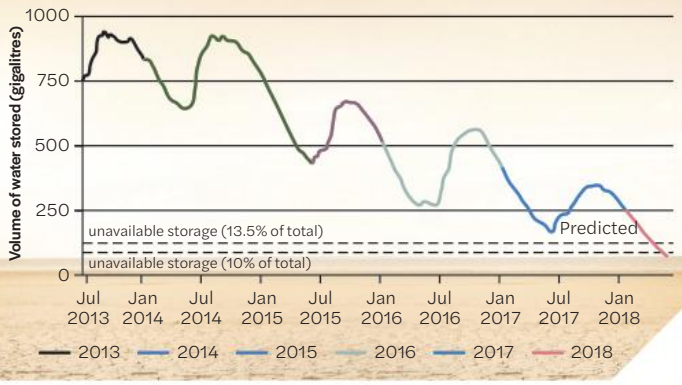
Theewaterskloof Dam supplies 41 per cent of Cape Town's water. It has been turned into a desert after the worst drought in a century.

Water crisis

On 23 February 2018, Cape Town had just 100 days of water left. Day Zero for Cape Town was 4 June, when the city's taps would run dry, cutting off water to its 4 million residents. At the time, the city's largest water supply, the Theewaterskloof Dam, held just 12 per cent of its massive 480 000 million cubic metre capacity.

At the start of 2018, Cape Town residents faced Level 6B water restrictions, which meant a limit of just 50 litres of water per person, per day. Queues formed at natural springs around Cape Town as people filled up water containers to build up their emergency supplies. Shops sold out of bottled water.

If Day Zero arrived, all water to homes would have been shut off and diverted to 200 distribution centres, where people would have to collect their daily rations of 25 litres of water.



Source: Climate System Analysis Group, 2018

Source 3

This graph shows Cape Town's water storage levels during the period 2013–2018.

Thankfully, Day Zero never eventuated. In response to the crisis, the people of Cape Town became extremely water-wise: households using too much water were fined and limits on water use for agriculture were introduced. Finally, in June 2018, the region experienced average rainfall for the first time in four years. However, Cape Town's water reserves are still critically low.

Causes of the problem

The twin problems behind Cape Town's water crisis were drought and massive population growth. Since 1915, Cape Town's population has grown by nearly 80 per cent, but dam water storage has increased by only 15 per cent.

The year 2017 was the driest on record for Cape Town, and 2015–2017 was the driest three-year period since 1933. In May 2017, the drought was declared the city's worst in a century.

Learning Ladder G2.5

Show what you know

1 What was Day Zero, and how did the threat of it come about?

2 What were the two major causes of Cape Town's water crisis?

3 Source 1: Use the satellite images to draw a map of Theewaterskloof Dam with a key that shows the changes that took place between 2013 and 2018. Include the following in your key: very deep water, deep water, shallow water and no water.

Geographical challenge

Step 1: I can identify responses to a geographical challenge

4 What action was taken to respond to the crisis?

Step 2: I can compare responses to a geographical challenge

5 What action could have been taken earlier to avert the water crisis?

Step 3: I can compare strategies for a geographical challenge

6 Search online to compare the current Cape Town water restrictions with those in place in Melbourne. What are the differences?

Step 4: I can evaluate alternatives for a geographical challenge

7 As a class, develop two strategies that could be undertaken to reduce the impacts of water shortages in Cape Town.

HOW TO

Satellite images, page 167

How much water is used to make goods?

Every day you consume 3496 litres of water without being aware of it. Most of this water is hidden in the food you eat and the products you use. Geographers call this virtual water. It is the responsibility of every consumer and every business to consider virtual water when making economic decisions.

Virtual water

Although it is invisible, millions of litres of water go into making the products we use every day. We don't physically drink this **virtual water**, but it is used in the production of almost every product we use.

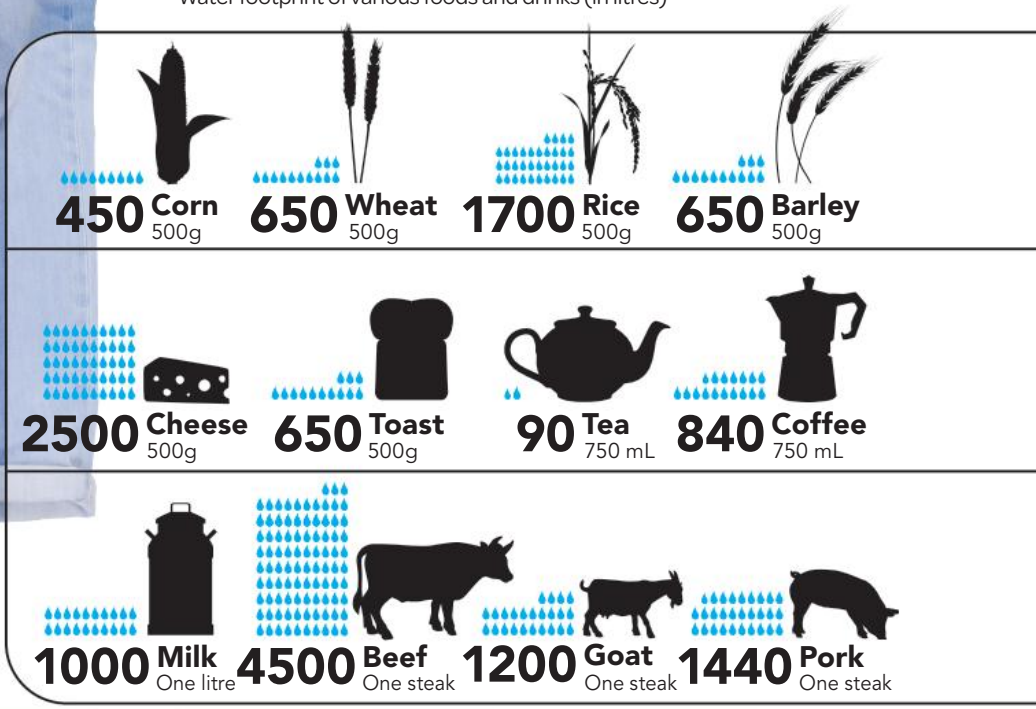
The water footprint of a product is the total amount of water used in each step of producing and transporting that product. To make a pair of jeans, cotton needs to be grown, spun and weaved into denim. Water is used during the production process to create steam for power, to cool machinery and to flush and clean equipment. More water is required to make packaging and to transport the jeans overseas.

Source 1

Creating jeans is a water-hungry process

Source 2

Water footprint of various foods and drinks (in litres)



3 060 000
The production of the grain, pasture and hay to feed a cow over three years requires more than 3 million litres of water

During three years of growth the grain-fed cow eats nearly 1300 kg of grains, such as wheat, oats, barley and corn

1300

7200
The cow also eats 7200 kg of pasture and hay

A single cow drinks 24 000 litres of water in three years

24 000

In total, we need 4500 litres of water to make just one steak.

4500

7000
7000 litres of water per cow is required to service the farmhouse and the slaughterhouse

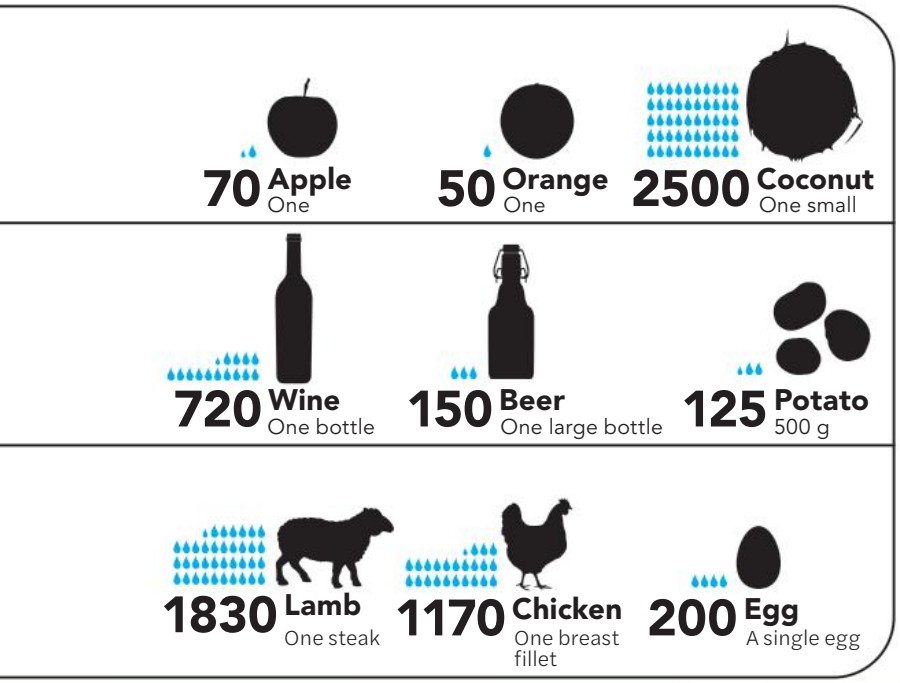
Source 3
4500 litres of water are used to make one beef steak

Water for farming

In most parts of the world, more than 70 per cent of fresh water is used for agriculture. By 2050, the world's population will have grown to 9 billion people, and that will require a 50 per cent increase in farm production and a 15 per cent increase in water use.

Of all water used for agricultural production in Australia, 90 per cent is used for irrigation of crops and pastures. Irrigation is the supply of water to farmland that doesn't receive enough rain to raise cattle or grow crops.

Water is required in the production of all foods – one-third of all water used in agriculture is for growing grain to feed livestock. Beef is the most 'water hungry' meat to produce, needing 4500 litres of virtual water to produce just one steak.



Learning Ladder G2.6

Economics and business

Step 1: I can recognise economic information

1 Source 1: What is the total water footprint of one pair of jeans?

Step 2: I can describe economic issues

2 Why is fresh water vital for industry?

Step 3: I can explain issues in economics

3 Why does it take so much water to produce one beef steak?

Step 4: I can integrate different economic topics

4 Sources 2 and 3: Explain why some beef production requires more virtual water for growth than other farm products.

Step 5: I can evaluate alternatives

5 Source 1: Look at the example of the life cycle of a pair of jeans.
   a Which stage of the jeans-making process uses the most water? Why?
   b Can you suggest an alternative to this stage that would require less water?

6 Calculate your own water footprint using the Water Footprint Network website (http://mea.digital/gh7_g2_1). In what ways could you reduce your footprint?

G2.7

thinking globally

Why does rice need so much water to grow?

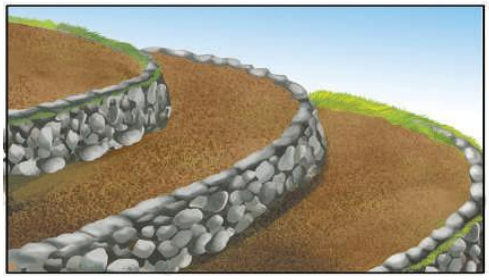
Bali paddies

To grow rice, you need plenty of heat and plenty of water. Rice is well suited to warm, wet, tropical places such as Bali in Indonesia. Rice fields are known as **paddy** fields. They are surrounded by low walls so that the paddies can be flooded with water. In hilly areas, flat rice fields are cut into hillsides as a series of steps, or **terraces**. Paddy rice requires 3400 litres of water to produce just 1 kilogram of the grain.

In Bali, native oxen known as *banteng* are used to plough the muddy fields before planting. After ploughing, the paddies are flooded. Rice seedlings are planted in rows by hand, and rainfall or irrigation is used to keep the paddies flooded for about four months. When the rice plants are a metre tall and turning yellow, they are harvested. To do this, the water in the rice paddies is reduced, and workers use sharp knives to cut the stalks off at ground level. The rice plants are then tied in bundles and left to dry in the sun.

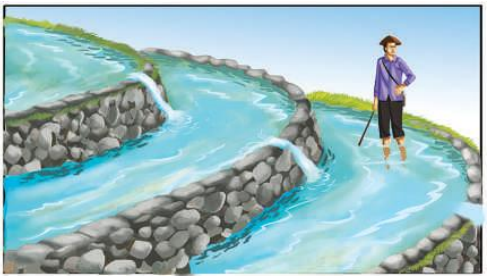
Source 1

Constructing a terraced farm to grow rice

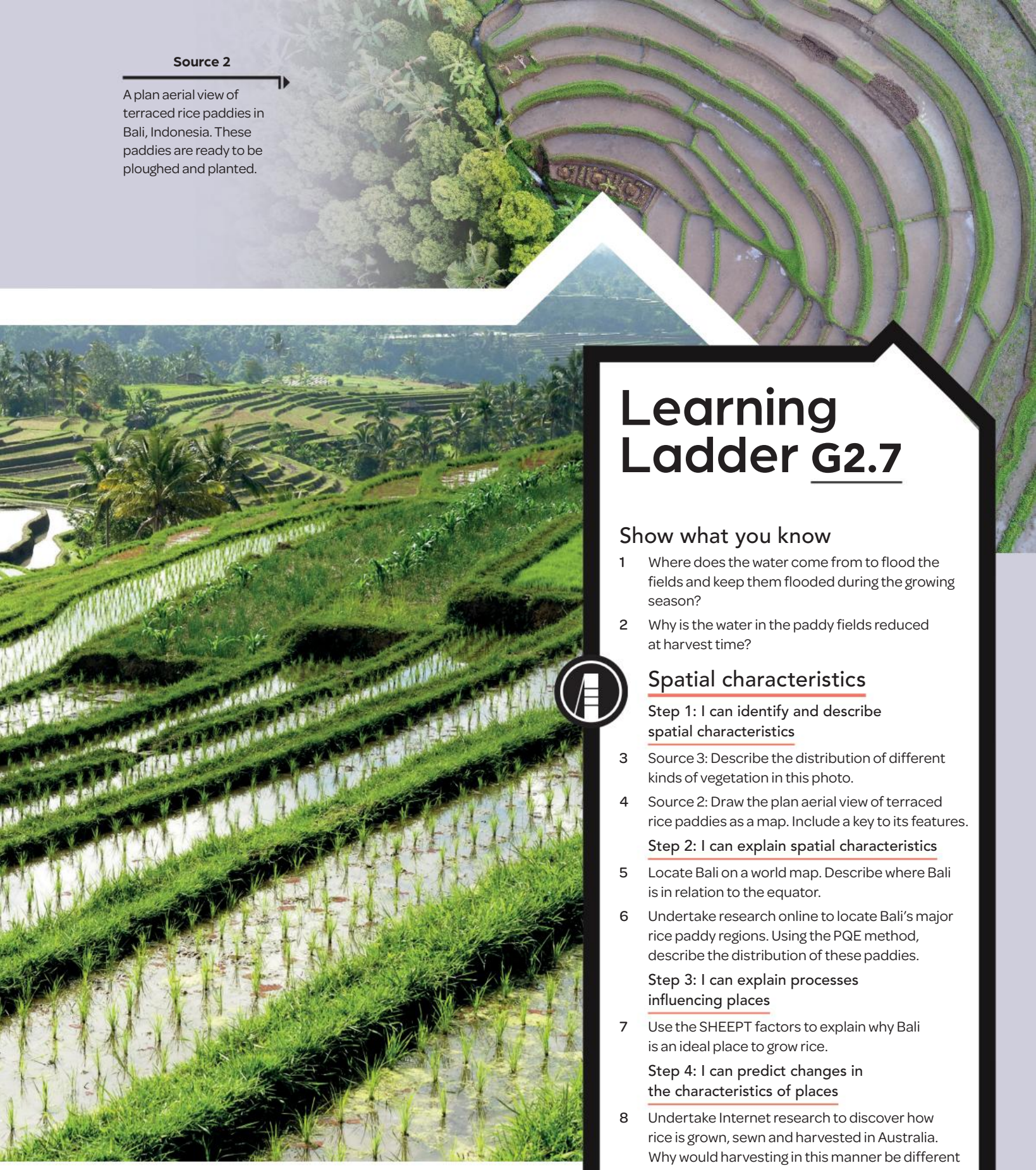


A stone retaining wall is built and backfilled with soil. The soil is flattened to provide a smooth terrace surface.

The terrace is flooded. The depth is controlled by an opening where water can be let out.



Other terraces are built and connected by a water supply.



Source 2

A plan aerial view of terraced rice paddies in Bali, Indonesia. These paddies are ready to be ploughed and planted.

Source 3

Rice plants grow in neat rows on flooded terraced fields called paddies. When the plants are fully grown, the water in the rice paddy is reduced to allow for easier harvesting.

Learning Ladder G2.7

Show what you know

1 Where does the water come from to flood the fields and keep them flooded during the growing season?

2 Why is the water in the paddy fields reduced at harvest time?

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

3 Source 3: Describe the distribution of different kinds of vegetation in this photo.

4 Source 2: Draw the plan aerial view of terraced rice paddies as a map. Include a key to its features.

Step 2: I can explain spatial characteristics

5 Locate Bali on a world map. Describe where Bali is in relation to the equator.

6 Undertake research online to locate Bali's major rice paddy regions. Using the PQE method, describe the distribution of these paddies.

Step 3: I can explain processes influencing places

7 Use the SHEEPT factors to explain why Bali is an ideal place to grow rice.

Step 4: I can predict changes in the characteristics of places

8 Undertake Internet research to discover how rice is grown, sewn and harvested in Australia. Why would harvesting in this manner be different to Bali?

HOW TO

PQE, page 156
SHEEPT, page 158

Is all water safe to drink?

Nearly 800 million people in the world do not have access to a reliable and safe fresh water supply. Millions of people around the world get sick or die from drinking contaminated (or dirty) water. Millions of women and children around the world spend several hours a day collecting and carrying enough water to sustain their families for another day.

The burden of thirst

Even at four in the morning, Binayo can run down the rocks to the river by starlight alone and climb the steep mountain back up to her village with 20 kilograms of water on her back. She has made this journey three times a day for nearly all her 25 years. So has every other woman in her village of Poro, in the Konso district of south-western Ethiopia.

Binayo dropped out of school when she was eight years old, in part because she had to help her mother fetch water from the Toiro River. The water is dirty and unsafe to drink; every year that the ongoing drought continues, the once mighty river grows more exhausted. But it is the only water Poro has ever had.

The task of fetching water defines life for Binayo. She must also help her husband grow cassava and beans in their fields, gather grass for their goats, dry grain and take it to the mill for grinding into flour, cook meals, keep the family compound clean, and take care of her three small sons. None of these jobs is as important or as consuming as the eight hours or so she spends each day fetching water.

Source 1

Gabra women in northern Kenya spend up to five hours each day hauling heavy jerry cans filled with dirty water back to their families.

'In wealthy parts of the world, people turn on a faucet [tap] and out pours abundant, clean water. Yet [in 2010] nearly 900 million people in the world have no access to clean water, and 2.5 billion people have no safe way to dispose of human waste – many defecate in open fields or near the same rivers they drink from. Dirty water and lack of a toilet and proper hygiene kill 3.3 million people around the world annually, most of them children under age five. Here in southern Ethiopia, and in northern Kenya, a lack of rain over the past few years has made even dirty water hard to find.

Where clean water is scarcest, fetching it is almost always women's work. In Konso a man hauls water only during the few weeks following the birth of a baby. Very young boys fetch water, but only up to the age of seven or eight. The rule is enforced fiercely – by men and women. "If the boys are older, people gossip that the woman is lazy," Binayo says. The reputation of a woman in Konso, she says, rests on hard work: "If I sit and stay at home and do nothing, nobody likes me. But if I run up and down to get water, they say I'm a clever woman and work hard."

'The burden of thirst', *National Geographic* April 2010.
Tina Rosenberg (text) and Lynn Johnson (photograph).

Waterborne diseases

Fresh water is essential for drinking, cooking, food production and hygiene, as well as for cleanliness. Many countries in the world lack safe water supplies and have poor sanitation (safe disposal of human urine and faeces). People get diarrhoea from drinking and bathing in contaminated water, and this can lead to diseases such as cholera, typhoid fever and dysentery. These illnesses kill 6000 children every day – and 3.4 million people die every year from waterborne diseases.

Water scarcity in Africa

Rapid population growth in Africa has made it even more difficult for African communities to find a reliable source of fresh water. In Africa, **water scarcity** affects one person in every three – and it is getting worse.

Reduced access to water means that people use water of poorer quality. The journeys women take to fetch water for the family become even longer. When they can get water, people store it in their homes – but this provides a breeding ground for mosquitoes, which carry dengue fever, malaria and other diseases.

Better access to safe water

World Vision and other **aid agencies** work with local communities to improve their access to safe water.

Just two protected wells provide the daily water for the 33 000 people of the Mwinilunga community in Zambia. Women and girls walk long distances to fetch water from unprotected wells and contaminated streams. Half of the Mwinilunga children suffer from life-threatening malaria or diseases caused by diarrhoea.

However, family health is improving in the Mwinilunga community as families gain access to safe water for the first time. World Vision has worked with the local community to:

- drill ten boreholes and equip them with pumps
- protect five wells against contamination
- build toilets for homes and schools
- train locals to operate and look after the borehole pumps
- conduct 100 hygiene education sessions and train 20 teachers.

Source 2

Rendille villagers in drought-stricken Northern Kenya in 2010. They are scooping the last remaining water from a tank that was filled by a government truck the night before. The next water delivery won't be for a week.

Source 3

This map shows countries where less than half the population can access clean water. The percentage for each country shows the number of people who have access to safe water supplies.

Learning Ladder G2.8

Show what you know

1 What problems does water scarcity bring?

2 What problems does drinking unsafe water cause?

Geographic challenge

Step 1: I can identify responses to a geographical challenge

3 Read the story 'The burden of thirst' on page 64.

a What is Binayo's most important job? Describe how she performs this task.

b How far away is the Toiro River and how many times does she travel to it each day?

Step 2: I can compare responses to a geographical challenge

4 How has access to safe water for the Mwinilunga community improved?

Step 3: I can compare strategies for a geographical challenge

5 Source 3: Use the map to locate target regions for action to improve safe water.

- In which continent is maintaining a sustainable safe water supply a major issue?
- Which country has the worst access to safe water?
- Which countries neighbouring Australia have difficulties sustaining a safe water supply?

Step 4: I can evaluate alternatives for a geographical challenge

6 Suggest three ways that economically developed countries can assist those with water scarcity.

Who has spiritual links with water?

In many cultures there is a deeper, spiritual connection with rivers, lakes and waterholes. Waterways can be central to religions and cultures and their stories.

Indigenous Australians' connection to water

Australia's Indigenous peoples are connected to the land and water, and are responsible for looking after them. Water places are spiritual for Aboriginal peoples, and their importance has been passed on through song, dance, painting and storytelling.

Many Aboriginal creation stories tell of the Rainbow Serpent as the creator of rivers, lakes and waterholes.

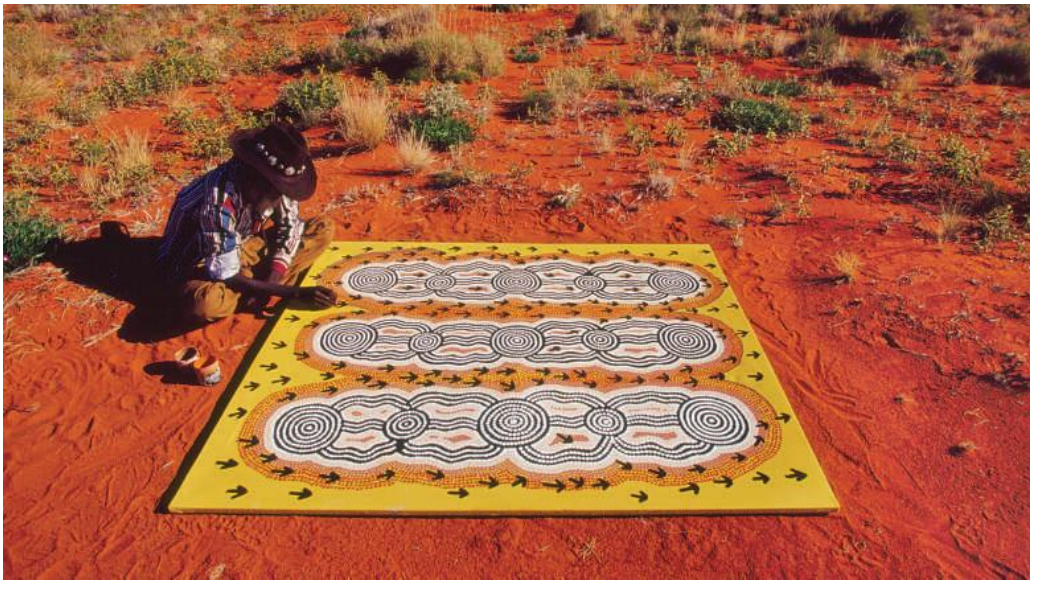
For some Indigenous people, the Rainbow Serpent is the source of all life and the protector of the land and people. According to myth, the Rainbow Serpent moved across the land, shaping the landscape with its powerful body. River beds were formed from the winding tracks made by the serpent.

According to Indigenous law, water places have spiritual significance, along with responsibilities for protecting cultural knowledge. However, Indigenous Australians have been largely left out of the management of their traditional water sources and significant sites.

'Water is the life for us all,' says Karajarri man John 'Dudu' Nangkiriyn. 'It's the main part. If we are gonna lose that, I don't know where we gonna stand. If that water go away, everything will die. That's the power of water.'

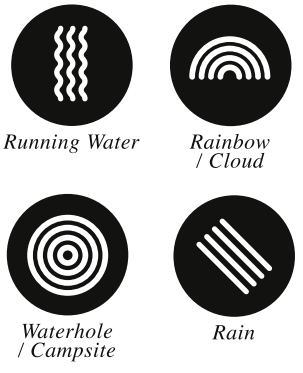
The holy Ganges River

The Ganges River in India is perhaps the holiest river in any religion. The Ganges is worshipped by Hindus, who believe they are purified by bathing and praying in the river.



Source 1

Aboriginal people in arid areas can map the location of water in their artwork. Campsites are closely associated with waterholes.



Source 2

During the Kartik Purnima festival in Patna, India, tens of thousands of Hindus come together on the banks of the Ganges River to bathe and offer prayers.

This sacred river is also used by millions of Indians daily – and it is one of the most polluted rivers in the world.

The Ganges is worshipped as a goddess in Hindu religion, and is referred to as Mother Ganga. Hindus believe that the waters of the Ganges are sacred and can wash the sins of previous lives away.

It is believed that people who die near the Ganges reach heaven, escaping the cycle of rebirth. As a result, cremating a dead body on the banks of the Ganges – or spreading the ashes of the deceased in the water – is believed to lead to heaven. The city of Varanasi on the banks of the Ganges is India's spiritual capital. Every year, 32 000 corpses are cremated in Varanasi, and up to 200 tonnes of half-burnt flesh end up in the Ganges, along with the unburned bodies of those Hindus who cannot afford firewood for their cremation.

However, the waters of the Ganges River that Hindus believe are so purifying are also dangerous to their health. It is estimated that two-thirds of the people who regularly use the Ganges for bathing, or for washing clothes or dishes, will suffer a serious illness.

In 2015, 100 000 Indian children died from the effects of diarrhoea, a waterborne disease (see page 66). This death toll was higher than for any other country in the world.

Learning Ladder G2.9

Show what you know

1 How have Indigenous Australians passed on the spiritual connection to water over time?

2 Why do you think Indigenous Australians want a say in how water resources are managed?

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

3 The concept of place looks at the significance of places. Why is the Ganges River a significant place?

Step 2: I can explain spatial characteristics

4 Source 1: How do some Aboriginal artworks show the spatial location of water resources?

Step 3: I can explain processes influencing places

5 Source 2 : What social factor is behind Patna being considered a special place?

Step 4: I can predict changes in the characteristics of places

6 As a class, discuss:

a the impact that the spiritual connection with the Ganges River has on the health of the people who bathe in it.

b how the Indian government can help to clean up the Ganges River, yet still respect people's spiritual beliefs.

HOW TO

Geographic concepts, page 4
SHEEPT factors, page 158

How do we manage water?

Water resources need to be carefully managed to make sure there are reliable supplies of safe water and a healthy environment. There is great competition for water use from farms, factories and cities.

Maintaining water balance

Water balance describes the flow of water in and out of a system. Managing our water supply requires having an understanding of all of the water that comes in and out of that system (see page 20).

Inputs refer to water coming *into* the system. This includes rainfall, **run-off** into rivers and lakes, and water flowing into underground reserves, as well as additional water piped in from outside the system (see desalination on page 72).

Outputs refer to water going *out* from a system. This includes **evaporation** from land and bodies of water, **transpiration** from plants, and our use of water from surface water and groundwater.

Governments and water authorities need to estimate the size of future **water resources** in a region. To do this, they have to calculate all of the inputs and all of the outputs, both natural and for human use.

Reliable water supply

Managing our precious **fresh water** supply is not easy, because:

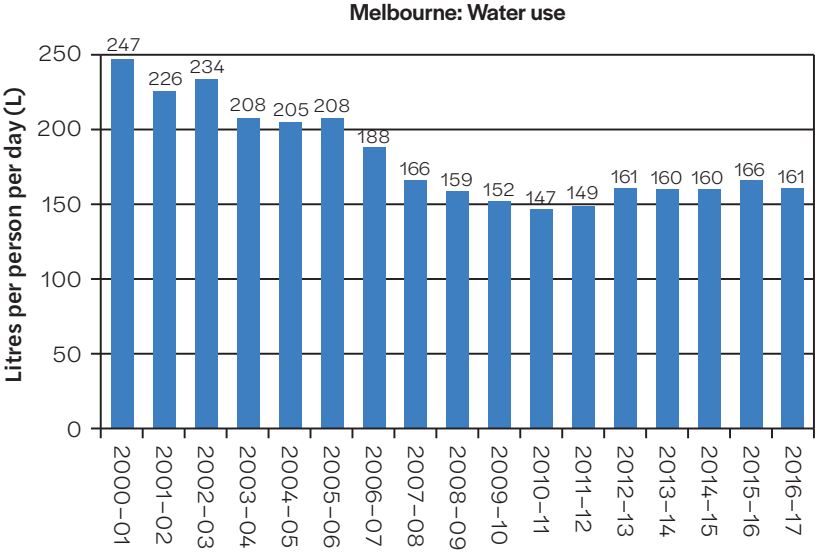
- it is an essential resource for all
- the amount of water available changes depending on rainfall, usage and rate of evaporation
- water resources are shared among many competing users.

Water storages, called **dams** or reservoirs (see page 27), provide a reliable water supply for **irrigation**, **hydroelectricity** (see page 16) and urban use. Water authorities monitor storage levels to make sure that there is enough water available.

Melbourne's water supply system is made up of water supply reservoirs and a **desalination** plant (see page 72). When the water supply drops below 60 per cent, the government will order water from the desalination plant and bring in water restrictions to reduce how much water people use – the outputs – from the water storages.

Source 1

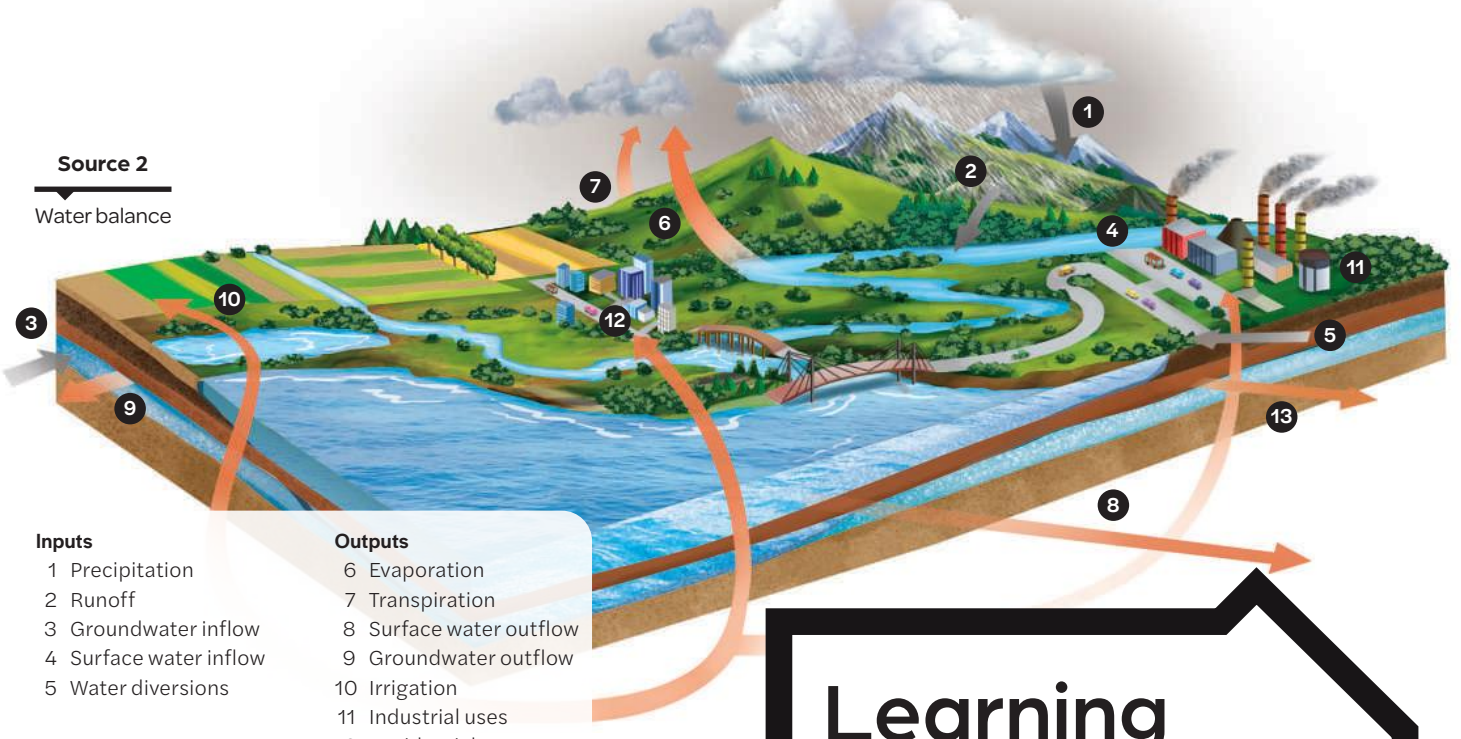
Melbourne's water use per person per day 2000–17



Source: City West Water, Melbourne Water, South East Water & Yarra Valley Water, 2017

Source 2

Water balance



Inputs

1 Precipitation
2 Runoff
3 Groundwater inflow
4 Surface water inflow
5 Water diversions

Outputs

6 Evaporation
7 Transpiration
8 Surface water outflow
9 Groundwater outflow
10 Irrigation
11 Industrial uses
12 Residential uses
13 Water diversions

Competition for Murray–Darling River water

Our largest river system, the Murray-Darling, does not carry much water compared to other rivers in the world. The **drainage basin** that supplies water to the Murray-Darling system receives about 530 000 gigalitres of water as rainfall – but then loses 94 per cent of this to evaporation and transpiration. Because Australia's climate varies so much, the actual amount of water in the river system can vary from less than 7000 gigalitres (in 2006) to almost 118 000 gigalitres (in 1956).

To ensure a regular supply of water from the Murray-Darling system, a series of water storages have been built: four major dams, 16 storage weirs and 15 navigable locks. The amount of water released from these dams depends on the amount of water entering the Murray-Darling system (see page 34).

There are many competing uses for water from the Murray-Darling River system, including irrigation, recreation, navigation, hydroelectricity and water storage, along with water for cities, industry and maintaining the natural environment. Competition also exists between upstream and downstream users of water from the Murray-Darling River system and users in different states.

The Murray River spans three states: Victoria, New South Wales and South Australia. As a downstream user of the Murray River, South Australia is always affected by how the water is used upstream. To ensure fairness in management, the river system is controlled by the independent Murray-Darling Basin Authority.

Learning Ladder G2.10

Show what you know

1 Why are water storages such as dams an important part of water supply?

2 How does the water supply in the Murray-Darling Basin vary?

3 What are competing uses for water from the Murray-Darling River system?

Interconnections

Step 1: I can identify and describe interconnections

4 What water movements in and out of the Murray-Darling Basin cause the water supply to vary so much?

Step 2: I can explain interconnections

5 Source 2: Use the block diagram to look at interconnections in this environment.
- a What are the natural inputs and outputs of a water system?
- b What are the human inputs and outputs?

Step 3: I can identify and explain the implications of interconnections

6 Summarise how our environment maintains a water balance. Use the concepts of interconnection and change in your writing.

Step 4: I can evaluate the implications of significant interconnections

7 Source 1: Look at the graph. Use the PQE method to describe and quantify the pattern. How have changes in water use helped maintain Melbourne's water supply?

HOW TO

PQE, page 156

G2.11

thinking locally

How can we make fresh water?

Australia's largest desalination plant is the Dalyston facility in Victoria. A desalination plant removes salt and impurities from seawater and turns it into fresh water.

Planning for the **desalination** plant started in 2007, when Melbourne's dam water storages fell below 30 per cent – their lowest level ever. The plant was built to supply Melbourne with water in times of drought. It was completed in 2012, but not used until 2017.

The desalination plant costs over $600 million per year to run and can produce up to 150 gigalitres (150 billion litres) of water each year.

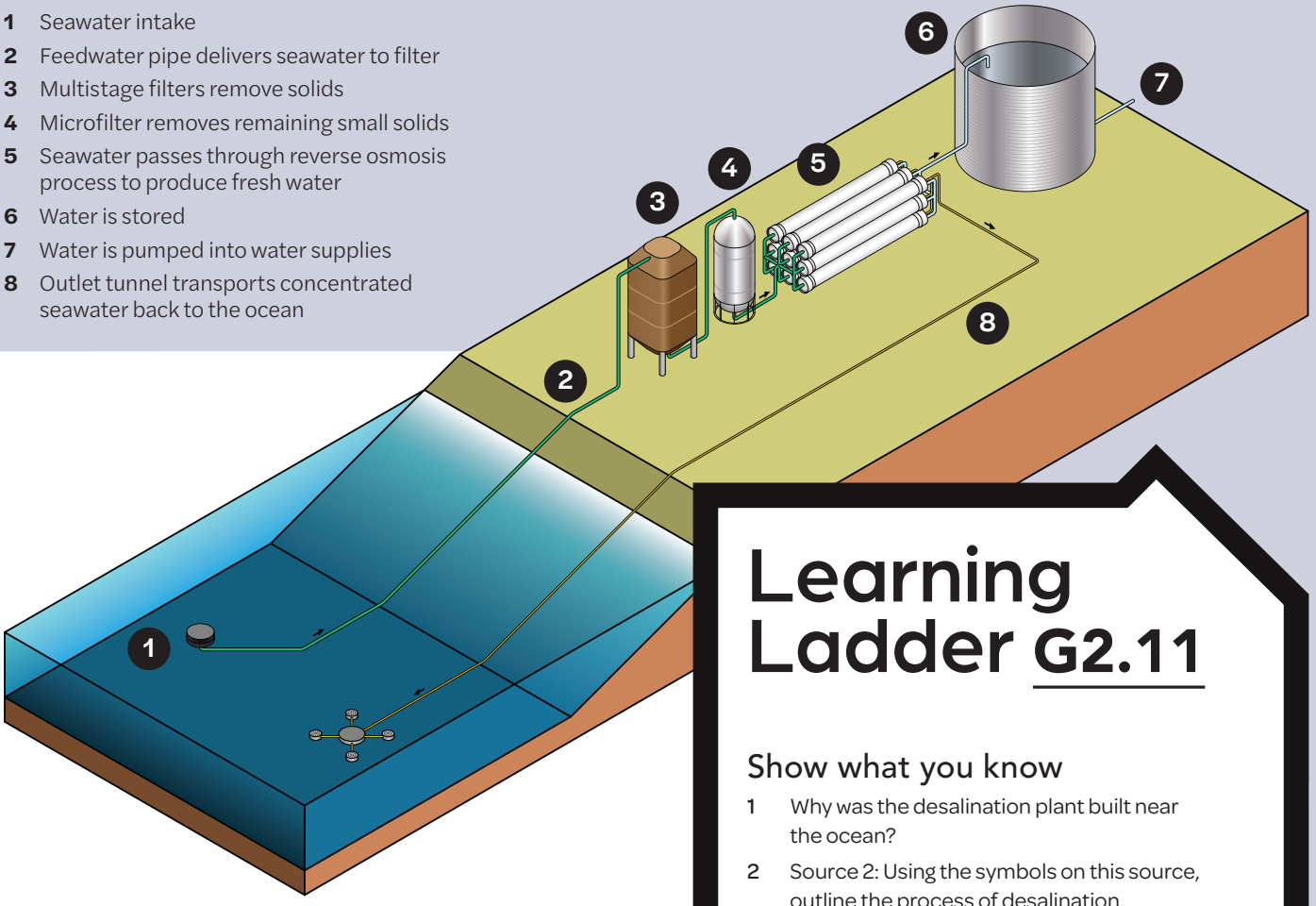
The plant takes in seawater through a pipeline 1.2 kilometres long. Seawater passes through filters and then through two stages of a process called **reverse osmosis**, where it is pushed under high pressure through ultra fine filters (called membranes). Fresh water passes through the membranes and leaves the salt and other impurities behind.

Drinking water is then pumped via an 84-kilometre pipeline from the Dalyston plant to Cardinia Reservoir, near Melbourne.

Source 1

Oblique aerial view of the Dalyston desalination plant. The long intake and outlet tunnels are buried beneath the ground and are not visible in this image.

1. Seawater intake
2. Feedwater pipe delivers seawater to filter
3. Multistage filters remove solids
4. Microfilter removes remaining small solids
5. Seawater passes through reverse osmosis process to produce fresh water
6. Water is stored
7. Water is pumped into water supplies
8. Outlet tunnel transports concentrated seawater back to the ocean

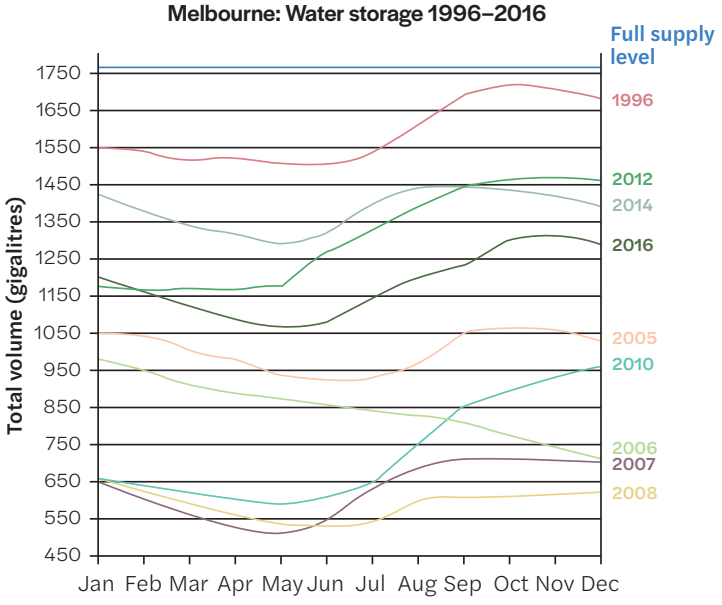


Source 2

How a reverse-osmosis water desalination plant works

Source 3

Total volume of water in Melbourne water storages 1996–2016



Source: State Government of Victoria, Department of Environment, Land, Water and Planning, 2017

Learning Ladder G2.11

Show what you know

1 Why was the desalination plant built near the ocean?

2 Source 2: Using the symbols on this source, outline the process of desalination.

Analyse data

Step 1: I can use geographic terminology to interpret data

3 Source 1: Why don't the intake and outlet pipes show on the oblique aerial photograph?

Step 2: I can describe patterns and trends

4 Source 3: Look at the graph. Use the data to answer these questions.
- a At what time of year do water storages peak?
- b When were the lowest storage levels recorded?

Step 3: I can explain the reasons behind a trend or spatial distribution

5 Source 3: Look at the graph.
- a Why do you think plans to build a desalination plant began in 2007?
- b Why do you think the desalination plant was not used until 2017?

Step 4: I can analyse relationships between different data

6 Many people living near Dalyston protested against the plant being built. As a class, discuss the issues they might have raised.

HOW TO

Flow diagrams, page 163
Graphing, page 164

How can we save water at home?

Most Australians are lucky to have instant access to clean, safe water at home. Per person, Australians are one of the biggest users of water in the world – but we can all help save water in the home with a few simple changes.

Domestic water use

Most Australian homes have good access to a reliable supply of clean water. As the country's supply of fresh water is low and varies a lot, Australian governments have encouraged water conservation and introduced water restrictions during times of drought.

Domestic use of water only accounts for 12 per cent of Australia's total water use, but Australia has one of the highest rates of water consumption per person in the world. The average daily water use is 340 litres per person, or 900 litres per household. Average water consumption ranges from 100 litres per person in some coastal areas to more than 800 litres per person in the **arid** inland areas.

Saving water in the home

More than 1.7 million Australian households have installed rainwater tanks – saving both water and money. Water collected in rainwater tanks is usually used for watering the garden and flushing toilets. It also provides an alternative supply of water during times of drought.

To improve water management in the home, we can capture water, **recycle** water or use less water. We can select water-saving appliances such as low-flush toilets and water-efficient showerheads to reduce the amount of water we use.

Source 1

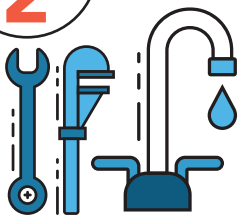
Water-saving measures at home help to save our valuable water. Between water restrictions and changes in water use, the amount of water used by Australian households fell 12 per cent between 2003 and 2009 – despite a population increase of 7.7 per cent.

TOP TIPS FOR SAVING WATER

TIP 1

Install a dual-flush toilet and do not dispose of rubbish in toilets.

TIP 2



Check and repair all leaks.

TIP 3

Do not leave water running when brushing your teeth, shaving or washing dishes.

TIP 4

Install watersaving showerheads and limit showers to four minutes.

TIP 5

Use full loads in the dishwasher and washing machine. Use an eco setting where possible.

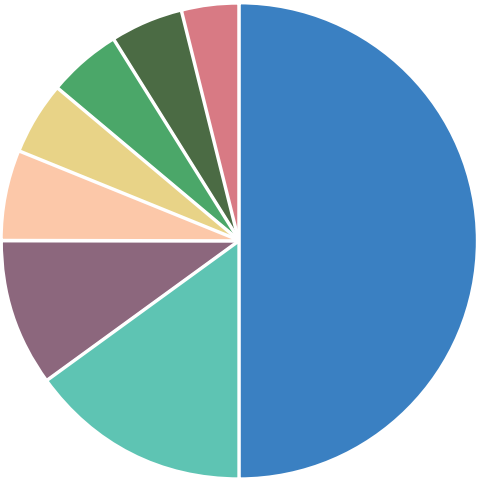
TIP 6

Other ways you can save water include watering the garden in the early morning and late evening, installing a rain water tank, and using buckets of water for cleaning.

Source 2

Tips for saving water

Australia: Domestic water use



Source 3

Domestic water use in Australia

Learning Ladder G2.12

Show what you know

1 How much of Australia's total water use occurs in our homes?

2 How did Australians reduce water usage by 12 per cent between 2003 and 2009?

Analyse data

Step 1: I can use geographic terminology to interpret data

3 What does the blue section of Source 3 show?

Step 2: I can describe patterns and trends

4 Source 3: Examine the pie chart.

a Where is half of domestic water used? List three ways we can reduce domestic water use.

b Which is the most water-hungry appliance inside the house? How can we reduce water use in this area?

Step 3: I can explain the reasons behind a trend or spatial distribution

5 'Water is a valuable resource that should not be used carelessly.' Support this statement using data from this spread.

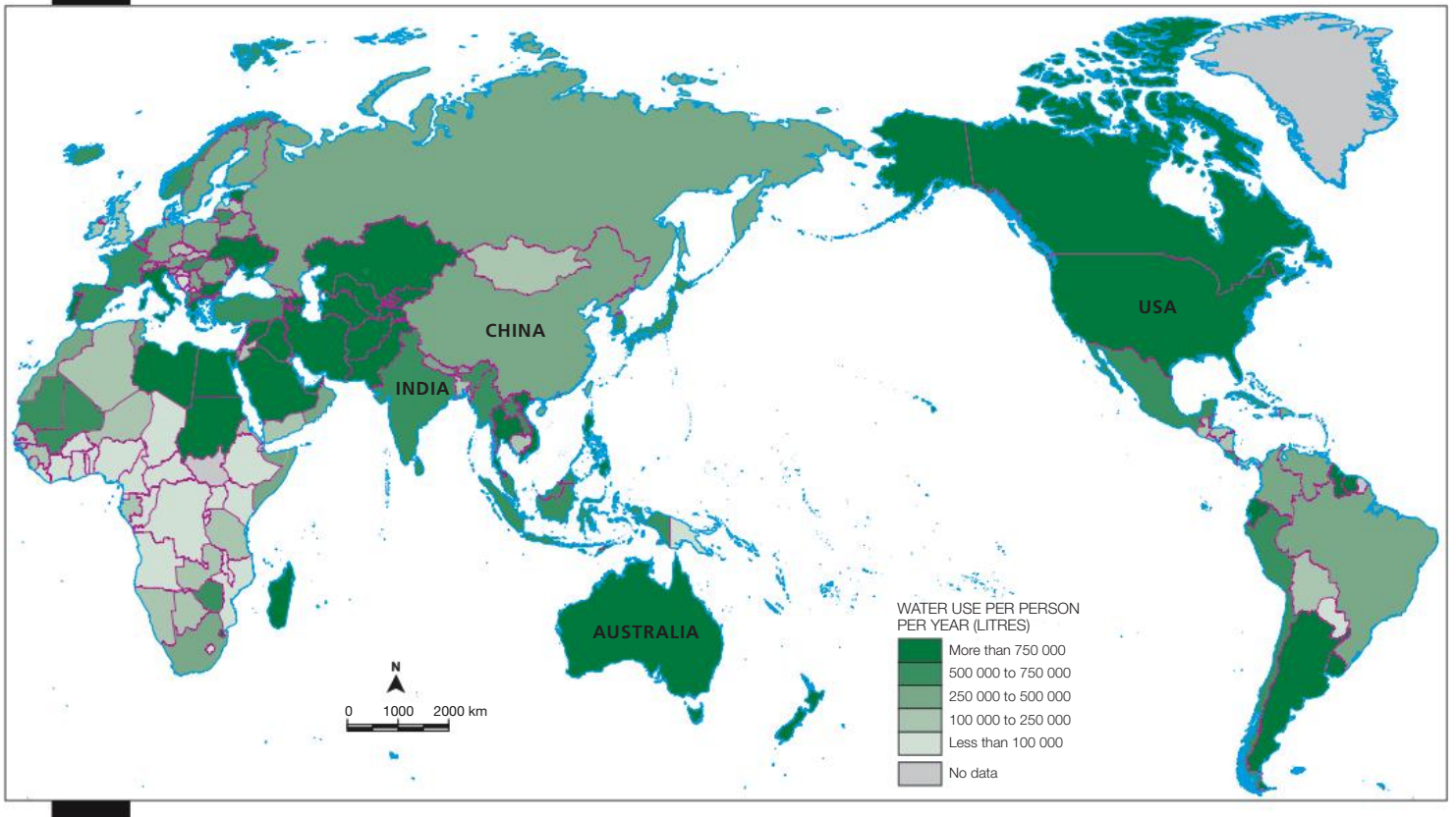
Step 4: I can analyse relationships between different data

6 Create a checklist of methods to investigate water use at school. Use one or more of these methods to conduct a survey of water use at your school.

Masterclass

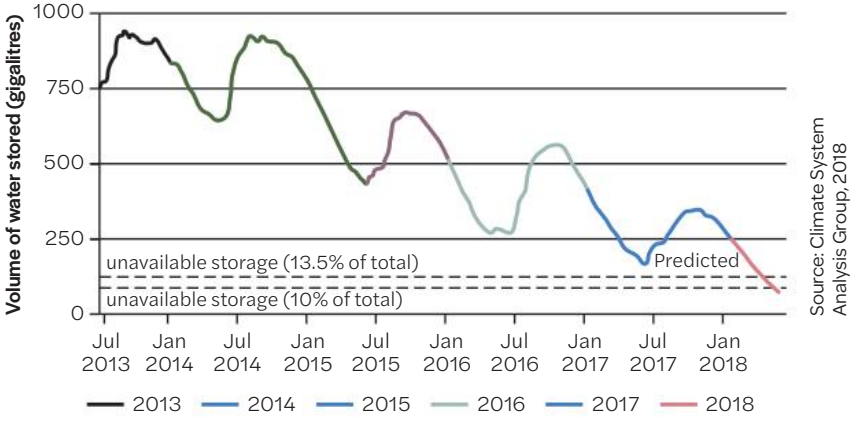
Learning Ladder

Work at the level that is right for you or level-up for a learning challenge!



Source 1

World water use



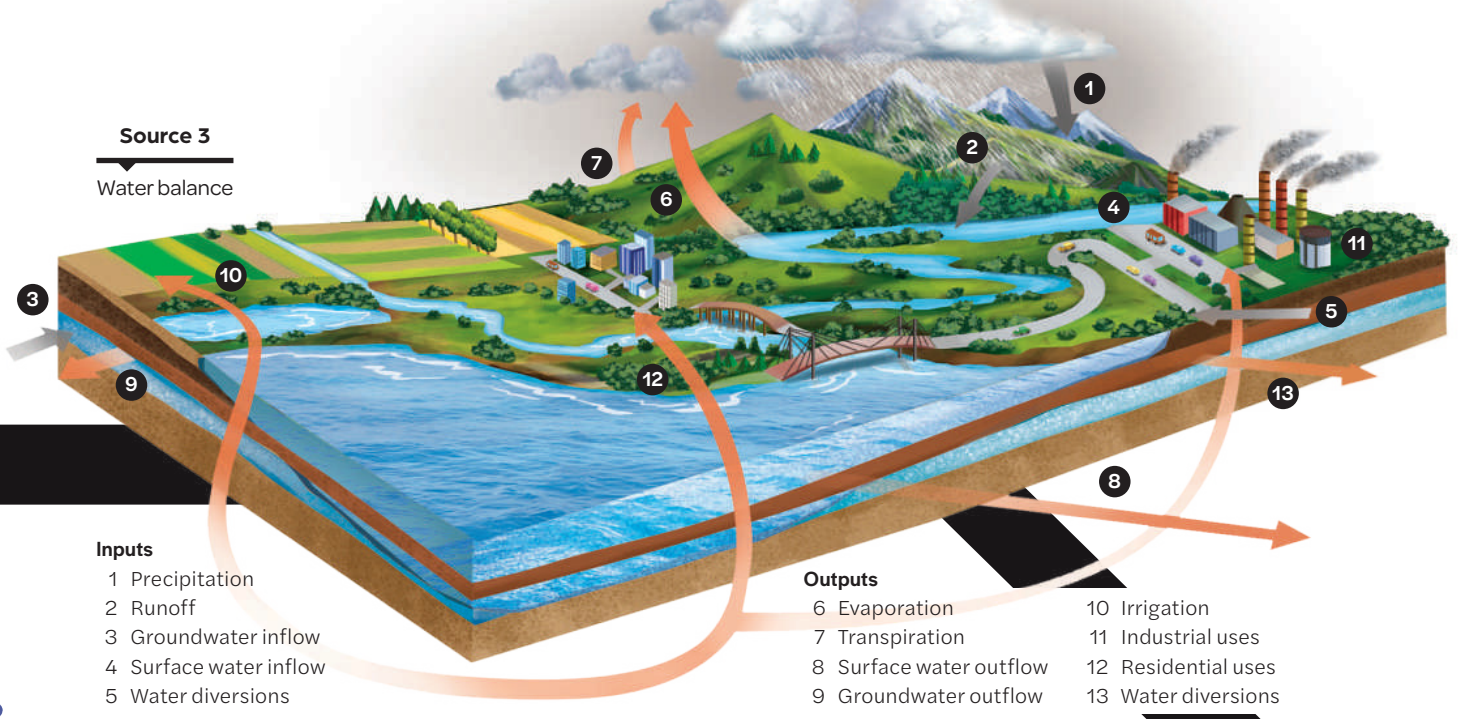
Source: Climate System Analysis Group, 2018

Source 2

Cape Town's water storage levels 2013–2018

Source 3

Water balance



Inputs

1 Precipitation
2 Runoff
3 Groundwater inflow
4 Surface water inflow
5 Water diversions

Outputs

6 Evaporation
7 Transpiration
8 Surface water outflow
9 Groundwater outflow
10 Irrigation
11 Industrial uses
12 Residential uses
13 Water diversions

Step 1

a I can identify and describe spatial characteristics

Look at Source 2. Identify the place shown in this source.

b I can identify and describe interconnections

Source 3: What are the natural inputs and outputs of a water system?

c I can identify responses to a geographical challenge

How did the government respond to the geographical challenge shown in Source 2?

d I can collect, record and display data in simple forms

Look at Source 2. What does the line represent?

e I can use geographic terminology to interpret data

Look at Source 1. Do countries in the northern or southern hemisphere generally use more water?

Step 2

a I can explain spatial characteristics

Water is said to connect places. Identify what the words 'connect' and 'place' mean in this context.

b I can explain interconnections

How is Cardinia Reservoir interconnected with the creation of fresh water at the Dalyston desalination plant 84 kilometres away (page 72)?

c I can compare responses to a geographical challenge

Compare Source 1 on page 65 with Source 2 on page 66. How do these responses to the challenge of providing water for the family differ?

d I can recognise and use different types of data

List a series of data collection methods that could be used to identify whether water in a particular place is safe for humans to drink.

e I can describe patterns and trends

Describe the trend for the volume of stored water in Cape Town using Source 2.

Step 3

a I can explain processes influencing places

Explain the interconnection between spirituality and water sources in Australia (page 68).

b I can identify and explain the implications of interconnections

Explain implications of the interconnection between spirituality and water sources in India (page 69).

c I can compare strategies for a geographical challenge

Compare water saving and storing strategies in Cape Town with those in Melbourne. What are the differences (pages 58 and 70)?

d I can choose, collect and display appropriate data

Create a step-by-step guide explaining how to create a photo essay to display information gathered during fieldwork.

e I can explain the reasons behind a trend or spatial distribution

Source 1: Using the SHEEPT factors explain the global pattern of water withdrawals.

Masterclass

Step 4

a **I can predict changes in the characteristics of places**

Predict how the Ganges River in India may change in the future based on current water uses (page 68).

b **I can evaluate the implications of significant interconnections**

In the last decade Kenya has faced many years of below average rainfall, leading to lower food harvests and high prices for food. What are the implications for the people of Kenya of the interconnection of these three factors (see pages 65–67)?

c **I can evaluate alternatives for a geographical challenge**

Suggest three ways that economically developed countries can assist those with water scarcity.

d **I can use data to support claims**

A student would like to explore how water connects people within their local community. Suggest two methods that would assist them in their investigation. Provide some reasons for your response.

e **I can analyse relationships between different data**

Compare the relationship between Sources 2 and 3. Which factors in Source 3 changed or stayed the same to produce the situation in Source 2?

Step 5

a **I can analyse the impact of change on places**

Suggest five ways we can sustainably use our fresh water sources.

b **I can explore spatial association and interconnections**

Find an online map of Australian land use from a reliable source. Compare the map to the map of Australia's average annual rainfall on page 50. Describe the spatial association between land use and rainfall regions with less than 250 mm per year.

c **I can plan action to tackle a geographical challenge**

Australia has the lowest volume of water in rivers of any inhabited continent in the world. Why is this the case and what action could be taken to improve it?

d **I can evaluate data**

How relevant is climate data when investigating how much water we use and have access to in Australia?

e **I can draw conclusions from analysing collected data**

Explain why some beef production requires more virtual water for growth than other farm products.

Capstone

How can I understand water for life?

In this chapter, you have learnt a lot about water for life. Now you can put your new knowledge and understanding together for the capstone project to show what you know and what you think.

In the world of building, a capstone is an element that finishes off an arch or tops off a building or wall. That is what the capstone project will offer you, too: a chance to top off and bring together your learning in interesting, critical and creative ways. You can complete this project yourself, or your teacher can make it a class task or a homework task.

Scan this QR code to find the capstone project online.

mea.digital/GHV7_G2

Living in Australia

G3

WHY DO PEOPLE LIVE IN CITIES?

page 96

analyse data

page 84

WHERE DO WE LIVE TODAY?

thinking nationally

page 90

WHAT'S LIFE LIKE IN TULLY?

civics + citizenship

page 102

WHAT ARE SOCIAL VALUES?

How can I understand living in Australia?

Australia is classified as a **more economically developed country (MEDC)**. This means that we generally have good access to education, healthcare, transport, open spaces and other key elements that make our country liveable. In 2019, three of our cities – Melbourne, Perth and Adelaide – were all ranked in the top 10 most liveable cities in the world.

learning ladder

	Spatial characteristics	Interconnections	Geographical challenge
step 5	**I can analyse the impact of change on places** I can analyse and evaluate the implications of growth or decline of places and calculate the impact on people and environments.	**I can explore spatial association and interconnections** I can compare distribution patterns and the interconnections between them; e.g. the importance of community of place for people in rural areas.	**I can plan action to tackle a geographical challenge** I can frame questions, evaluate findings, plan actions and predict outcomes to tackle a population-based geographical challenge.
step 4	**I can predict changes in the characteristics of places** I can predict changes in the characteristics of places over time due to population growth.	**I can evaluate the implications of significant interconnections** I can identify, analyse and explain key population-based interconnections within and between places, and evaluate their implications over time and at different scales.	**I can evaluate alternatives for a geographical challenge** I can weigh up alternative views and strategies on a population-based geographical challenge using environmental, social and economic criteria.
step 3	**I can explain processes influencing places** I can explain the series of actions leading to change in a place, such as the decline of rural towns.	**I can identify and explain the implications of interconnections** I can identify, analyse and explain population-based interconnections and explain their implications.	**I can compare strategies for a geographical challenge** I can compare strategies for a geographical challenge, taking into account a range of factors and predicting the likely outcomes.
step 2	**I can explain spatial characteristics** I can identify concepts of Space, Place, Interconnection, Change, Environment, Sustainability and Scale (SPICESS) when I read about living in Australia.	**I can explain interconnections** I can describe and explain interconnections and their effects, such as different farming activities in different climates and environments.	**I can compare responses to a geographical challenge** I can identify and compare responses to a geographical challenge and describe its impact on different groups.
step 1	**I can identify and describe spatial characteristics** I can talk about spatial characteristics at a range of scales; e.g. Australian cities.	**I can identify and describe interconnections** I can identify and explain simple interconnections involved in phenomena such as people with similar interests coming together in community groups.	**I can identify responses to a geographical challenge** I can find responses to a geographical challenge such as population growth and understand the expected effects.

Warm up

Source 1

Melbourne's central business district (CBD) is surrounded by parklands and recreational spaces.

I can evaluate data
I can determine whether data presented about human settlements is reliable and assess whether the methods I used in the field or classroom were helpful in answering a population-based research question.

I can draw conclusions from analysing collected data
I can summarise findings and use collected data to support key patterns and trends I have identified for population-based research.

I can use data to support claims
I can select or collect the most appropriate data and create specialist maps and information using ICT to support investigations into human settlements.

I can analyse relationships between different data
I can use multiple data sources, overlays and GIS to find links and relationships that exist in patterns of human settlement on Earth.

I can choose, collect and display appropriate data
I can select useful sources of human data and represent them to conform with geographic conventions.

I can explain the reasons behind a trend or spatial distribution
I can identify Social, Historical, Economic, Environmental, Political and Technological (SHEEPT) factors to help me explain patterns in data.

I can recognise and use different types of data
I can define the terms primary, secondary, qualitative and quantitative data and represent data in more complex forms.

I can describe patterns and trends
I can identify Patterns, Quantify them and point out Exceptions (PQE) to describe the patterns I see.

I can collect, record and display data in simple forms
I can identify that maps and graphs use symbols, colours and other graphics to represent data.

I can use geographic terminology to interpret data
I can identify increases, decreases or other key trends on a map, graph or chart about human settlements.

Collect, record and display data

Analyse data

Spatial characteristics

1 What place is shown in Source 1?

Interconnections

2 *Interconnection* is the idea that two things or phenomena are related, interact or are linked in some way. Suggest why most major cities of the world are interconnected with rivers.

Geographical challenge

3 As a class, brainstorm key factors that make your local community liveable. Are there any elements that restrict the liveability of your area?

Collect, record and display data

4 Annual world liveability rankings are based on survey results.

a Make a list of the types of questions you think should be asked in a world liveability survey.

b Is this primary or secondary data collection?

Analyse data

5 Sketch the photo of Melbourne's CBD and surrounds in your notebook. Label it with elements that make this capital city one of the most liveable in the world.

Where did the first Australians live?

Aboriginal and Torres Strait Islanders are the first peoples of Australia. Most early Aboriginal people lived along the coast and in the river valleys, where the resources they needed to survive were plentiful. Today, Indigenous Australians live in all parts of Australia: in cities, in suburbs and in regional and remote areas.

Finding resources

Early Indigenous Australians looked for places that were **liveable** and had the water and food they needed to survive and thrive.

The highest **density** of Indigenous Australians was along the coastline – which means that was where the most people lived. Those people who chose to live inland were located mainly along the banks of the Murray River and its tributaries.

Fresh water was the most important resource for survival. Early Indigenous peoples hunted animals that were attracted to sources of water, and built stone traps to catch fish and eels. Ancient fish traps used by Wailwan people on the Barwon River at Brewarrina, New South Wales are 40 000 years old – which makes them the oldest human-made structures on Earth.

Living in the desert

Further inland, resources were scarcer and Aboriginal populations were less dense. In desert regions, early Aboriginal peoples changed where they lived according to the seasons. They followed the summer monsoonal rains and the movement of animals, or the natural cycles of fruiting plants.

Aboriginal desert peoples knew the locations of permanent waterholes and followed birds to other available water sources. They dug up the roots of trees known to hold water – and even caught a species of water-holding frog and drained the water from it to get the water they needed.

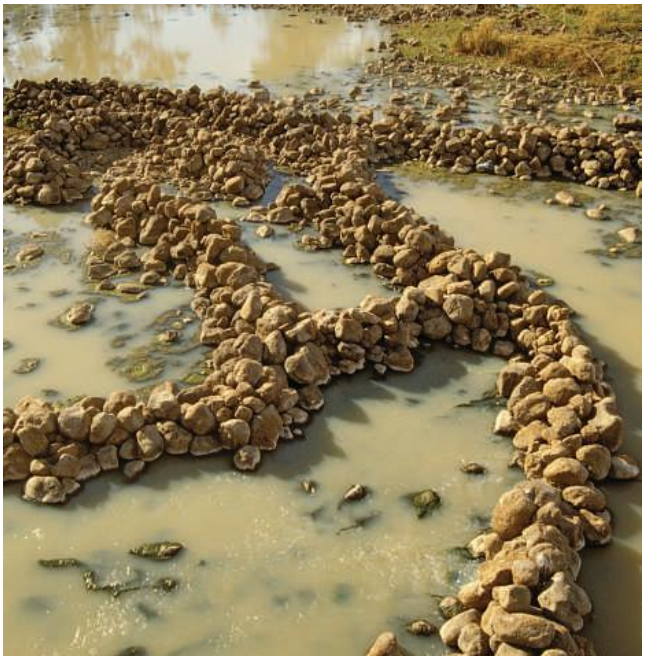
Connection with the land

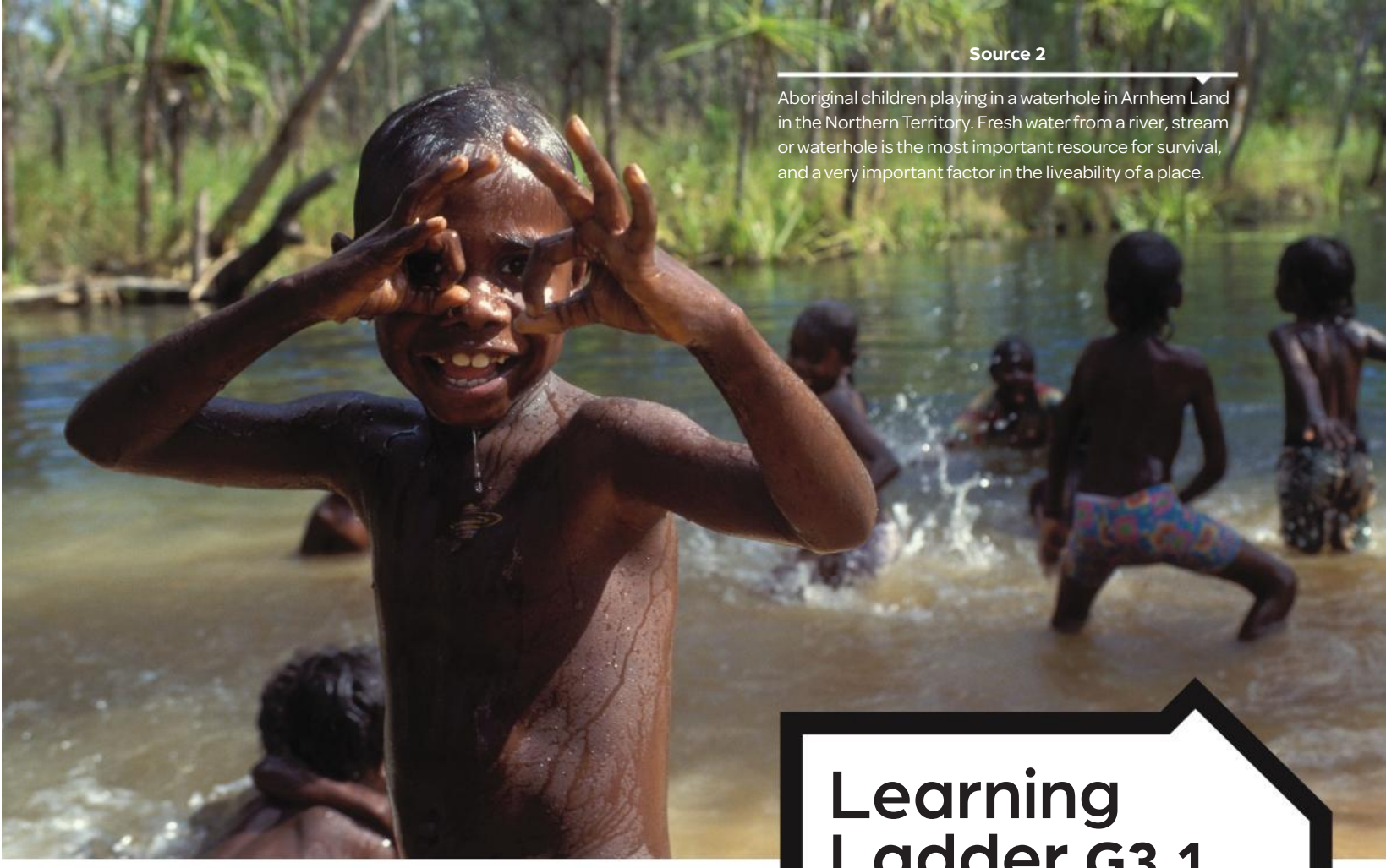
For Indigenous Australians, liveabilty means much more than whether an area can supply food and water.

Indigenous Australians have a strong sense of identity that comes from belonging to a region. The deep relationship between Indigenous Australians and the land is often described as **connection to Country**.

Source 1

The Wailwan people built fish traps on the Barwon River at Brewarrina, New South Wales, about 40 000 years ago.

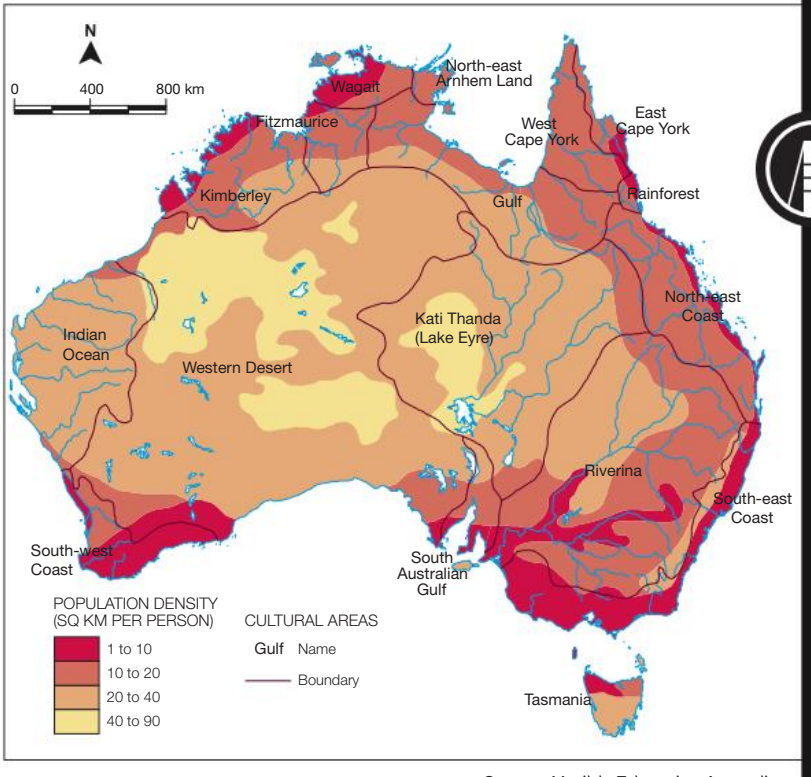




Source 2

Aboriginal children playing in a waterhole in Arnhem Land in the Northern Territory. Fresh water from a river, stream or waterhole is the most important resource for survival, and a very important factor in the liveability of a place.

Population density of Aboriginal Australians before 1788



Source: Matilda Education Australia

Source 3

Population density of Aboriginal Australians before 1788

Learning Ladder G3.1

Show what you know

1 List the important factors that contributed to a place's liveability for early Indigenous Australians.

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

2 Source 3: Identify the regions of Australia that had the densest populations of Indigenous Australians before the arrival of Europeans in 1788.

Step 2: I can explain spatial characteristics

3 Describe why a sense of connection to the land is important for Indigenous Australians.

Step 3: I can explain processes influencing places

4 Source 3: Which inland environments had the greatest populations before 1788 and why were they important resources for Aboriginal Australians?

Step 4: I can predict changes in the characteristics of places

5 Look at Source 1 on page 30 of the History section. Describe the cultural borders of Indigenous Australians, and compare this to our state and territory boundaries today.

Where do we live today?

Australia is mainly desert, and is one of the world's most sparsely populated countries. Nine out of ten Australians live in urban areas along the coastline.

Australia's population distribution

In area, Australia is the sixth largest country in the world, but it is only the 53rd largest in terms of population. In summary: large area, not many people. So even though Australia's total population reached 25 million people in 2018, it was still the third most sparsely populated country in the world. The average population density is just 3.3 people per square kilometre.

Australia's low **population density** – the number of people per square kilometre – is due to the desert land that makes up much of Australia's interior. Seventy per cent of Australia receives less than 500 mm of rainfall per year and is classified as desert or semi-desert. Very few Australians live in the arid centre of the continent.

Eighty-nine per cent of Australians live in **urban** areas along the coastline, with 40 per cent of all Australians living in either Sydney or Melbourne. Sydney is Australia's largest city, with a population of 5.1 million. Melbourne is growing faster than Sydney and looks set to take over as Australia's largest city by 2054.

	Growth[1]	2014	2034[2]	2054[2]
		Population (,000)	Population (,000)	Population (,000)
Adelaide	1.06%	1304.6	1604.7	1843.7
Brisbane	1.92%	2274.6	3340.6	4406.6
Canberra	1.70%	386.0	N/A	N/A
Darwin	2.30%	140.4	175.5	212.6
Hobart	0.67%	219.2	250.4	266.6
Melbourne	1.95%	4440.3	6238.1	7982.4
Perth	3.05%	2021.2	3451.8	4923.0
Sydney	1.50%	4840.6	6432.6	7966.4

1 Annual population growth rate between 2009 and 2014

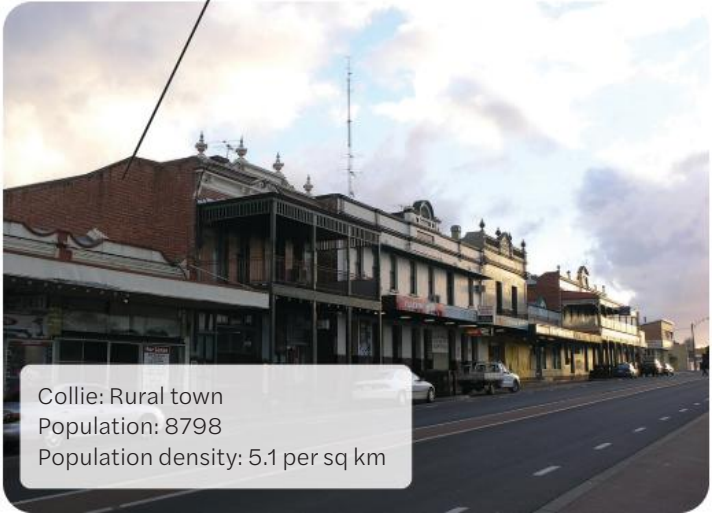
2 Estimates based on medium levels of fertility, overseas migration, life expectancy and interstate migration flows

Source 1

Expected growth of Australia's capital cities over time

Source 2

Map showing Australian population density

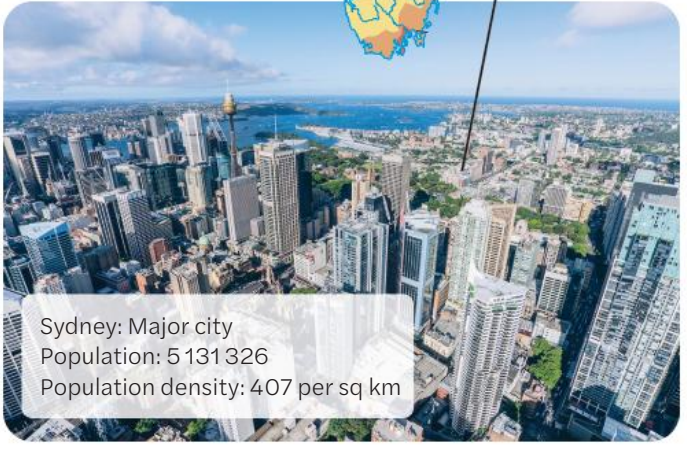


Collie: Rural town
Population: 8798
Population density: 5.1 per sq km

Alice Springs: Regional city
Population: 29 137
Population density: 85 per sq km

Longreach: Remote town
Population: 3660
Population density: 0.1 per sq km

Source: Matilda Education Australia



Sydney: Major city
Population: 5 131 326
Population density: 407 per sq km

Learning Ladder G3.2

Show what you know

1 Why does Australia have such a small population if we have one of the biggest countries?

2 How does climate influence liveability in different regions of Australia?

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

3 Source 1: Use the table to rank Australia's capital cities based on their predicted population in 2034.

Step 2: I can explain spatial characteristics

4 Source 2: Use PQE to describe the distribution of people in Australia per square kilometre.

Step 3: I can explain processes influencing places

5 Sources 1 and 2: Use SHEEPT to explain Australia's **population distribution**.

Step 4: I can predict changes in the characteristics of places

6 Source 1: Use the data in the table to create a graph showing how the population is expected to grow between 2014 and 2054 in Australia's eight capital cities.

7 Using the graph you created in question 6, describe those cities that are expected to grow the fastest and slowest over the 40-year period. Suggest reasons to support the trends.

HOW TO

Using PQE, page 156
Using SHEEPT, page 158

Why do we live where we do?

Early Indigenous Australians made decisions on where to live based on natural factors they needed to survive. European settlers had to make these decisions too. Towns and cities in Australia have developed in these areas. Today, the liveability of a place also includes access to services and work, and the quality of the environment.

Natural factors

Liveability in Australia depends on water, climate and flat land.

Fresh water

Access to fresh water is the most important factor in the liveability of a place. People originally settled near rivers and lakes, and in areas of high rainfall. Today, modern technology means that food and water are available right across Australia.

Settlements in Australia are mainly located around the coastline, where the highest rainfall occurs. The biggest towns and cities are mainly located along the east coast, between the Great Dividing Range and the coastline.

Climate

Climate is a very important factor for liveability. Most Australians choose to live in those regions that have a mild climate, without extremes of heat or cold. Other people prefer hotter or cooler climates.

Many retired Australians prefer the warmer coastal climates of Queensland's Sunshine Coast and Gold Coast.

Flat land

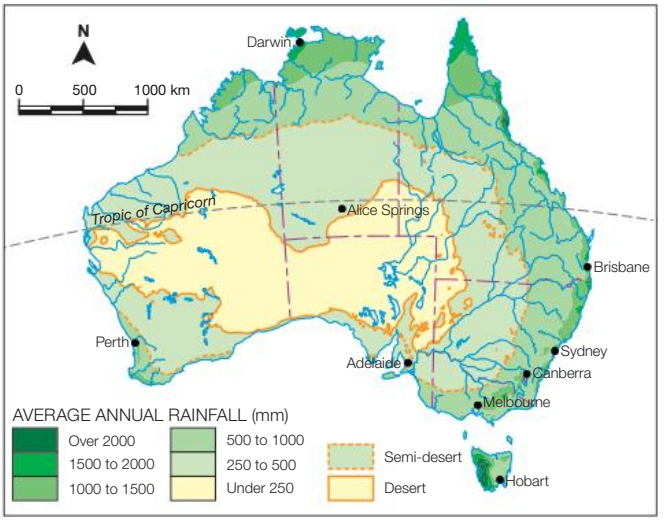
Flat or gently sloping lands are the most densely populated areas in Australia. Most Australian towns and cities have developed on the flatter coastal plains, and along mountain valleys. That's because farms and transport networks are easier to develop on flat land, and it is easier and cheaper to build on than hilly land.

The most liveable areas of Melbourne are on the flat coastal plain surrounding Port Phillip Bay, as shown in Source 1.

Source 1

Melbourne's metropolitan area spreads out across the flat coastal plain between Port Phillip Bay and the Dandenong Ranges.

Australian average annual rainfall

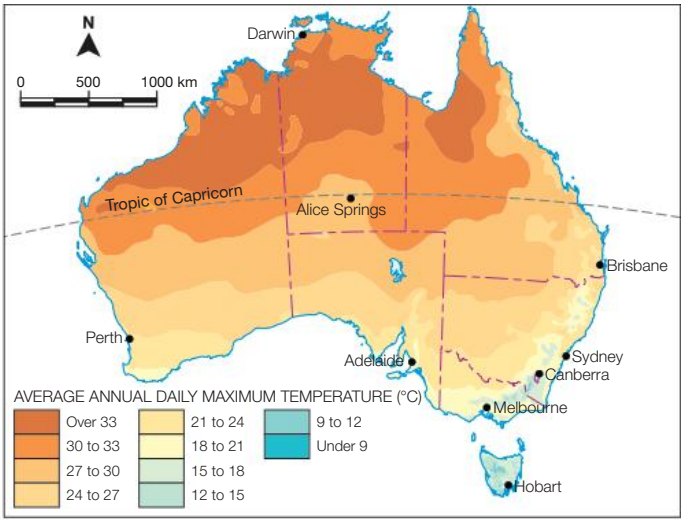


Source: Matilda Education Australia

Source 2

Australia's average annual rainfall

Australian average annual daily maximum temperature

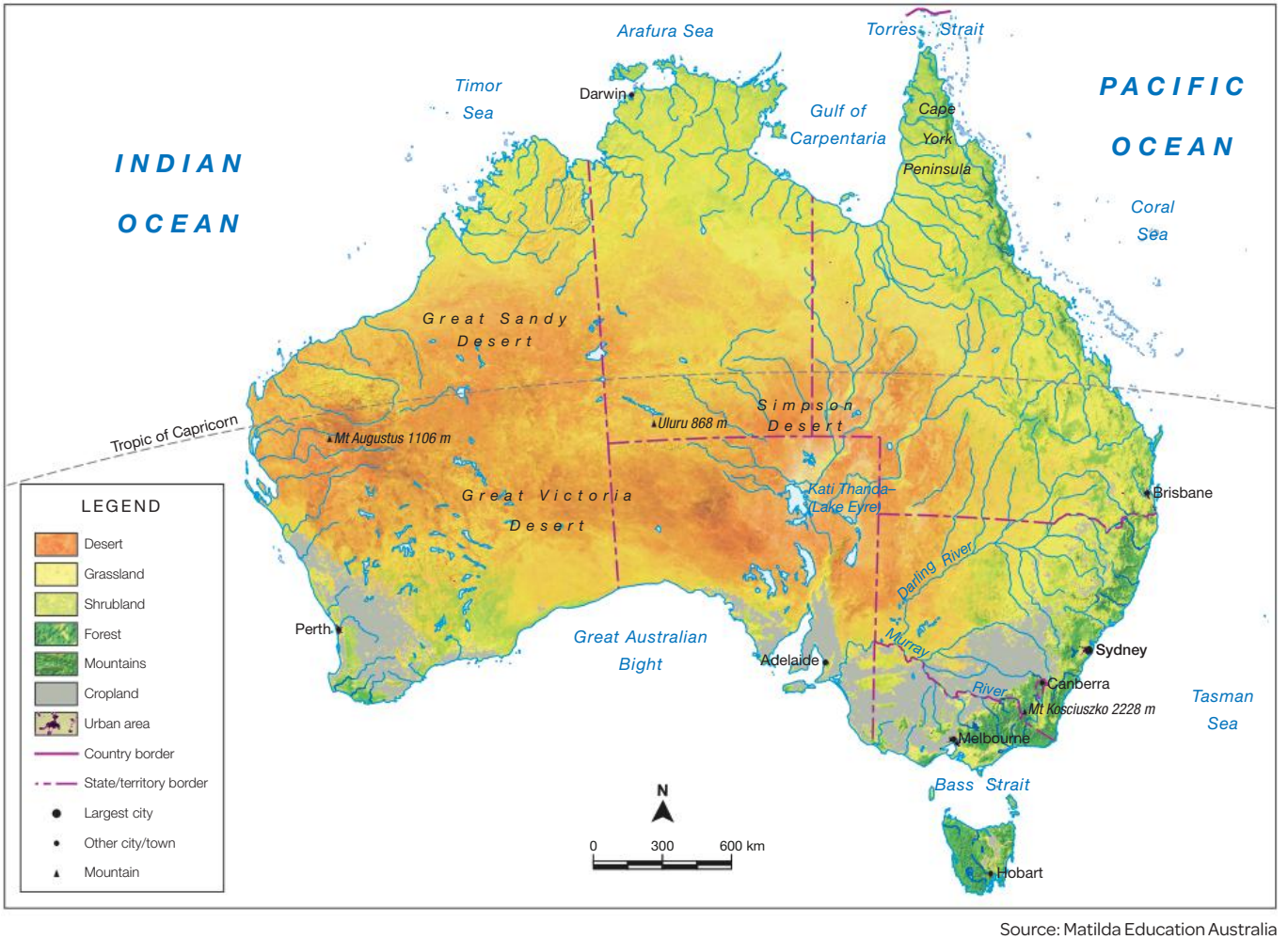


Source: Matilda Education Australia

Source 3

Average annual daily maximum temperatures

Physical and human environments map of Australia



Source: Matilda Education Australia

Source 4

This map shows different environments, including where people choose to live.

Human factors
Where people choose to live also depends on human factors – such as access to services and facilities, the quality of the environment, safety, and closeness to friends and family. A person's ideas about liveability change depending on their age and the stage of life they are at. School-age children might rate the liveability of an area highly if they are close to school, friends, public transport and facilities such as sporting grounds and shops. Adults with families might need schools, healthcare, affordable housing, outdoor recreation areas and access to jobs. How liveable a place is depends on what is important to you.

Employment
People of working age need to live in a place where they can access employment. The most jobs are generally in capital cities and larger towns, so many young people move from country towns to cities to study and to find employment. Mining towns with very few facilities and services can also be a magnet for workers because they offer high-paying jobs.

Services
Liveabilty increases with good access to services. Local shopping centres give people access to supermarkets, shops and restaurants, as well as services such as doctors and hairdressers. Good access to public transport and an efficient road system help people to move around. Other community facilities that can improve liveability include playgrounds, sports arenas, parks, skate ramps and bike tracks.

Source 5
Example of a community environment

Cultural connections
A key factor in making a place liveable is feeling part of the community. People often choose to live near family members and friends, or to find areas where people with similar interests live. People migrating from overseas to an Australian town or city might be attracted to a town or city where other people from their cultural background live. This gives them some familiarity, with local shops selling products from their home country, and local services available from people who speak their language. More than 60 per cent of the population of the Melbourne suburb Box Hill were born in China, or are of Chinese ancestry.

Housing
Selecting a home is based on finding the most liveable area where you can afford to buy or rent. Some key decisions include how close the housing is to facilities such as shops, transport and parks. The size and type of the home selected will differ – some people will want a large home with a garden, where other people will want a low-maintenance apartment.

Safety
A very important factor in the liveability of a place is that people feel safe in their homes and within their communities. Areas with lower crime rates are the most liveable. Safety is even more important in countries that suffer from war and conflict.

Environment
Environmental quality impacts on the liveability of places, and the quality of life for people living there. Factors that contribute to the quality of the environment are the climate, the quality of the air and water, the availability of parks and open spaces, and how it looks – the **aesthetics**. Increasing numbers of Australians are choosing to move to coastal areas or rural areas to enjoy the natural environment and leave the pressures of urban life behind.

Learning Ladder G3.3

Show what you know

1 Why is living next to a fresh water source no longer necessary in order for a place to be liveable?

Analyse data

Step 1: I can use geographic terminology to interpret data

2 Source 1: Suggest two reasons why most Australian cities developed on the flatter coastal plains.

Step 2: I can describe patterns and trends

3 Sources 2 and 3. Why do fewer Australians choose to live in central Australia?

Step 3: I can explain the reasons behind a trend or spatial distribution

4 Source 5: List the factors that make living in a community more liveable. Rank your list according to the factors that make your community liveable.

Step 4: I can analyse relationships between different data

5 Compare Source 4 on page 87 with Source 2 on page 84. How is population density interconnected with the physical features of the land?

What's life like in Tully?

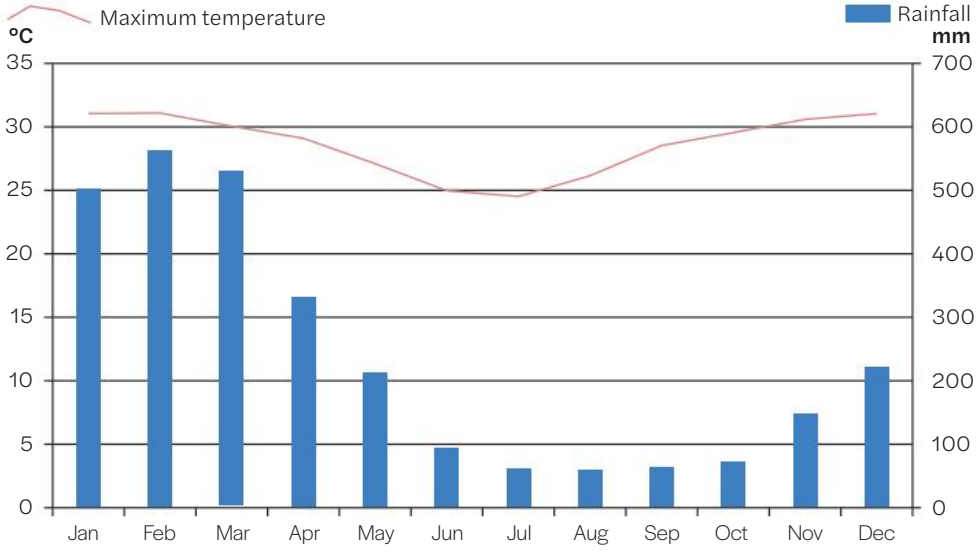
Tully is a town in far north Queensland. It is built on flat land in a valley between some of the highest peaks in the Great Dividing Range.

Climate and liveability

Tully has a tropical climate, with maximum temperatures above 24°C throughout the year. It also has the second-highest rainfall of any town in Australia – with more than four metres of rainfall each year! The warm climate is part of the liveability of Tully for its residents – along with the World Heritage-listed rainforest of Tully Gorge, the tropical islands and nearby Mission Beach.

Tully was established in the 1920s as a sugarcane-growing town, because it has the perfect climate for growing tropical crops such as sugar cane and bananas. In harvesting season, the Tully sugar mill employs more than 12 per cent of the town's population of 2400 people. About 325 growers in the region supply the mill with sugarcane, which is transported to the mill via 200 kilometres of special 'cane train' railway.

Climate graph for Tully, Queensland



Source 1

Climate graph for Tully

Source: climate-data.org, 2019

Source 2

A sugarcane train pulls a long load of harvested sugar cane along special railway lines that connect the farms to the Tully sugar mill. The sugar industry is the key employer in the Tully region.

Source 3

A satellite image of Tully, a sugarcane town in far north Queensland. The town of Tully, the sugarcane farms and the sugar mill are all located on the flat land at the base of the Great Dividing Range. Tully is one of the wettest towns in Australia, with an average annual rainfall of more than 4000 mm.

Learning Ladder G3.4

Show what you know

1 What factors attract people to live in Tully?

2 Source 1: Roughly how much rainfall occurs in summer and what impact might it have on the population?

Interconnections

Step 1: I can identify and describe interconnections

3 Is there an interconnection between regions with a tropical climate and rainforest?

Step 2: I can explain interconnections

4 Source 3: Explain the interconnections with the Tully sugar mill.

Step 3: I can identify and explain the implications of interconnections

5 Source 3: Draw a sketch map of the satellite image and use a key to identify high land, flat land and creeks. Use a grid pattern to overlay the area of farms. Explain the interconnection between the area of farms and the physical features.

Step 4: I can evaluate the implications of significant interconnections

6 Source 1: Evaluate the interconnection between climate and growing sugarcane and bananas. Why do farmers choose to grow sugarcane and bananas in the Tully region?

HOW TO

Satellite images, page 167

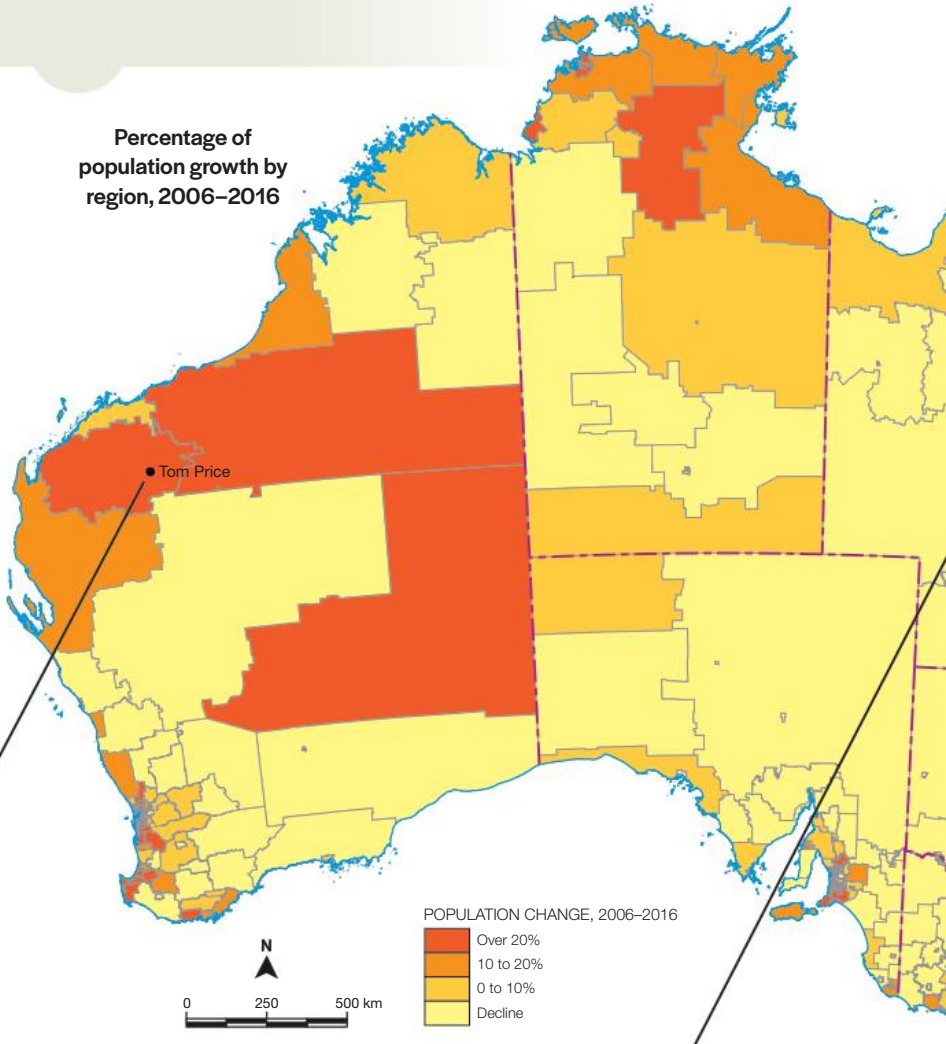
How do places change over time?

Growth areas on the **rural–urban fringe** of major cities are attracting thousands of new residents – at the same time as many small rural towns are losing population and services and becoming less liveable.

A simple way to measure the liveability of a place is to calculate whether it is growing or declining. Fast growing areas show there is demand – people want to live there. The fastest growing places in Australia are new housing estates on the edges of capital cities.

Source 1

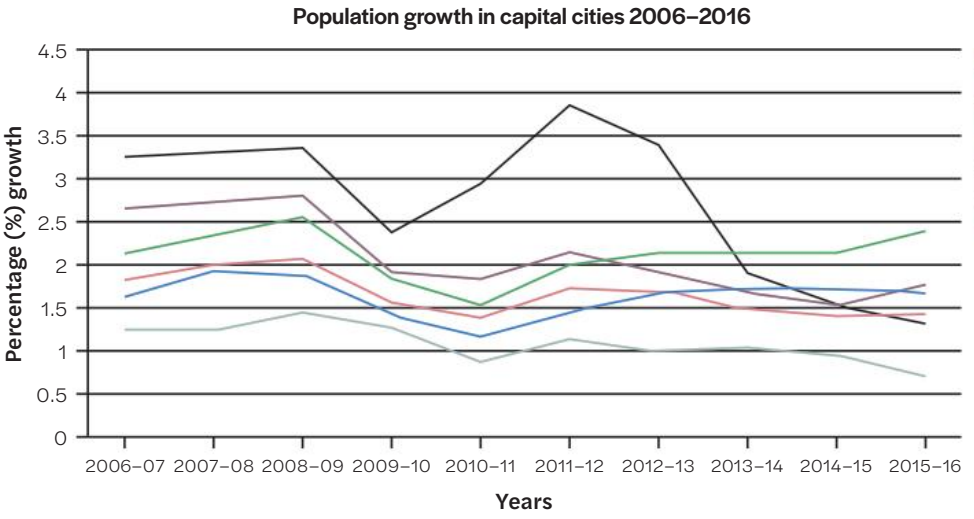
Percentage of population growth by region, 2006–2016



Source: Australian Bureau of Statistics, 2015–16

Tom Price
The mining industry has driven growth in places such as Tom Price, a town in Western Australia. The population of Tom Price grew by 85 per cent during the 2006–2011 mining boom. Then, as the mining boom ended, the population declined by 50 per cent between 2011 and 2016.

Hughenden, Queensland
Hughenden is a small town in outback Queensland. It has lost half its population in the last 50 years. Hughenden is a service centre for the surrounding agricultural areas, but businesses have closed as people have left the town – and one of the businesses to close was the Grand Hotel. The town is hopeful that a recent discovery of dinosaur bones will bring tourists to the area.

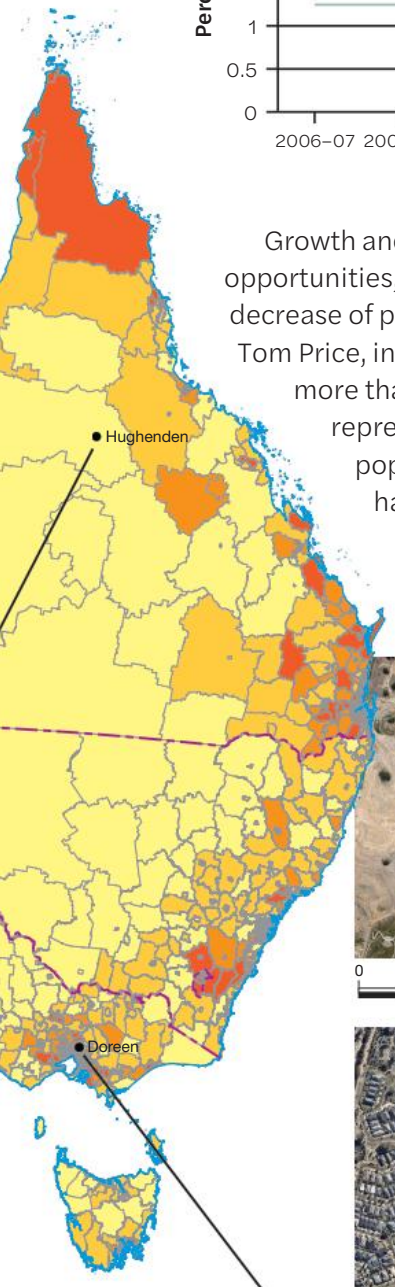


Source 2

Population growth in Australian capital cities, 2006–2016

Source: Australian Bureau of Statistics, 2019

Growth and decline can also be linked to work opportunities, such as the rapid increase and decrease of populations in mining towns like Tom Price, in Western Australia. Small rural towns more than 100 kilometres from capital cities represent many of Australia's declining populations. Tough farming conditions have forced many farmers off the land; in turn, this forces shops, schools and hospitals in nearby country towns to close.



Doreen, Victoria
The population of Doreen in Melbourne's outer north doubled between 2011 and 2016, as new housing estates were build on what had been farmland. New services such as supermarkets, shopping centres, schools and medical centres have been built to support the growing population.

Learning Ladder G3.5

Show what you know

1 Why are places with growing populations more liveable and those with declining populations less liveable?

2 Why did the population of Mount Tom Price change so rapidly in the decade between 2006 and 2016?

3 Where are the fastest growing places in Australia and why are people attracted to these places?

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

4 What do the lines on the graph in Source 2 show?

Step 2: I can recognise and use different types of data

5 Source 2: Is this line graph a source of primary or secondary data? Justify your response.

Step 3: I can choose, collect and display appropriate data

6 List the primary and secondary methods you could use to collect appropriate data investigating whether the population of your local suburb is growing or shrinking.

Step 4: I can use data to support claims

7 Look up Google Earth Engine (http://mea.digital/gh7_g3_1). How has Google used data to show changes to Las Vegas? How effective is it?

G3.6

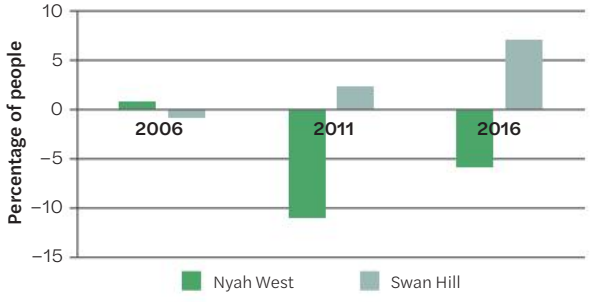
thinking locally

What is the impact of Nyah West's declining population?

Nyah West is a small town in north-western Victoria, near the New South Wales border. It was established in 1915 when the railway was extended from Swan Hill, and it has since supported the surrounding irrigated farms that produce wine, dried fruit, vegetables and wool.

Many farmers sold up and moved away after a long drought and falling prices for dried fruit. Like many small rural towns in Australia, Nyah West is losing its people to larger cities such as Melbourne and to the nearby 'sponge city' of Swan Hill, which soaks up the populations of smaller surrounding towns as they lose their services. Nyah West lost several government services and all of its banks in the 1980s and 1990s. These are all now available in the growing town of Swan Hill, just 20 minutes away.

Population change in Nyah West and Swan Hill, 2006–2016

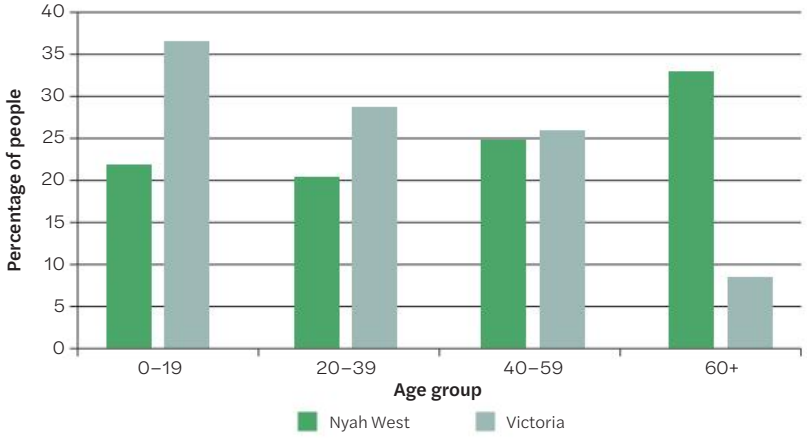


Source: Australian Bureau of Statistics

Source 1

Population change in Nyah West and Swan Hill, 2006–2016

Age groups living in Nyah West and Victoria, 2016



Source: Australian Bureau of Statistics

Source 2

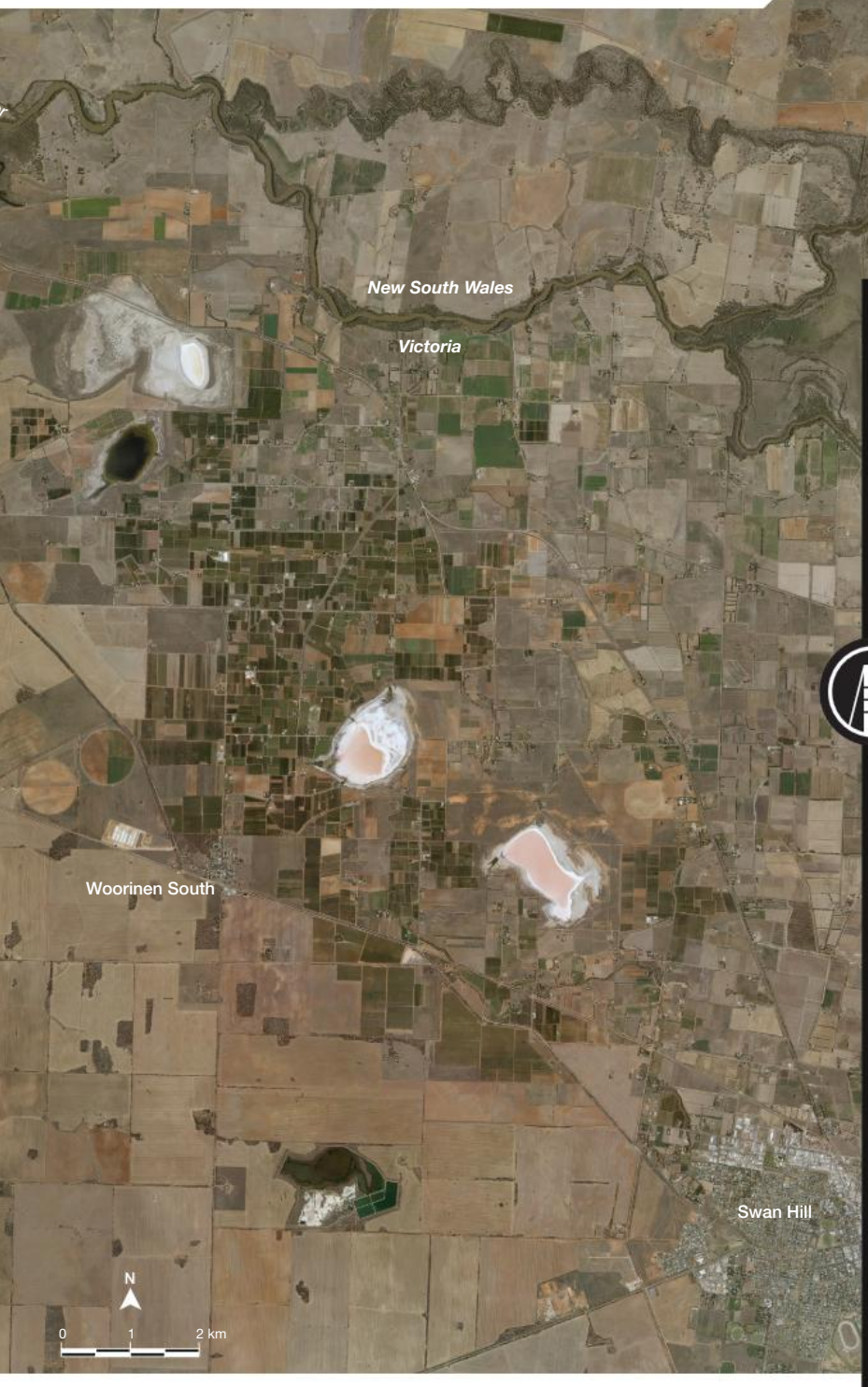
Age groups living in Nyah West and Victoria, 2016

Source 3

Swan Hill offers a wide range of services for its residents and the local region.

Source 4

Vacant shops line the main street of Nyah West, a declining town in Victoria's Mallee region. Only three of the 20 shops in the main street are still open. Once it had three more cafes, three supermarkets, two hairdressers, a baker, a gunsmith, a bank, three doctors and a nursing hospital. The primary school is still there, but has only half of the 100 pupils it once had.



Learning Ladder G3.6

Show what you know

1 How have changes in Nyah West altered the liveability of this place?

Geographical challenge

Step 1: I can identify responses to a geographical challenge

2 Source 4: What evidence of a declining population is there on the main street of Nyah West? How does this make a place less liveable?

Step 2: I can compare responses to a geographical challenge

3 Source 1: Compare the population change in Nyah West and Swan Hill between 2006 and 2016 and suggest why this pattern has occurred.

Step 3: I can compare strategies for a geographical challenge

4 One impact of population decline in Nyah West is its ageing population. Use data from Source 2 to explain this pattern and suggest the services Nyah West might need to support this population.

Step 4: I can evaluate alternatives for a geographical challenge

5 Source 3. How far do Nyah West residents go now to access services they once had in their town? What alternatives do they have?

Why do people live in cities?

Major cities such as Sydney and Melbourne are some of the most liveable in the world. They attract people with job opportunities and a wide range of services available in education, health, entertainment and shopping.

Living in big cities

Australia is one of the most **urbanised** countries in the world – with 89 per cent of our population living in cities. Over 66 per cent of Australians live in the metropolitan area of Australia's eight capital cities.

Large cities attract people to live there because they have:

- jobs – 75 per cent of all jobs are based in Australia's major cities
- education opportunities at a range of public and private schools, universities and training colleges
- a large range of shops and businesses
- entertainment at large sporting arenas, theatres, cinemas, museums and art galleries
- transport infrastructure such as airports, major highways and railway lines
- a large range of health services, including specialists and large hospitals.

Liveable capital cities

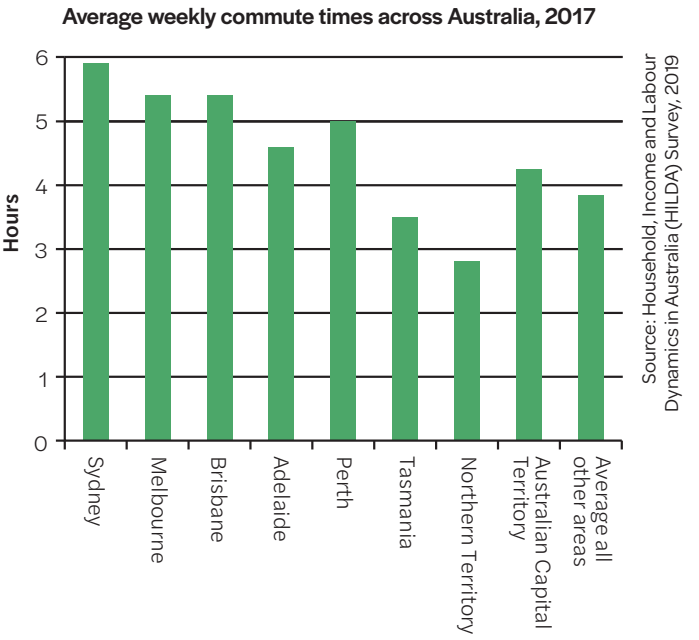
Australian cities are continually voted the most liveable cities in the world. In 2018 and 2019, Melbourne was listed as the second most liveable city in the world after being the most liveable city for seven years.

Source 1

Cyclists on a bike path heading towards the Melbourne CBD. Open space, walking trails and bike paths make busy cities more liveable.

Source 2

Major cities such as Melbourne offer large entertainment venues, such as the Melbourne Cricket Ground and Rod Laver Arena, along with a range of art galleries, theatres, cinemas and restaurants.



Source 3

As a city grows, more people use its infrastructure, such as transport. This leads to increased traffic and travel times, which can make a city less liveable.

The Global Liveability Index ranks 140 cities in the world according to these factors:

- Stability – the threat of terror, war and crime
- Health care availability and quality
- Culture and environment
- Education availability and quality
- Infrastructure – quality of housing, transportation, water, energy and telecommunications.

Australian cities score well in liveability studies because they are smaller and less crowded than many other large cities around the world. Australian cities also have good education and healthcare, and relatively low crime rates.

Maintaining liveability

As cities grow, open spaces are replaced with housing – this happens particularly on the edges of cities, where new suburbs appear on what was previously farmland. Then schools, shopping centres, medical centres, transportation, sporting facilities and other services need to be provided to meet demand from residents in new suburbs.

As city populations rise, more pressure is put on **infrastructure** and services. On average, Sydney and Melbourne drivers now spend one hour and 10 minutes commuting to and from work each day. By 2031 commute times are predicted to be two hours a day.

Learning Ladder G3.7

Geographical challenge

Step 1: I can identify responses to a geographical challenge

1 Work with a partner to create a list of the pros and cons of living in a city environment. Share your list with the class. Did you have different ideas to other groups?

Step 2: I can compare responses to a geographical challenge

2 Give two reasons why Melbourne was ranked second-most liveable city in the world in 2018.

Step 3: I can compare strategies for a geographical challenge

3 Source 3: Which capital city has the longest weekly work commute? What strategies could be used here to improve the liveability of this place?

Step 4: I can evaluate alternatives for a geographical challenge

4 Source 1: What examples are given here to improve the liveability of large cities. Why is it sometimes difficult to supply these in large cities?

How do we plan for population growth?

Melbourne is Australia's most liveable city – but it is under pressure from record population growth. This is an economic issue. City planners have come up with a range of solutions, each with its own costs and benefits.

Record population growth

Melbourne is one of the fastest growing cities in the **developed** world. In 2017 it grew at a rate of 2.7 per cent, which is double the growth rate of most cities in advanced countries. It is a growth rate usually associated with cities in **less economically developed countries (LEDC)**, such as those in South America and Africa.

According to figures from the Australian Bureau of Statistics, Melbourne's population grew more than 2.5 per cent each year between 2011 and 2017. In the same period, Sydney grew by 1.8 per cent.

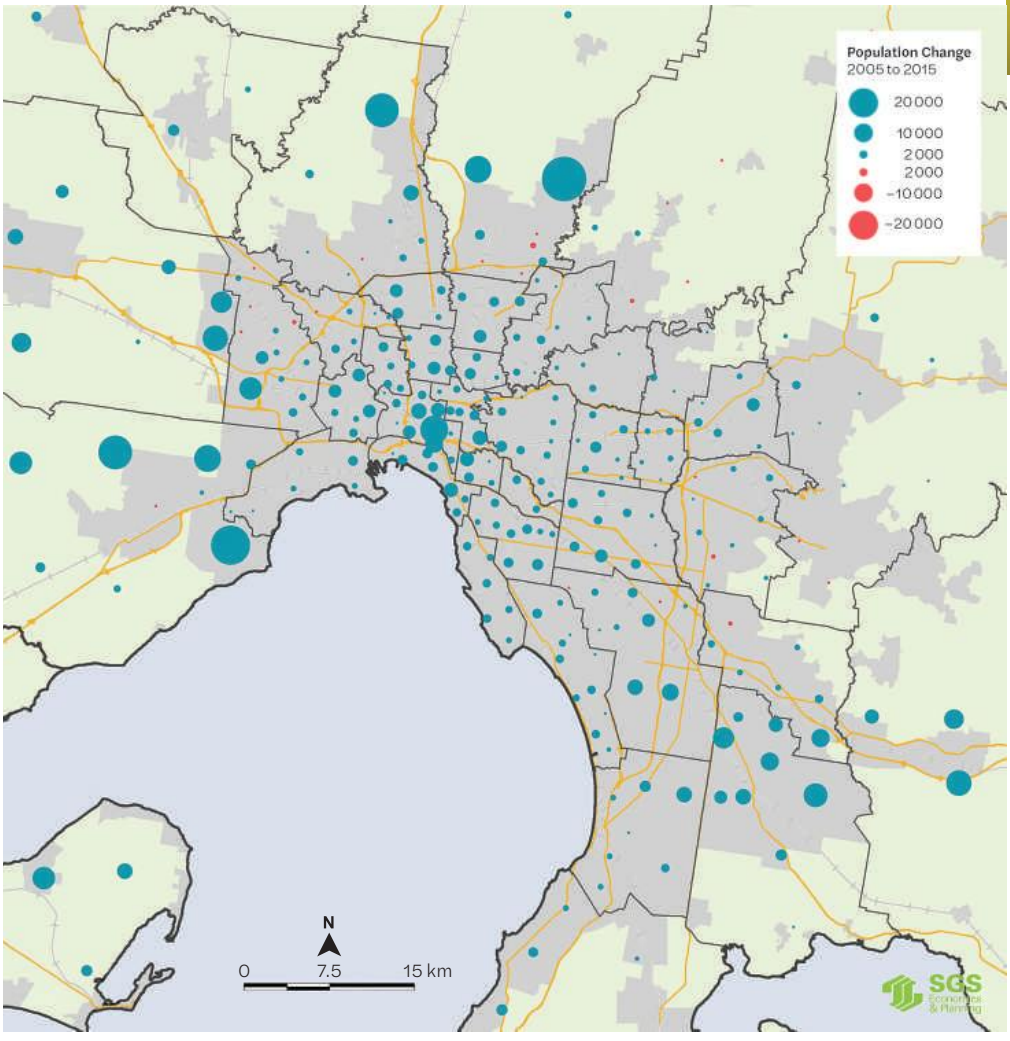
In 2017, Melbourne added 123 000 people – and since 2011 it has increased its population by 650 000 people.

Melbourne's economic problem

Population growth is an **economic problem**. As more and more people come to live in Melbourne, the need for essential services such as housing and water is increased.

Needs are items that people require for survival, such as food, water, clothing and housing. Needs are different to **wants**, which are products or services that are not critical for survival, such as more public transport and better roads to reduce travel times.

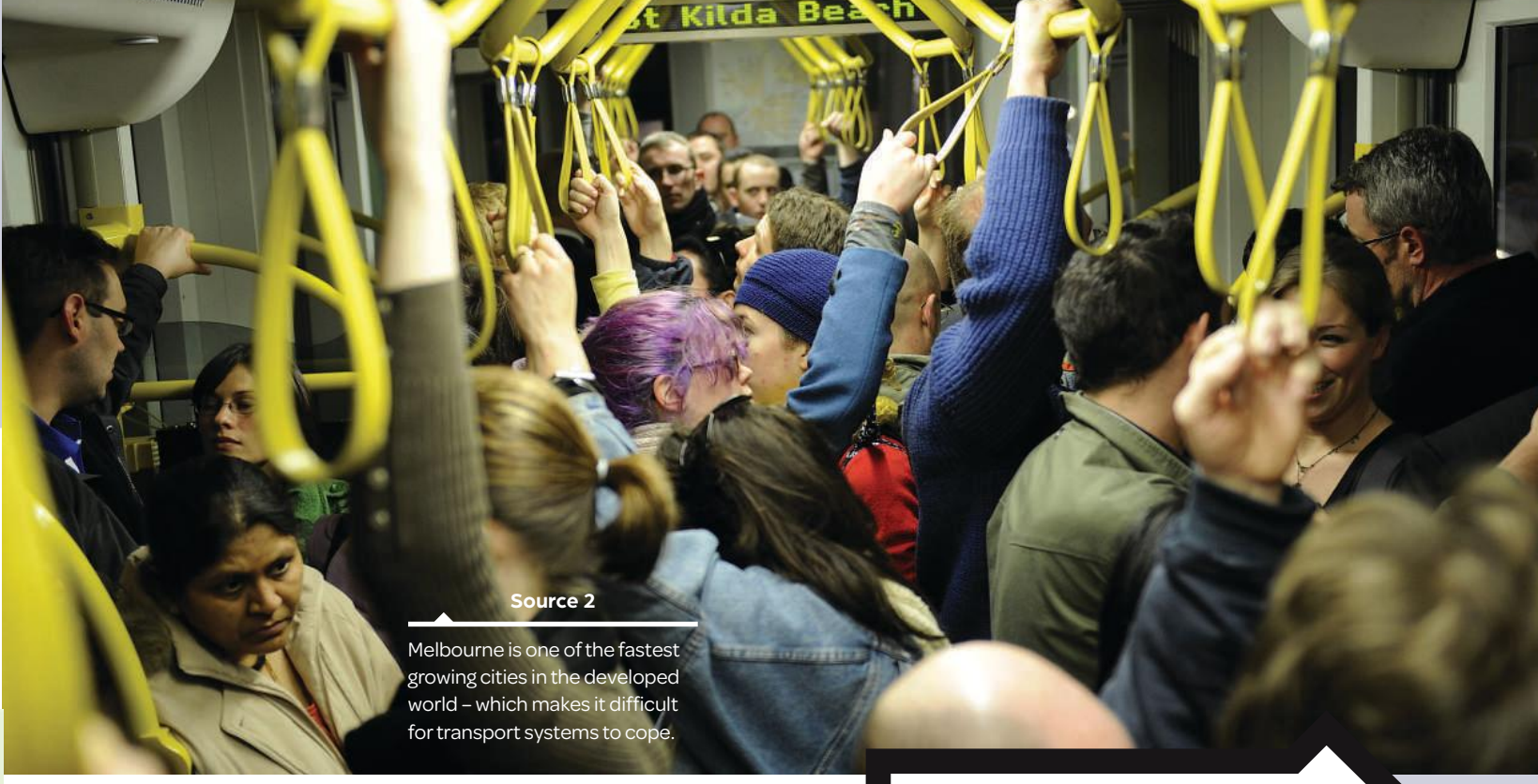
Population change in Melbourne 2005–2015



Source 1

Population change in Melbourne 2005–2015

Source: SGS Economics and Planning, 2016



Source 2

Melbourne is one of the fastest growing cities in the developed world – which makes it difficult for transport systems to cope.

In 2018, Vienna was declared the world's most liveable city, replacing Melbourne. Vienna's smaller population of 1.8 million is a big factor in its liveability – cities with higher populations face greater challenges.

Melbourne's fast urban growth has a negative effect on its liveability. As urban areas grow into what used to be farmland – called urban sprawl – the liveability of cities is threatened. Melbourne's fast population growth has led to high prices for homes and lengthy traffic jams.

Planning for the future

Economists work with governments and businesses to help solve economic problems, such as rapid population growth. They calculate the needs for Melbourne's growing population, such as the number of homes required. Economists prioritise the different wants of consumers – such as transport, schools, medical services and green space – and suggest ways to satisfy as many wants as possible.

There is often more than one way to solve an economic problem, and each solution will have its own **costs** and **benefits**. Some suggested solutions for Melbourne are:

- reducing the number of migrants coming to Australia to remove pressure on resources
- increasing the density of new housing developments, so more homes can be built in a smaller area
- encouraging people to move from urban to country areas to relieve urban congestion – which is called **decentralisation**.

Learning Ladder G3.8

Economics and business

Step 1: I can recognise economic information

1 Why is population growth an economic problem?

Step 2: I can describe economic issues

2 Source 1: Look carefully at the map showing the change in Melbourne's population.
   a Use compass directions to explain the fastest growing population areas.
   b What do most of the areas with the largest population change have in common?

Step 3: I can explain issues in economics

3 Source 1: What additional problems might economists face when planning for growth of new suburbs on the outer rim of the city, compared to growth in the inner suburbs?

Step 4: I can integrate different economic topics

4 In what ways is Melbourne's population growth affecting its liveability?

Step 5: I can evaluate alternatives

5 List three solutions to solve the economic problem of population growth in Melbourne. Search online to find one example of a plan to ease the problems of overpopulation in Melbourne.

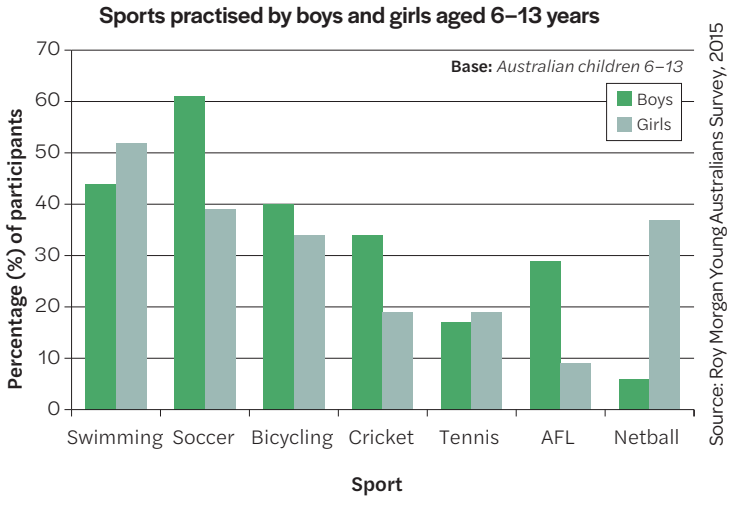
Why is a *community of place* important?

Living in a community brings people together. Being part of a community helps people feel more connected and supported – and makes a place more liveable.

Connected communities

The most **liveable** places are those where everyone feels connected to the local **community**. A community is a group of people who have something in common such as a neighbourhood, a workplace, a school, a sporting club, a returned soldiers league or a language group.

We are all members of many different communities that make our lives more enjoyable. For example, over 6 million Australians are actively involved in sporting communities. They might play sport at an elite level or just for fun, or they might be a spectator or follow a particular sporting team.



Source 1

Sports practised by Australian boys and girls aged 6–13 years

Community of place

A **community of place** is a community of people who come together because of where they live, work, visit or spend time.

People living in remote or rural areas need the support and sense of belonging to a local community to overcome the isolation of where they live. Places such as schools, churches, sporting clubs, cafes and hotels are important meeting points for country people. Community events – such as rodeos, agricultural shows, festivals, sporting events and social celebrations – are important to help overcome the loneliness felt by many people on the land.

Source 2

Shri Shiva Vishnu Hindu temple at Carrum Downs is a popular community venue for Melbourne's Indian community.

Source 3

People connect with each other when they join up to share a common interest, such as sport. If people feel connected through communities, the place they live in becomes more liveable. Boys and girls have a variety of sports they can be involved in, and their participation in sports has changed over time.

Cultural communities

People are often attracted to a place where they know there are other people from the same cultural background. Half of Australia's population was either born overseas or has a parent who was born overseas. So some people find specific rural towns – and specific suburbs in some cities – are more liveable for them because they know there are other people living there who share their language and culture.

Cultural communities often share the same religious beliefs. Melbourne has Australia's largest Indian community, so Hinduism, which is India's biggest religion, has become Melbourne's fastest growing religion. Belonging to a religious community helps make places more liveable for new Australians who have migrated from another country.

Learning Ladder G3.9

Show what you know

1 Define the term 'community of place'.

2 How does 'community of place' increase the liveability of an area?

Interconnections

Step 1: I can identify and describe interconnections

3 Discuss how living in a community helps people interconnect.

Step 2: I can explain interconnections

4 Source 3: Suggest two reasons why sport enables interconnection.

Step 3: I can identify and explain the implications of interconnections

5 List the local community groups in your area. As a class, discuss how these groups contribute to the local community of place.

Step 4: I can evaluate the implications of significant interconnections

6 Source 4: Why are opportunities for interconnection through a community of place even more important for people in rural communities?

Source 4

Agricultural shows are a way of bringing rural communities together. Local, regional and state shows give an opportunity to showcase livestock and produce. For many people in remote areas, the local show is the highlight of the year – and the focus for the whole community.

What are social values?

Liveability is improved when people feel connected to a place, community or society. Australia is a **multicultural** and **multi-faith** country. This means that everyone has the freedom and the right to practise and share their cultural beliefs, free from discrimination or censorship.

Values

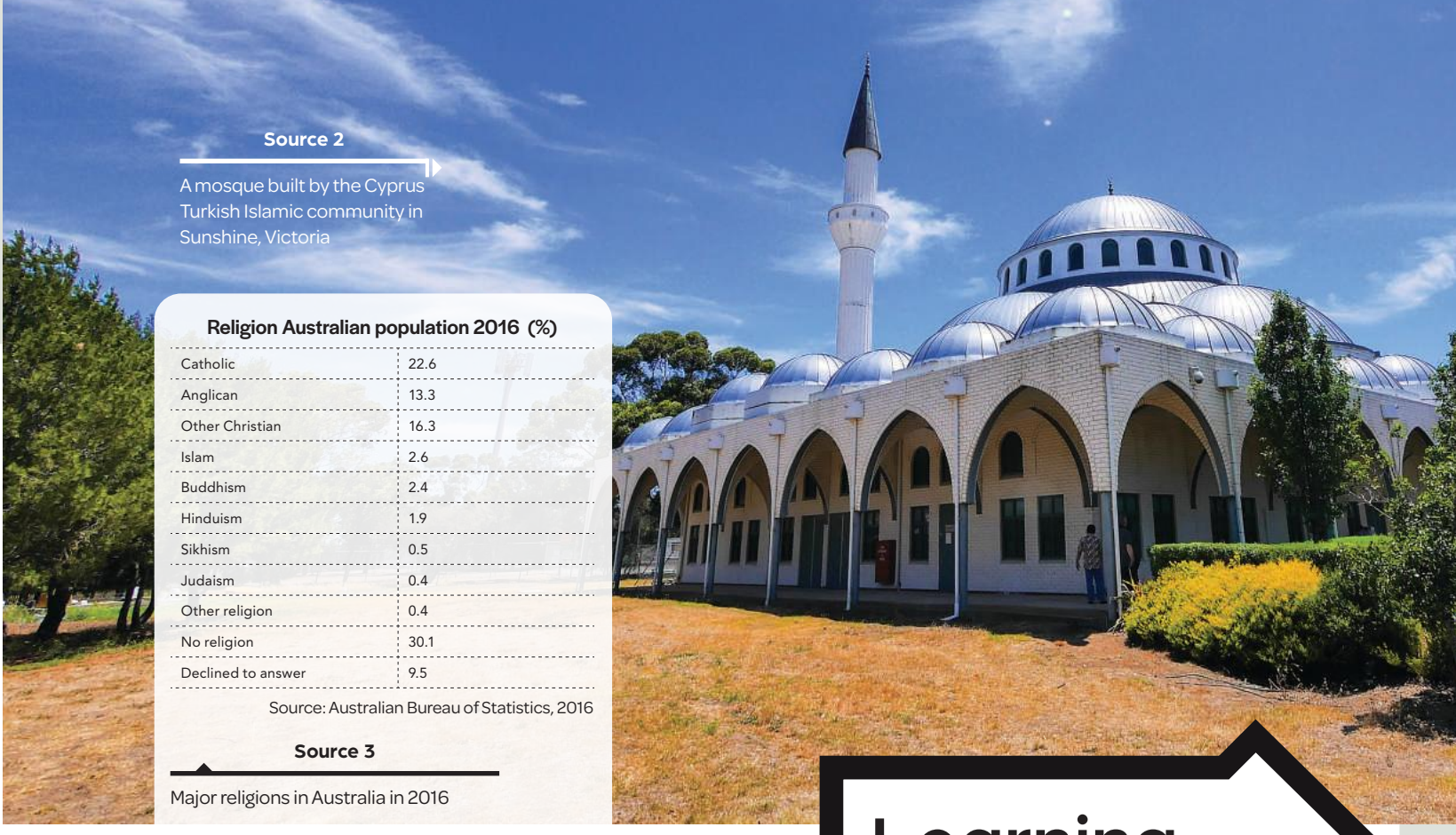
While each individual has their own beliefs, Australians share the values of respect, compassion, equality, inclusion and freedom. These values guide our behaviour, and help us to live in harmony. They are reflected in the Australian **Constitution** and in our laws.

As Australia has developed over time, its people, governments and the legal system have promoted these values:

- **Freedom** to make our own decisions within the boundaries of the law. Australians enjoy freedoms that some other people don't have, such as the freedom to openly express opinions in public and the freedom to practise different religions.
- *Equality* for everyone, without **discrimination**. All Australians deserve a 'fair go' to access work, education and healthcare, regardless of their sex, race or wealth.
- *Compassion* towards people that need our help. For example, compassion towards refugees who may have fled from difficult circumstances, such as war, and who arrive with different values, beliefs and language.
- *Inclusion* of every person that makes up our society, no matter what they look like or how they choose to live. The most liveable places are those where everyone feels connected to the community, rather than living in isolation.

Source 1

A key Australian value is freedom of speech. Australian citizens can speak openly and protest peacefully when they want to let their views be known.



Source 2

A mosque built by the Cyprus Turkish Islamic community in Sunshine, Victoria

Religion Australian population 2016 (%)

Catholic	22.6
Anglican	13.3
Other Christian	16.3
Islam	2.6
Buddhism	2.4
Hinduism	1.9
Sikhism	0.5
Judaism	0.4
Other religion	0.4
No religion	30.1
Declined to answer	9.5

Source: Australian Bureau of Statistics, 2016

Source 3

Major religions in Australia in 2016

- *Responsibility* for our actions, and making sure that others do not suffer as a result. All Australians should understand what is right and wrong – laws are in place to make sure that people act responsibly (see page 65 of the History section).

Religion

One of the freedoms enjoyed in Australia is the opportunity to practise whatever religion you choose, or no religion at all. Australia has developed as a multi-faith society as people from many different cultures have brought their customs, beliefs and religions.

Australia is also a **secular** country, where the church is separate from the government and does not directly influence the decisions of government. In a secular nation the religious beliefs of one group of people are not forced onto those of other faiths. Australia is able to support people to choose their own religious beliefs or to be **atheists** (people who do not have a religion).

Nearly a quarter of the world's countries are non-secular, where the legal and government systems are based on religious teachings. Most of these countries are in northern Africa and south-east Asia. Some examples of non-secular nations are Iran (Shia Islam), Iraq (Islam), Israel (Judaism), Malaysia (Sunni Islam), Cambodia (Buddhism) and England (Protestantism).

Learning Ladder G3.10

Civics and citizenship

Step 1: I can identify topics about society

1 Source 2: Look at the photo of the mosque.
   a How has the Turkish community influenced the character of Sunshine?
   b How does the mosque help the Islamic people in Sunshine feel connected to the community?

Step 2: I can describe societal issues

2 What is inclusion? Why is it an important Australian value for communities?

Step 3: I can explain issues in society

3 What does it mean to an Australian to be given a 'fair go'?

Step 4: I can explain different points of view

4 Source 1: Look at the photo of the protesters.
   a Which key value in Australian society are these people using to stage a peaceful protest?
   b Which values do they think are being ignored by other Australians?

Step 5: I can analyse issues in society

5 Discuss this question: Are Australians free to do whatever they want to?

How do environments affect liveability?

The quality of the environment is an important factor in the liveability of a place. In large cities, liveability improves with access to clean air and open space. To find clean air and open space, people are increasingly moving away from cities to coastal or rural areas so they can enjoy a more liveable environment.

Sea change

More people are choosing to live in coastal towns, where they can enjoy the natural environment as well as swimming, surfing, fishing and walking along the beach. The decision to move to a coastal location is known as a **sea change**. Increasingly, large numbers of people are moving to coastal areas to get away from the pressures of big city life. Apart from capital cities, coastal communities are the fastest growing regions in Australia.

Tree change

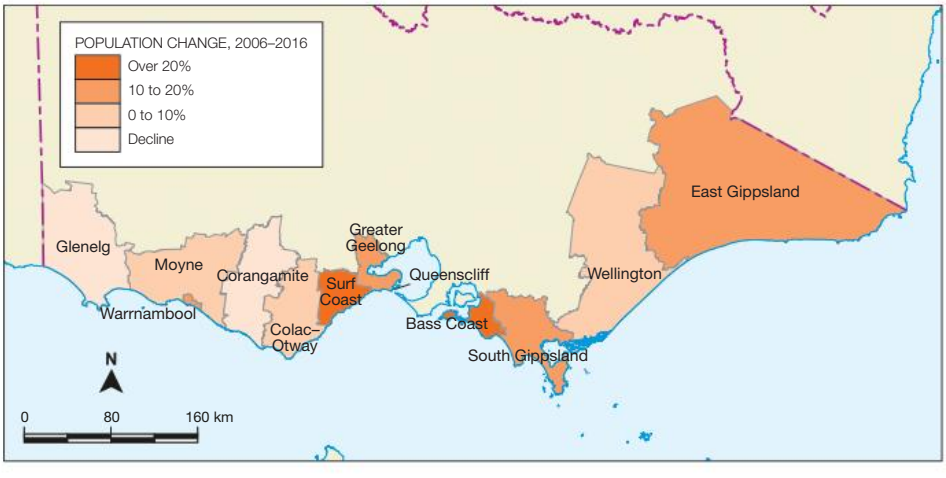
When people move from the city to a rural area, it is known as a **tree change**. A tree change is usually made in search of a more **liveable** environment. Country towns offer people a better balance of work and leisure (called 'work–life balance'), a lower cost of housing and living, clean air and a slower pace of life.

For people considering a tree change, the lower cost of homes in rural areas is tempting. A buyer might get a large home on a block of land for the price of an apartment in a capital city. More than 30 per cent of the people moving to country areas say the cost of living was their main reason to move.

Source 2

Adelaide is consistently voted one of the most liveable cities in the world. The central business district is surrounded by parklands for Adelaide's residents to enjoy.

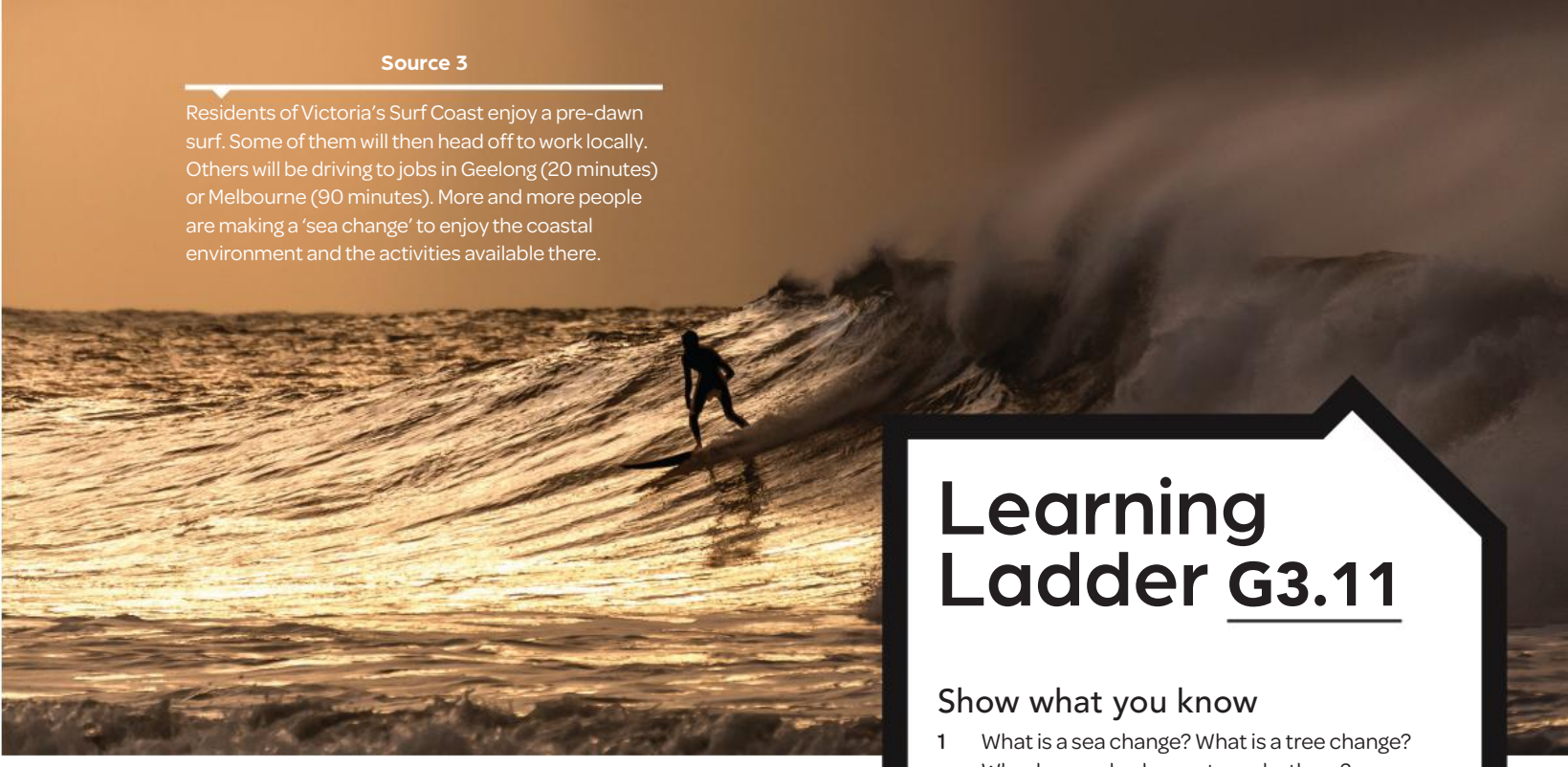
Population change in Victorian coastal regions 2006–2016



Source: Matilda Education Australia

Source 1

Population change in Victorian coastal regions 2006-2016



Source 3

Residents of Victoria's Surf Coast enjoy a pre-dawn surf. Some of them will then head off to work locally. Others will be driving to jobs in Geelong (20 minutes) or Melbourne (90 minutes). More and more people are making a 'sea change' to enjoy the coastal environment and the activities available there.

With improvements to internet connections across Australia, more residents can make a tree change and work from home to minimise their travel time and increase their quality of living.

A key motivation for a person to make a tree change to a rural area is to find a better living environment. The aesthetic appeal of rolling green pastures with grazing animals and fresh air appeals to many people.

Green belts and wedges

Green belts and **green wedges** are undeveloped areas within or around cities that have been set aside for open space. Green belts surround the outer limits of cities, and green wedges run through urban areas.

These green zones help make major cities more liveable, as they:

- protect natural and rural environments
- improve air and water quality
- give city residents access to rural and natural environments
- provide bushwalking, camping and riding areas close to cities
- provide a connected habitat for native animals and plants.

Source 4

Birregurra is a small rural town with a population of 828 people. It is located in the foothills of the Otway Ranges, about 130 km south-west of Melbourne. Birregurra is surrounded by grazing land and is close to coastal attractions such as Port Campbell.

Learning Ladder G3.11

Show what you know

1 What is a sea change? What is a tree change? Why do people choose to make them?

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

2 Source 1 is a choropleth map.What do these types of maps show?

Step 2: I can recognise and use different types of data

3 Source 4 is an oblique aerial photograph. How is this form of data useful in understanding places?

Step 3: I can choose, collect and display appropriate data

4 As a class, create a list of questions to determine whether people in your class would prefer a tree change or a sea change. Survey the whole class and graph the results.

Step 4: I can use data to support claims

5 Refer to the data you collected in question 4. Provide some possible explanations as to why your class prefers a sea change or tree change.

HOW TO
Surveys, page 150
Graphing, page 164

G3.12

thinking locally

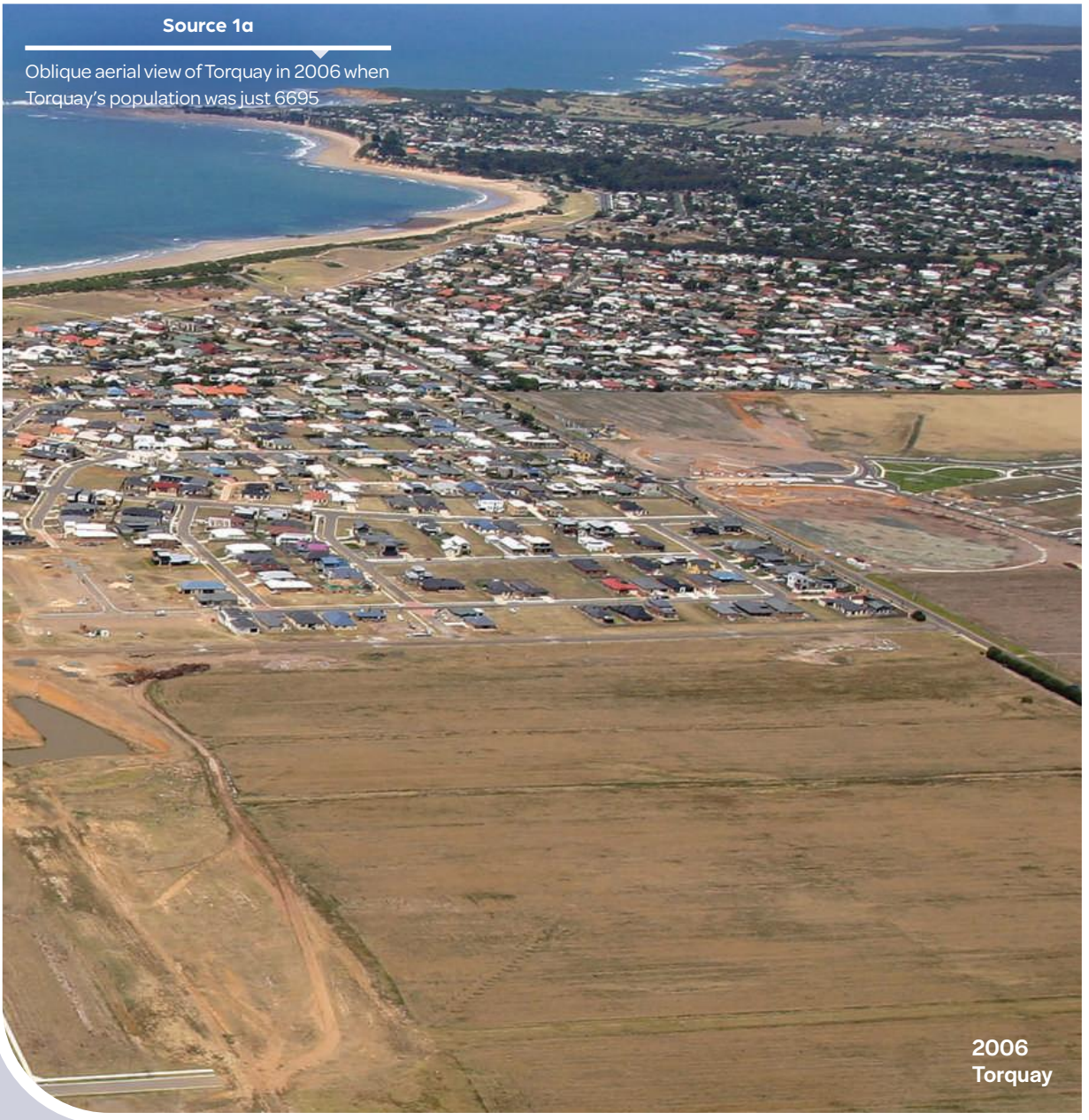
Why is Torquay booming?

Torquay is a coastal town just 90 minutes from Melbourne. Between 2001 and 2016, its population grew by 130 per cent – putting it at the centre of one of the biggest population booms in Australia.

Families are choosing to make a sea change to enjoy the coastal environment of Torquay, with many people commuting to Melbourne each day for work. As the population grows, new services such as schools and shopping centres are being built.

Source 1a

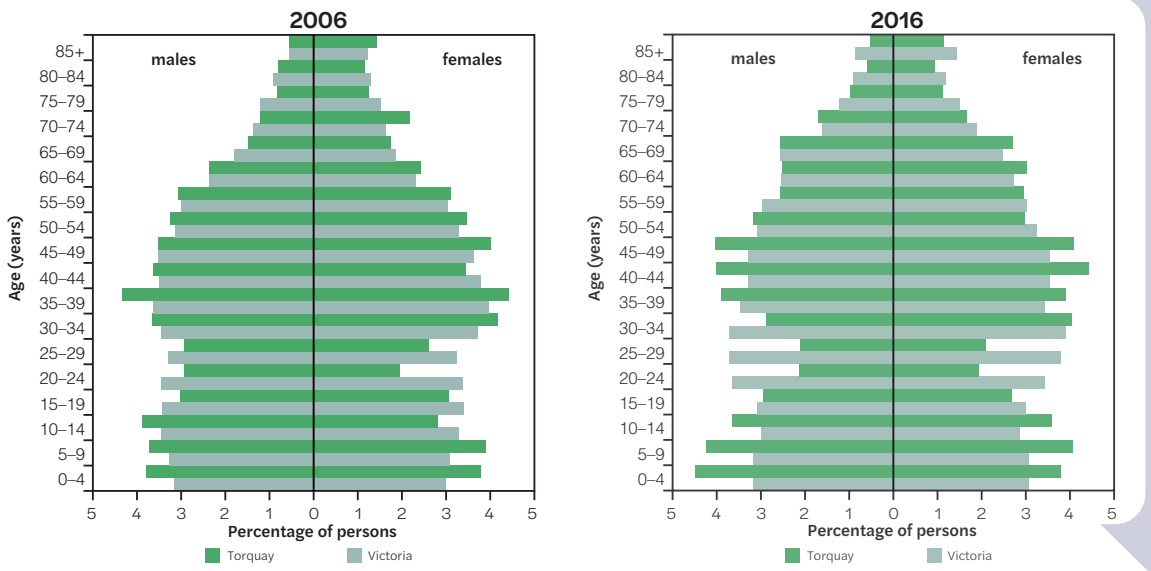
Oblique aerial view of Torquay in 2006 when Torquay's population was just 6695



2006 Torquay

2016 Torquay

Torquay's age-sex profile between 2006 and 2016



Source: Australian Bureau of Statistics, 2016

Source 2

Population pyramids showing Torquay's changing age–sex profile between 2006 and 2016

Source 1b

Oblique aerial view of Torquay in 2016 when the population had grown to more than 13 000

Learning Ladder G3.12

Show what you know

1 Why are more people making the sea change to Torquay?

2 What new services does a community require with a fast-growing population?

Analyse data

Step 1: I can use geographic terminology to interpret data

3 On a blank map of Victoria, locate Torquay and describe its relative location.

Step 2: I can describe patterns and trends

4 Source 2: Use the age-sex pyramids to describe how the population structure in Torquay has changed over time.

Step 3: I can explain the reasons behind a trend or spatial distribution

5 Sources 1a and 1b: Compare the two images from 2001 and 2016. As a class, using SHEEPT, discuss key changes that have occurred in Torquay and suggest reasons why the growth is occurring.

Step 4: I can analyse relationships between different data

6 Source 2: How does the population profile for Torquay compare to the average for Victoria in 2016? Based on this information, suggest the types of services that need to be built to support the Torquay community.

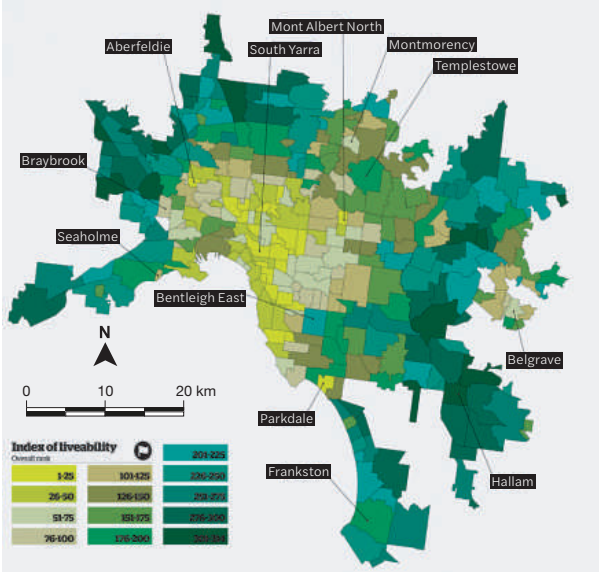
HOW TO

SHEEPT, page 158
Population pyramids, page 166
Satellite images, page 167

Masterclass

Learning Ladder

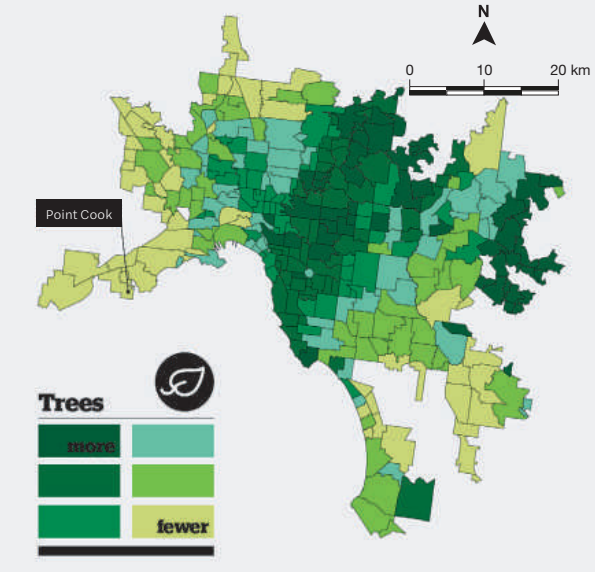
Overall liveability ranking of Melbourne suburbs



Source 1

Choropleth map showing liveability of Melbourne suburbs

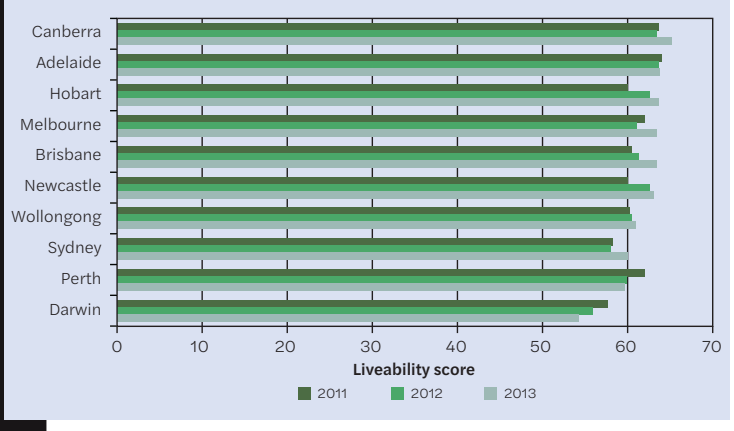
Number of trees in Victorian suburbs



Source 2

Choropleth map showing amounts of trees in Melbourne suburbs

Liveability score for Australia's major cities



Source 3

Liveability scores of Australian cities

Suburb	2015–16 population	2015–16 population growth	2015–16 growth rate	Area (km²)
South Morang	64 354	4971	8.40	59.70
Cranbourne East	23 901	4956	26.20	42.90
Craigieburn – Mickleham	52 848	4491	9.30	106.10
Point Cook	50 774	3512	7.40	36.90
Epping	42 236	3226	8.30	84.90
Tarneit	36 961	2872	8.40	62.10
Truganina	23 222	2863	14.10	27.00
Melbourne – Hoddle Grid	35 447	1975	5.90	2.40
Melton South	24 341	1831	8.10	111.00
Beaconsfield – Officer	13 605	1817	15.40	41.70

Source: Australian Bureau of Statistics

Source 4

Population change over time for a range of Victorian suburbs

Work at the level that is right for you or level-up for a learning challenge!

Step 1

a **I can identify and describe spatial characteristics**

Explain why the environment is an important factor when determining local liveability.

b **I can identify and describe interconnections**

How do communities help enable interconnections between people (see pages 100–101)?

c **I can identify responses to a geographical challenge**

List three responses to population decline in rural communities (see pages 94–95)?

d **I can collect, record and display data in simple forms**

List the data collected to create the table in Source 4.

e **I can use geographic terminology to interpret data**

Look at Source 1. Describe the location of the least liveable suburbs in Melbourne.

Step 2

a **I can explain spatial characteristics**

Refer to Source 3. Explain why Darwin's liveability score has changed over time.

b **I can explain interconnections**

Is there an interconnection between Melbourne's most liveable suburbs (Source 1) and suburbs with more trees (Source 2)?

c **I can compare responses to a geographical challenge**

Compare responses from urban planners working to improve the liveability of large cities. Which do you think is the most important (see pages 98–99)?

d **I can recognise and use different types of data**

Source 3 is an example of a clustered bar graph. Explain how this type of graph works.

e **I can describe patterns and trends**

What do the suburbs in Source 4 have in common?

Step 3

a **I can explain processes influencing places**

Refer to Source 1. Using data, outline the liveability ranking of South Yarra and Hallam and suggest possible reasons for the difference.

b **I can identify and explain the implications of interconnections**

Explain the interconnection between the area of farms and the physical features in Tully (pages 90–91).

c **I can compare strategies for a geographical challenge**

List three solutions to solve the geographical challenge of population growth in Melbourne (see pages 98–99).

d **I can choose, collect and display appropriate data**

Using the data from Source 4, graph the population growth rate of 10 Victorian suburbs for 2015–2016.

e **I can explain the reasons behind a trend or spatial distribution**

Use SHEEPT to explain the pattern shown in Source 1 on page 92.

Step 4

a **I can predict changes in the characteristics of places**

Describe the capital cities in Australia that are expected to grow the fastest and slowest by 2054 and suggest reasons to support the trends (Source 1, page 84).

Masterclass

b **I can evaluate the implications of significant interconnections**

Why are opportunities for interconnection through a community of place even more important for people with different cultures and languages (see pages 100–01)?

c **I can evaluate alternatives for a geographical challenge**

How can those suburbs shown as least liveable in Source 1 improve their liveability rating?

d **I can use data to support claims**

Local residents in Torquay are pushing for new aged care facilities. Does the data in Source 2 on page 107 support these claims?

e **I can analyse relationships between different data**

Why is Parkdale a good example to support the hypothesis that liveable suburbs have more trees?

step 5

Step 5

a **I can analyse the impact of change on places**

Compare the satellite images of Torquay in 2006 and 2016 on pages 106 and 107. What impact has population change had in this area?

b **I can explore spatial association and interconnections**

Source 1 page 92: What is the spatial association between Australian regions with declining populations and inland rural towns?

c **I can plan action to tackle a geographical challenge**

Using Nyah West as an example (pages 94–95), list the actions the town could take to improve its liveability.

d **I can evaluate data**

What additional information would be useful to test the reliability of the data used to build Source 3?

e **I can draw conclusions from analysing collected data**

Using a map of Melbourne to locate the suburbs in Source 4, identify the region of Melbourne that will most urgently require require infrastructure such as roads , schools and hospitals. Justify your decision.

Capstone

How can I understand living in Australia?

In this chapter, you have learnt a lot about living in Australia. Now you can put your new knowledge and understanding together for the capstone project to show what you know and what you think.

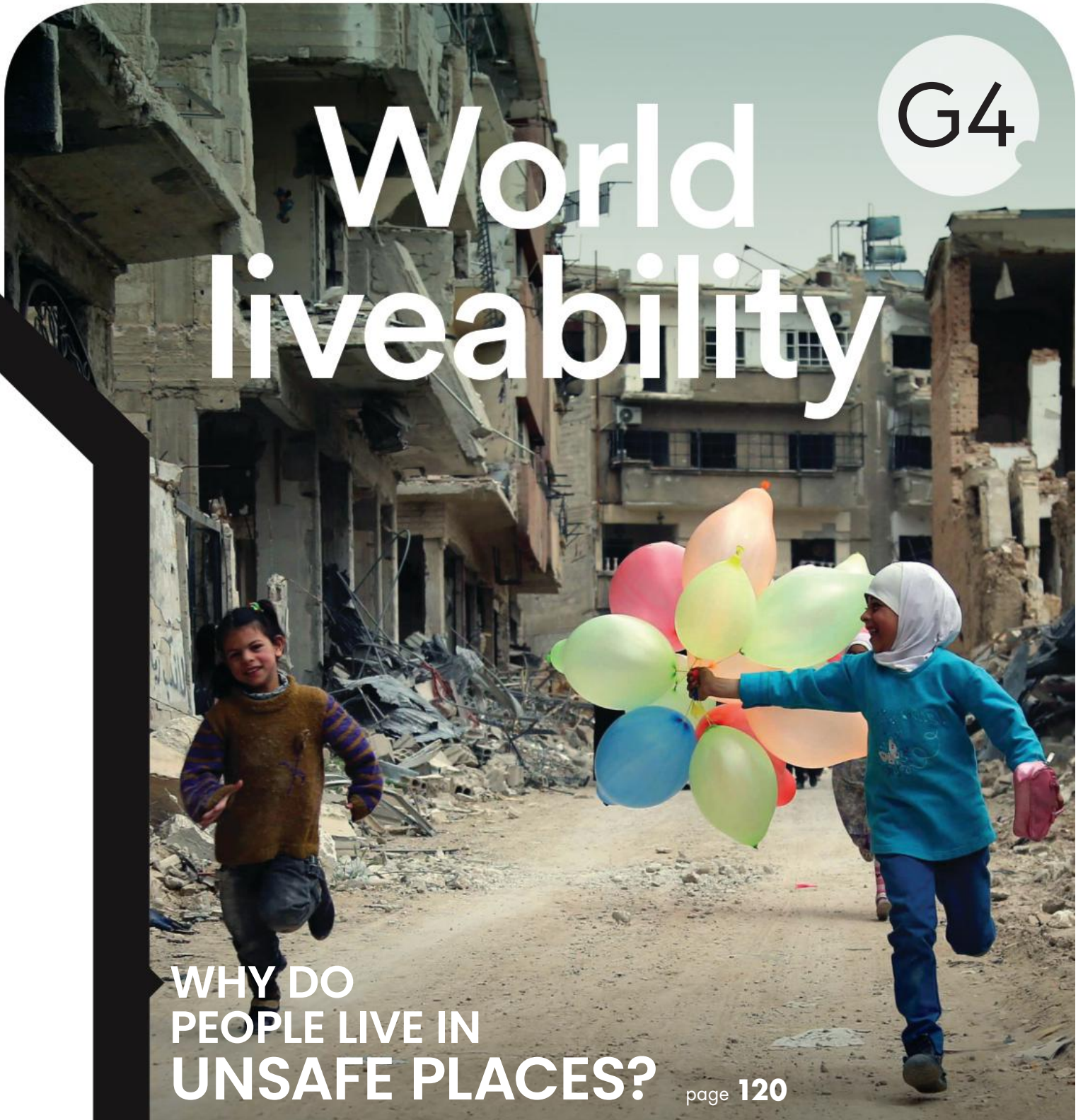
In the world of building, a capstone is an element that finishes off an arch or tops off a building or wall. That is what the capstone project will offer you, too: a chance to top off and bring together your learning in interesting, critical and creative ways. You can complete this project yourself, or your teacher can make it a class task or a homework task.

Scan this QR code to find the capstone project online.

mea.digital/GHV7_G3

G4

World liveability



WHY DO PEOPLE LIVE IN UNSAFE PLACES?

page 120

geographical challenge

page 116

CAN HUMANS LIVE IN EXTREME ENVIRONMENTS?

thinking globally

page 128

WHERE ARE THE WORLD'S HAPPIEST COUNTRIES?

economics + business

page 134

WHAT CHALLENGES DO LOW- AND HIGH-INCOME COUNTRIES FACE?

How can I understand world liveability?

Liveability varies between regions. High-income countries tend to have access to resources, high-quality education and advanced health care, while low-income countries may not have the technology and infrastructure to support their growing populations.

learning ladder

	Spatial characteristics	Interconnections	Geographical challenge
step 5	**I can analyse the impact of change on places** I can analyse and evaluate the implications of factors such as safety and calculate the impact on people and environments.	**I can explore spatial association and interconnections** I can compare distribution patterns and the interconnections between them; e.g. the safety of places and patterns of liveability.	**I can plan action to tackle a geographical challenge** I can frame questions, evaluate findings, plan actions and predict outcomes to tackle a liveability-based geographical challenge.
step 4	**I can predict changes in the characteristics of places** I can predict changes in the characteristics of places over time due to factors such as natural hazards.	**I can evaluate the implications of significant interconnections** I can identify, analyse and explain key liveability-based interconnections within and between places, and evaluate their implications over time and at different scales.	**I can evaluate alternatives for a geographical challenge** I can weigh up alternative views and strategies on a liveability-based geographical challenge using environmental, social and economic criteria.
step 3	**I can explain processes influencing places** I can explain the series of actions leading to change in a place, such as people being forced to become refugees.	**I can identify and explain the implications of interconnections** I can identify, analyse and explain liveability-based interconnections and explain their implications.	**I can compare strategies for a geographical challenge** I can compare strategies for a liveability-based geographical challenge using environmental, social and economic criteria.
step 2	**I can explain spatial characteristics** I can identify concepts of Space, Place, Interconnection, Change, Environment, Sustainability and Scale (SPICESS) when I read about world liveability.	**I can explain interconnections** I can describe and explain interconnections and their effects, such as malnutrition and infant deaths.	**I can compare responses to a geographical challenge** I can identify and compare responses to a geographical challenge and describe its impact on different groups.
step 1	**I can identify and describe spatial characteristics** I can talk about spatial characteristics at a range of scales; e.g. extreme environments.	**I can identify and describe interconnections** I can identify and explain simple interconnections involved in phenomena such as environmental quality and liveability.	**I can identify responses to a geographical challenge** I can find responses to a geographical challenge such as adapting to extreme environments.

Source 1

An example of inequality in liveability in Mumbai, India. In the background we see large skyscrapers, parklands and road networks, and in the foreground are slums characterised by their tarp roofs and cramped living conditions.

Warm up

I can evaluate data
I can determine whether data presented about human settlements is reliable and assess whether the methods I used in the field or classroom were helpful in answering a liveability-based research question.

I can draw conclusions from analysing collected data
I can summarise findings and use collected data to support key patterns and trends I have identified for liveability-based research.

I can use data to support claims
I can select or collect the most appropriate data and create specialist maps and information using ICT to support investigations into liveability.

I can analyse relationships between different data
I can use multiple data sources, overlays and GIS to find links and relationships that exist in patterns of liveability on Earth.

I can choose, collect and display appropriate data
I can select useful sources of liveability data and represent them to conform with geographic conventions.

I can explain the reasons behind a trend or spatial distribution
I can identify Social, Historical, Economic, Environmental, Political and Technological (SHEEPT) factors to help me explain patterns in data.

I can recognise and use different types of data
I can define the terms primary, secondary, qualitative and quantitative data and represent data in more complex forms.

I can describe patterns and trends
I can identify Patterns, Quantify them and point out Exceptions (PQE) to describe the patterns I see.

I can collect, record and display data in simple forms
I can identify that maps and graphs use symbols, colours and other graphics to represent data.

I can use geographic terminology to interpret data
I can identify increases, decreases or other key trends on a map, graph or chart about factors of liveability.

Collect, record and display data

Analyse data

Spatial characteristics

1 Source 1: Comment on how liveability can differ in one place.

Interconnections

2 Source 1: Suggest why the world's largest slums are found in countries where people from poor rural areas are migrating to large cities.

Geographical challenge

3 Source 1: What challenges do you think the growth of urban populations and the development of slums present for governments?

Collect, record and display data

4 Source 1: This is a ground level photograph. Ground level and oblique aerial photographs have a foreground and a background. Why is some information hidden in these photographs?

Analyse data

5 Source 1: Sketch one of the shanty homes shown in this slum in Mumbai and label the materials used to build it. Why do you think this strip of land was left open for new migrants to the city to claim for their makeshift homes?

Where do people live in our world?

Ninety per cent of the world's population lives on just 10 per cent of all the available land on Earth. Some places on Earth – such as deserts, high mountains and polar regions – are inhospitable, and it is difficult for humans to live there.

Living on Earth

The most **liveable** places on Earth are between the Arctic Circle and the Antarctic Circle, where the temperatures are warm enough to grow food.

Antarctica is the only continent that does not have a permanent population. It is the coldest place on Earth. Scientists spend time on Antarctica – but mainly during the summer months, when there are more opportunities to work outside.

The world's population is 7.8 billion people, and we inhabit six of the seven continents. Asia has the highest population, at 4.5 billion people. Sixty per cent of the world's population lives in Asia, and 36 per cent of the world's people live in just two countries: China and India.

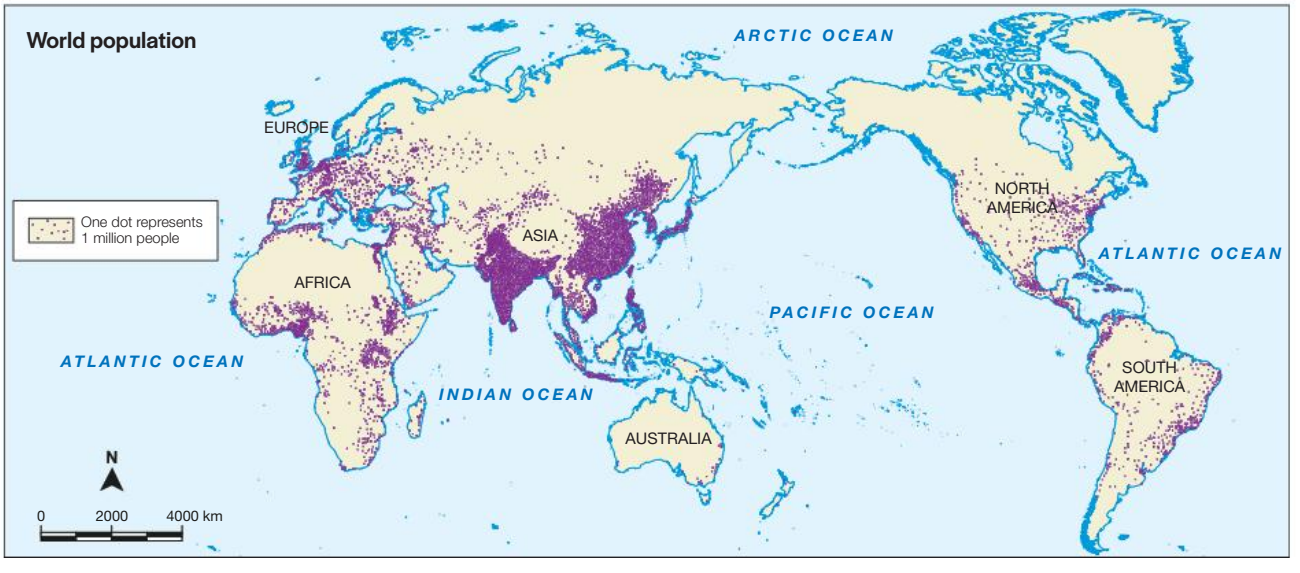
Population density

The **population density** of a region is a measure of how crowded that place is. It is calculated by dividing the population by the area of the region. For example, the continent of Australia has a population of 25 000 000, and an area of 7 692 024 square kilometres, so its population density is 3.25 persons per square kilometre.

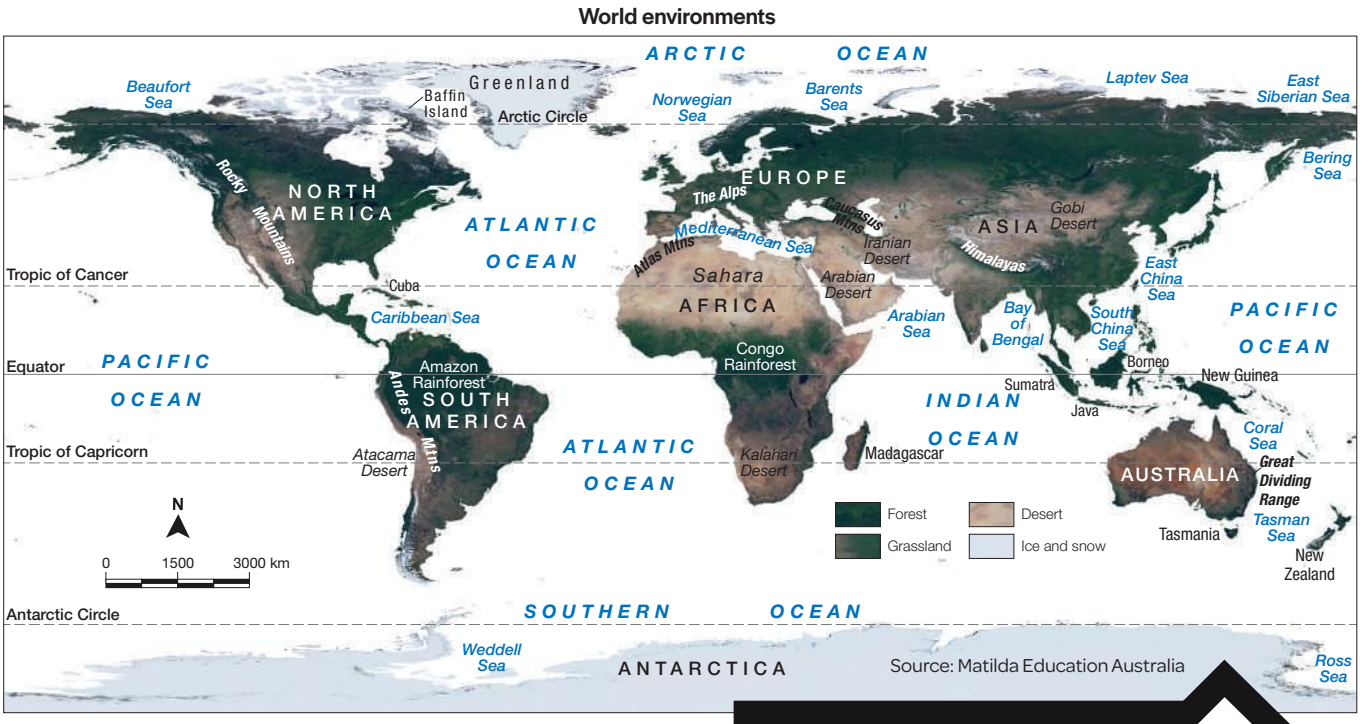
Population density varies from continent to continent. Australia has the lowest population density of all the populated continents. Asia has the world's highest population density – with 146 people for every square kilometre of land. On average, the world's population density is about 15 people for every square kilometre

Source 1

World **population distribution** dot map



Source: Matilda Education Australia



Source 2

World environments shown on a satellite image

of land on Earth. However, about 90 per cent of the Earth's population live on just 10 per cent of the land – mainly along coastlines and near sources of freshwater.

Least liveable regions

Over half of Earth's land mass consists of regions with harsh conditions that make it difficult for humans to survive. This is why **polar** regions, **deserts** and high mountains have very low population densities (see pages 116–117).

Every continent has a region (or regions) with low population density:

- Africa: northern half contains the Sahara desert
- Europe: far north is in the frozen Arctic Circle
- Asia: central Asia has the Himalayan Mountains and desert
- Australia: all of central Australia is desert or semi-desert
- North America: northern tip is in the Arctic, plus deserts in south-west
- South America: northern half contains the Amazon rainforest.

Learning Ladder G4.1

Show what you know

1 Define the term 'liveability'.

2 Why isn't there a permanent human population on Antarctica?

3 Brainstorm a list of basic things that humans require to live in a region.

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

4 Which continent has the highest population density?

Step 2: I can explain spatial characteristics

5 How does Antarctica's environment contribute to its low population density?

Step 3: I can explain processes influencing places

6 Source 2: Identify the environments that provide the least liveable conditions on Earth. Provide one example for each.

Step 4: I can predict changes in the characteristics of places

7 Source 1: How will the pattern shown on this map change as the world's population grows?

Can humans live in extreme environments?

Some of the least liveable places on Earth are mountains, deserts and polar regions. Over time, some people have adapted well to living in these harsh environments. Their bodies have become used to extremes in temperature, or less water or oxygen.

Difficult environments

Some environments have very harsh conditions that make it difficult for humans to survive. They may be extremely hot or cold, or there may be no water or little oxygen to breathe. Polar regions, deserts and high mountains are examples of extreme environments where the few humans who live there have had to adapt to survive.

Polar regions

The Arctic and Antarctica are the Earth's two **polar** regions. The Arctic is the cold area around the North Pole. One indigenous people who live there are called the Inuit. The Inuit have adapted their diet, clothing, transport and housing to help them live in the extreme cold.

Antarctica is the coldest, highest and windiest place on Earth. It is the only continent that has no permanent human population. Scientists from Australia, New Zealand and many other countries work and live in scientific stations on Antarctica where even in summer the temperature can drop to –50°C.

Buildings on Antarctic stations are heated to 18°C. When working outside people have to wear lots of layers topped with a thick, quilted freezer suit. **Hypothermia** (lowering of body temperature below normal) and **frostbite** (freezing of the skin and other tissues) are both dangerous risks.

Antarctic air is so dry that a person's body can lose water just through breathing. A person needs to drink six to eight litres of water per day to stay hydrated while on Antarctica.

Desert regions

Deserts are very dry areas that receive less than 250 millimetres of rain a year. Most people think that deserts are hot places, and in the day many deserts are. But overnight, deserts are cold. Deserts known as 'cold deserts' also have relatively low temperatures during the day.

Places without a water supply are difficult to live in. People such as the Bedouins of the Middle East and North Africa are **nomadic** – they herd animals around in search of the most productive land. In Chile's Atacama Desert – the world's driest place – the people of the village of Chungungo use fine nets to capture moisture from the sea fogs that pass over the desert. The water droplets drip into large containers and pipes that supply the village with water.

Mountain regions

People living in the high mountains of the world need to adapt to cold temperatures and rugged terrain. Living in mountains also offers unique challenges for breathing. Many visitors to high altitudes suffer mountain sickness caused by the oxygen-thin air. Symptoms range from shortness of breath, dizziness and headaches to coma or death.

Ethnic groups that have lived in high altitudes for many generations, such as Tibetans and Sherpas in the Himalayas and Quechuan in the Andes mountains, have developed a genetic change in their blood that allows them to comfortably live and work at high altitudes with less oxygen.

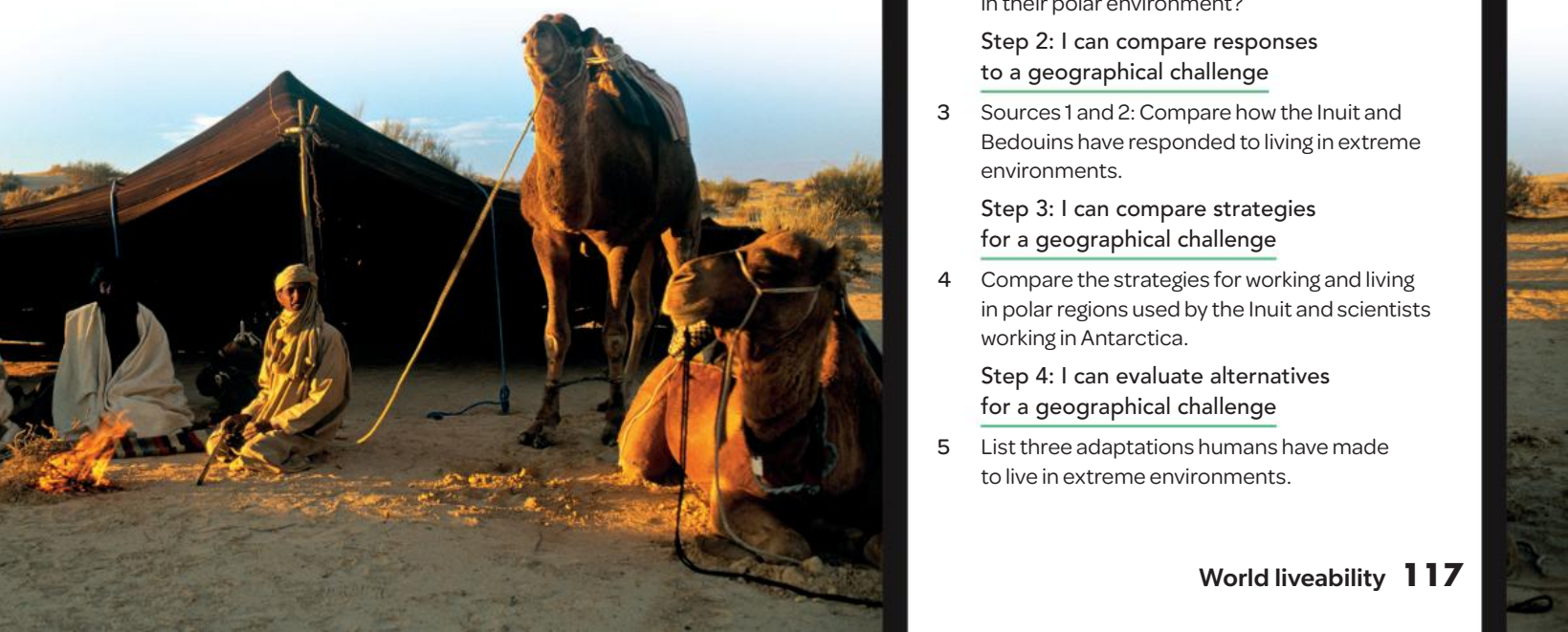
Source 1

Traditional Inuit people live in the Arctic areas of Alaska, Canada, Siberia and Greenland. The Inuit learnt to make warm winter homes, known as igloos, from snow and ice. They used animal skins and furs to make warm clothing. The Inuit people are unable to grow their own food because the Arctic climate is so harsh, and mostly eat meat from seals, whales, polar bears and caribou. Originally, Inuit used dog sleds for transport – but today they use snowmobiles.

Learning Ladder G4.2

Source 2

Bedouin tribes live in desert areas in North Africa and the Middle East. They have herds of camels and other animals that are well adapted to desert conditions. Their traditional nomadic lifestyle means they frequently move to find scarce resources in the dry desert environment. Bedouin tents are designed to allow air to circulate. Animal hair is used to insulate the tents so they stay cool during the hot days but warm during the freezing nights.



Show what you know

1 Define the term 'extreme environment'.

Geographical challenge

Step 1: I can identify responses to a geographical challenge

2 Source 1: How have the Inuit adapted to life in their polar environment?

Step 2: I can compare responses to a geographical challenge

3 Sources 1 and 2: Compare how the Inuit and Bedouins have responded to living in extreme environments.

Step 3: I can compare strategies for a geographical challenge

4 Compare the strategies for working and living in polar regions used by the Inuit and scientists working in Antarctica.

Step 4: I can evaluate alternatives for a geographical challenge

5 List three adaptations humans have made to live in extreme environments.

G4.3

How is safety interconnected with liveability?

Being safe is a key ingredient of a liveable place. Many people in the world live in unsafe places with the threat of volcanoes, earthquakes and tsunamis. Others live with conflict, or are forced to escape war zones as refugees.

Looking for safety

Along with having food, water and shelter, feeling safe is the most important factor in the **liveability** of a place. Many of the world's least liveable cities are found in war-torn countries such as Syria (see page 122), Afghanistan and South Sudan.

In regions of conflict, people are forced to leave their homes. They seek safety, food and shelter in camps that have been set up by welfare organisations. Some people are forced to flee their homes and move to camps somewhere else in their country – these are called **internally displaced persons**. Many threatened people flee to other countries as **refugees** in order to escape war, violence or a natural disaster. More than 1 million refugees from South Sudan are now living across the southern border in Uganda.

Safe and unsafe countries

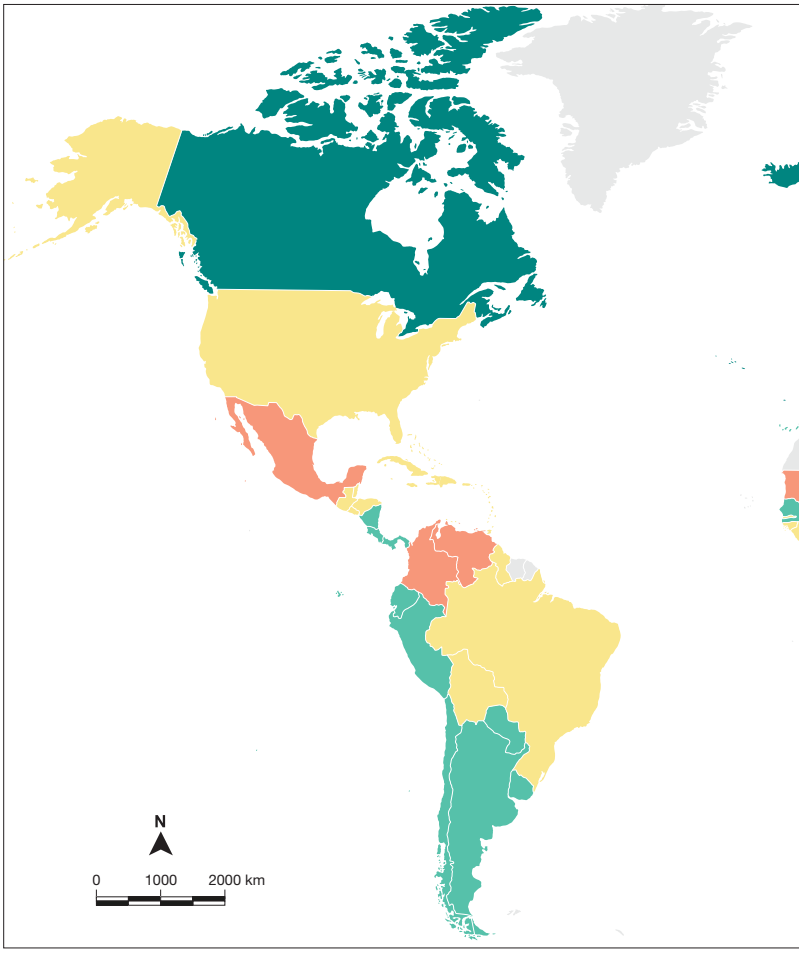
The Global Peace Index ranks countries according to their level of peacefulness. In 2018, the countries rated as the most peaceful were Australia, New Zealand, Canada and Japan, as well as some countries in Europe. Russia, the Middle East and North Africa were rated among the world's least peaceful regions.

The following measures (or criteria) are used to measure peacefulness.

- *Safety and security:* amount of crime, numbers of people jailed, the threat of terrorism, the number of refugees.
- *Ongoing conflict:* number of conflicts and casualties.
- *Militarisation:* military spending, and numbers of military personnel.

Source 1

Global Peace Index 2018



Source: Institute for Economics and Peace, 2019

Source 2

A soldier walks past women in northern South Sudan who are carrying their belongings. One-third of South Sudan's population has been forced to find a safer place to live following a long-running conflict between two rival ethnic groups.

Learning Ladder G4.3

Show what you know

1 Define the word 'safety' in the context of where people live.

2 Describe two key differences between an internally displaced person and a refugee.

Interconnections

Step 1: I can identify and describe interconnections

3 Many refugees are escaping conflict. Describe the areas of the world shown in Source 1 where refugees are likely to come from.

Step 2: I can explain interconnections

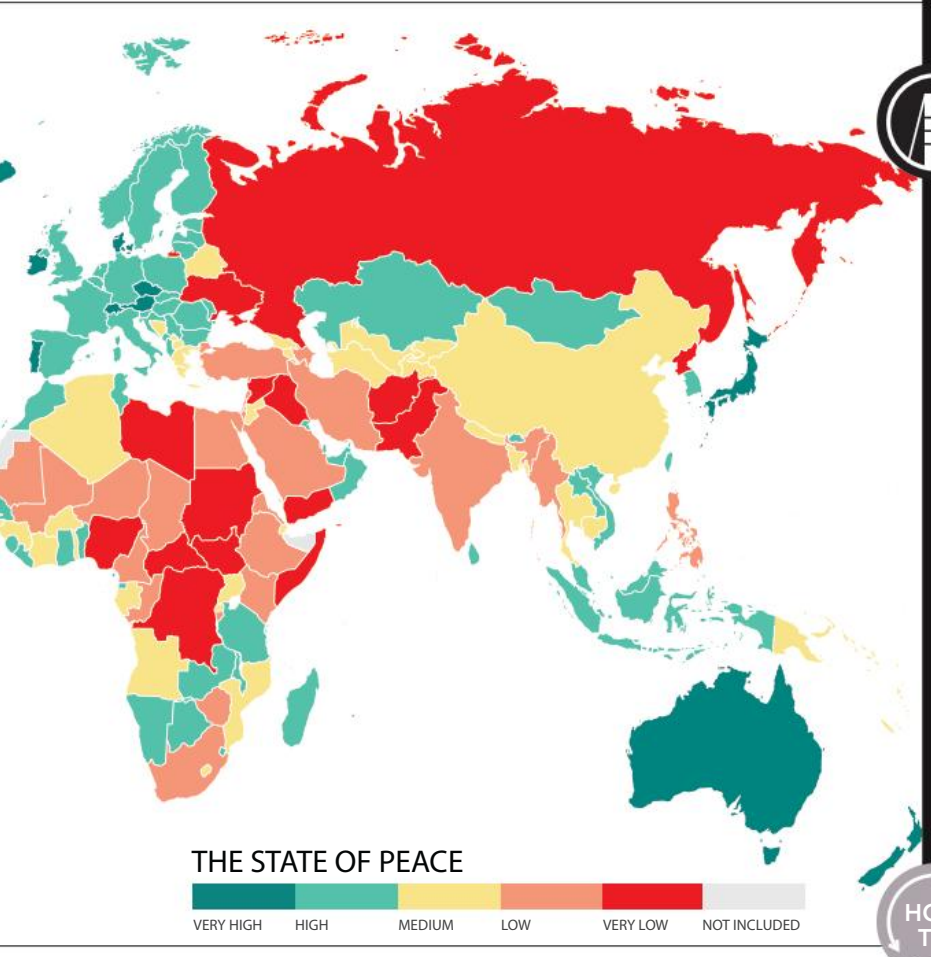
4 Where do refugees move to seek safety from the conflict where they live?

Step 3: I can identify and explain the implications of interconnections

5 Source 2: What are the implications for these refugees? Where are they, how might they be feeling, what are they carrying and where are they going?

Step 4: I can evaluate the implications of significant interconnections

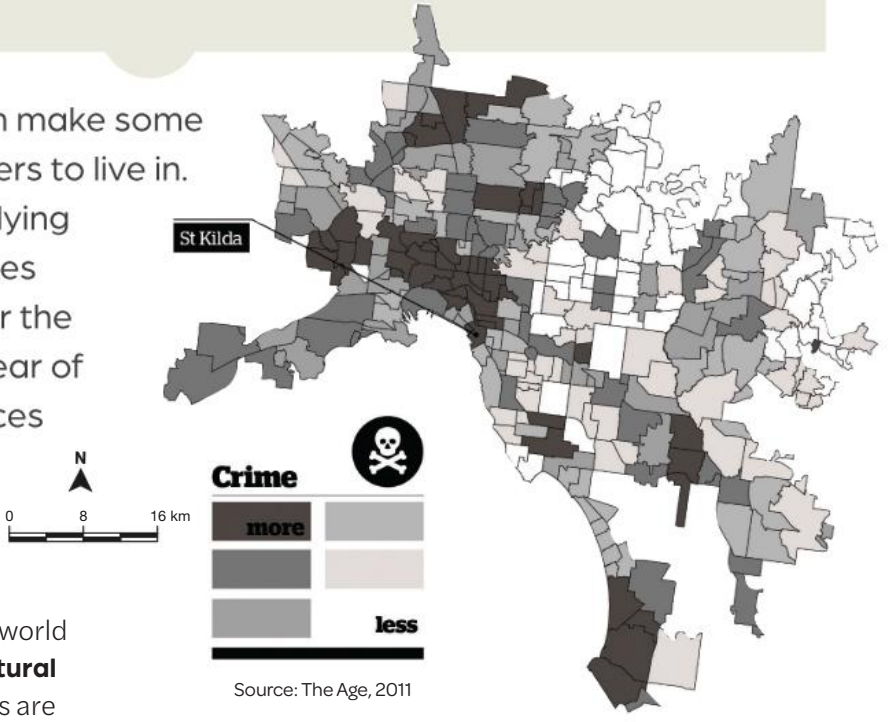
6 Source 1: Use SHEEPT to explain why Australia is ranked as more peaceful than Africa. Research how the Australian government has reacted to refugees trying to reach Australia by sea. Why have they taken this action?



HOW TO Using SHEEPT, page 158

Why do people live in unsafe places?

The threat of natural hazards can make some areas of Earth less safe than others to live in. For example, floods occur in low-lying areas near water, and earthquakes and volcanoes tend to occur near the boundaries of **tectonic plates**. Fear of crime forces people to avoid places where they feel threatened.



Source: The Age, 2011

Source 1

Melbourne suburbs according to crime statistics

Living in a hazardous place

Hundreds of millions of people around the world choose to live in areas that are prone to **natural hazards**. For example, areas with volcanoes are hazardous, but they attract many people because the rich soil is good for farming.

Because so many people have chosen to live in hazardous zones, natural events such as volcanic eruptions, earthquakes, tsunamis and cyclones can quickly turn into **natural disasters**. In Australia the most common natural disasters are bushfires, floods and cyclones.

Making places safe from crime

The most liveable places are where people feel safe from injury, abuse, theft and damage. Australian cities are regarded as safe by world standards, so they perform well in liveability rankings (see page 97). Governments are continually looking at ways to make places safer. They measure safety by surveying communities and studying crime statistics. Maps can show the areas where most crimes occur and police can be moved to areas of high crime.

Source 2

The dots and triangles on this map indicate major volcanic eruptions, earthquakes and tsunamis.

Natural disasters

Source 3

An aerial view showing the complete destruction of Palu in Sulawesi, Indonesia. The area was devastated in 2018 by an earthquake and tsunami that claimed more than 2000 lives.

Different measures are put in place to make public spaces safer. For example, improved lighting and building design can help make public areas more visible. Police patrols and surveillance cameras help prevent crime, and make residents feel safer. These strategies help to reduce the number of crimes because if places are more visible and a police presence is more obvious, then any criminal activity is also easier to see, too.

Source: Matilda Education Australia

Learning Ladder G4.4

Show what you know

1 What factors cause a location to be 'unsafe'?
Hint: Use SHEEPT to help you answer the question.

Analyse data

Step 1: I can use geographic terminology to interpret data

2 Source 3: Describe what has happened here.

Step 2: I can describe patterns and trends

3 Source 1: Use PQE to describe the distribution of crime across Melbourne.

Step 3: I can explain the reasons behind a trend or spatial distribution

4 Source 2: What natural hazards are shown here and which areas of the world are affected by them? Why do people choose to live in these regions even though they are hazardous?

Step 4: I can analyse relationships between different data

5 Source 1: Suggest what action could be taken in St Kilda to make it a safer place.

HOW TO

PQE, page 156
SHEEPT, page 158

Why is Syria an unsafe place to live?

From 2013 to 2019, Syria's capital Damascus has been rated as the world's least liveable city in the annual survey compiled by the Economist Intelligence Unit. Conflict in Syria has made this Middle Eastern country one of the most unsafe regions in the world.

In 2011, Syrian people who were peacefully protesting against their government were shot at by the Syrian army. This led to civil war, as opposition groups armed themselves to fight back. By 2019, the fighting had killed nearly half a million people, injured more than 1 million and forced about 12 million people from their homes – roughly two-thirds of the Syrian population.

More than 6 million people have fled their homes and are displaced within Syria. More than 5 million **refugees** have crossed the borders of neighbouring countries looking for a safe environment, with 3.5 million Syrian refugees crossing the border into Turkey alone.

Thousands of Syrians flee their country every day. The risks on the journey are high, with families walking long distances at night to avoid being shot or kidnapped.

Source 1

Territories held by opposing forces in Syria in April 2019

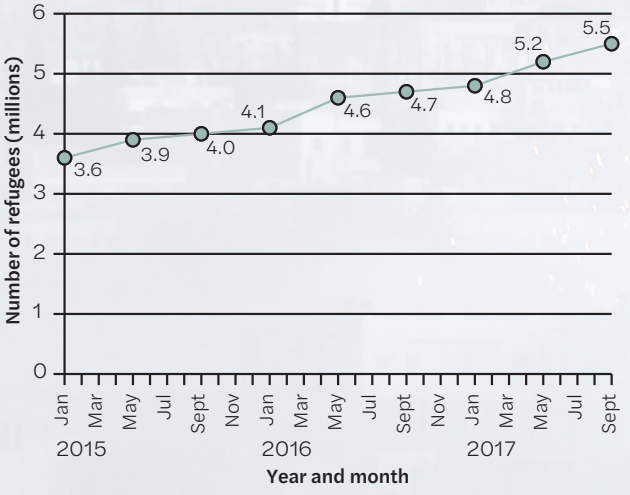
Control of Syria April 2019

Source: Matilda Education Australia

Source 2

The explosion of a suicide car bomb rocks the Syrian city of Kobani, near the border with Turkey. Since 2011, fighting in Syria has killed nearly half a million people and forced 12 million people from their homes. From 2013 to 2019, the Syrian capital Damascus was named the world's least liveable city.

Syrian refugees in neighbouring countries



Source: United Nations OCHA

Source 3

More than 12 million Syrians have been displaced from their homes. This includes about 5.5 million refugees who have been forced to seek safety in neighbouring countries, out of a total 6.3 million Syrian refugees worldwide.

Source 4

A Syrian woman and youths – one of them carrying a wounded baby – flee the site of a reported bomb attack by Syrian government forces in the city of Aleppo in 2014. Syria's war has forced two-thirds of the population to flee from their homes.

Learning Ladder G4.5

Show what you know

1 Summarise the issues that are impacting liveability in Syria.

2 Put yourself in the shoes of the people in Source 4. What would you be thinking and what action would you take to find a safe environment?

3 How can countries like Australia help displaced people in Syria?

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

4 Source 1: Identify what the colours on the map represent.

Step 2: I can recognise and use different types of data

5 Source 1: List the countries that surround Syria. How have they been drawn into the conflict?

Step 3: I can choose, collect and display appropriate data

6 What does the graph in Source 3 show and why do you think this type of graph has been chosen?

7 Use Source 3 to identify how many Syrians were displaced in January 2016 and September 2017.

Step 4: I can use data to support claims

8 The Syrian conflict is also having a great impact on neighbouring countries such as Turkey. Use data from this spread to support this claim.

G4 .6

Are environments and health interconnected with liveability?

The most liveable places are those where the quality of the environment is high, and people have food to eat and the medical services they need to help them live a healthy life.

Environmental quality

The quality of the environment is a key factor that determines how liveable a place is. Characteristics such as clean air and clean water, low noise levels, and access to open spaces make a place healthier and more liveable.

Source 1

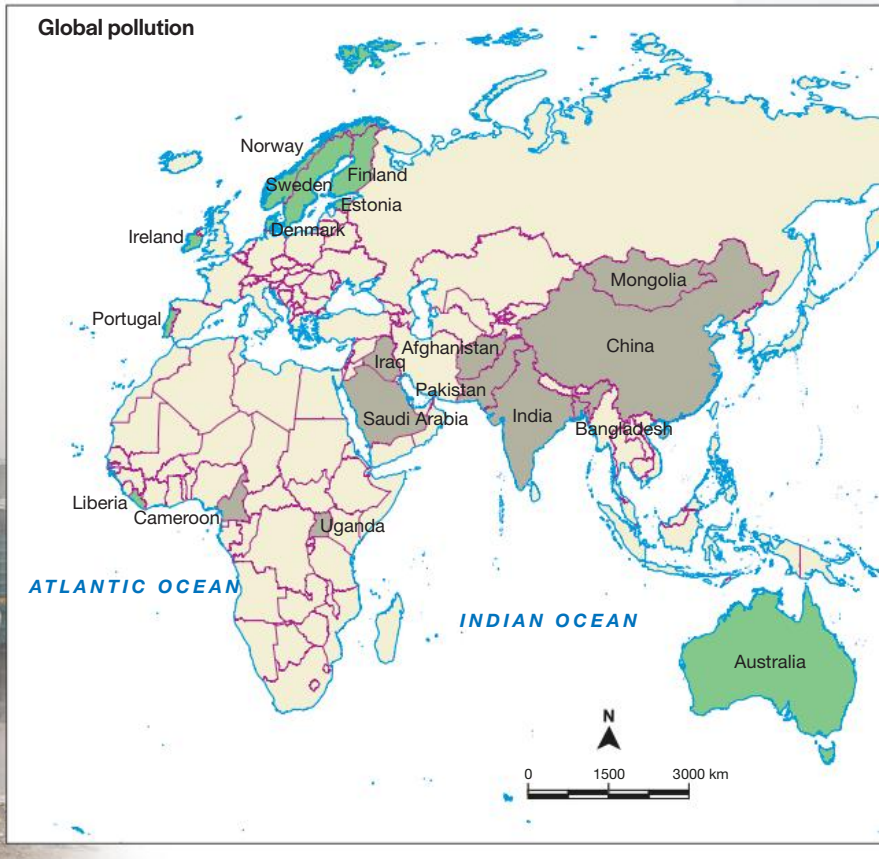
New Delhi, November 2017: Indian schoolchildren cover their faces with handkerchiefs as they walk to school through heavy smog. Other commuters wore masks or covered their mouths with scarves. The government shut all the primary schools, as pollution levels were nearly 30 times the World Health Organization safe level.

Air pollution

Many large cities around the world suffer badly from harmful particles in the air, known as **air pollution**. The major sources of outdoor air pollution are:

- exhaust gases from motor vehicles
- power generation – such as oil and coal power plants
- industrial factories, mines and oil refineries
- burning of agricultural waste
- home cooking, heating and lighting.

Global pollution

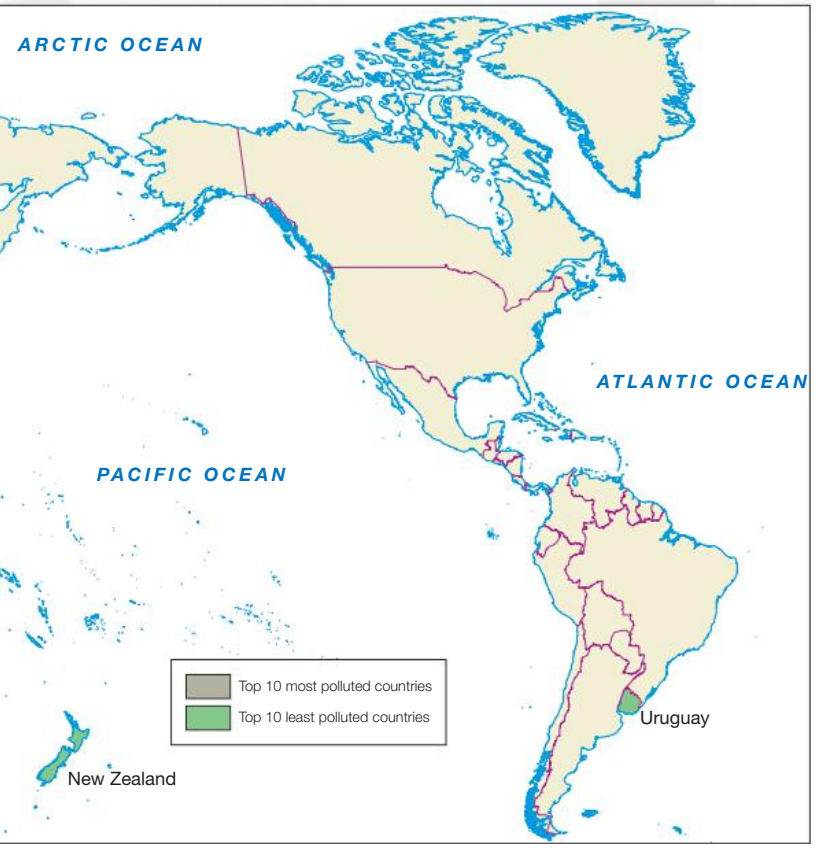


Source 3

Te Anau in New Zealand is one of the least polluted areas in the world. It is the gateway to the wilderness area of Fiordland National Park.

Source 2

World map showing global pollution levels



Source: Matilda Education Australia

If there are too many harmful particles in the air, people breathe them in when they inhale. This can cause serious health conditions, such as lung cancer, heart disease and respiratory diseases. Each year, around 4.2 million people die because of exposure to air pollution – and 91 per cent of the world's population lives in places where air quality is worse than (or 'exceeds') World Health Organization guidelines.

Air pollution affects both high-income and low-income countries, with the highest levels experienced in South-East Asia. In 2018, India had the 14 most polluted cities in the world. In November 2017, air pollution levels in India's capital, New Delhi, were 30 times beyond the level that is safe to breathe. The Indian government closed schools for three days, stopped all construction, and warned people to stay indoors for their own safety.

To improve the liveability of cities, India and other countries and cities have been trying to reduce their air pollution levels. Some have banned old, polluting cars, or reduced the number of cars on the road. Other countries are investing in clean energy, such as solar power and wind power.

Improving global health

Over the last 30 years there has been a great improvement in the health of the world's population. There has been a reduction by more than 4 million in the number of children dying before they reach one year old.

However, despite the improvements in healthcare, there are still millions of people who don't have a healthy place to live. Wealthy countries have better health opportunities than poorer countries:

- In Africa, children are 15 times more likely to die before the age of five than children in high-income countries, and one child in every 13 dies before they are five.
- Children living in the world's poorest 20 per cent of households are twice as likely to die before their fifth birthday as children in the richest 20 per cent of households.
- Only one per cent of mothers who die during pregnancy or from complications during childbirth live in wealthy countries.

Improving children's health

In 2017, more than 5 million children under the age of five died – and half of these deaths could have been prevented with access to simple and affordable medical care.

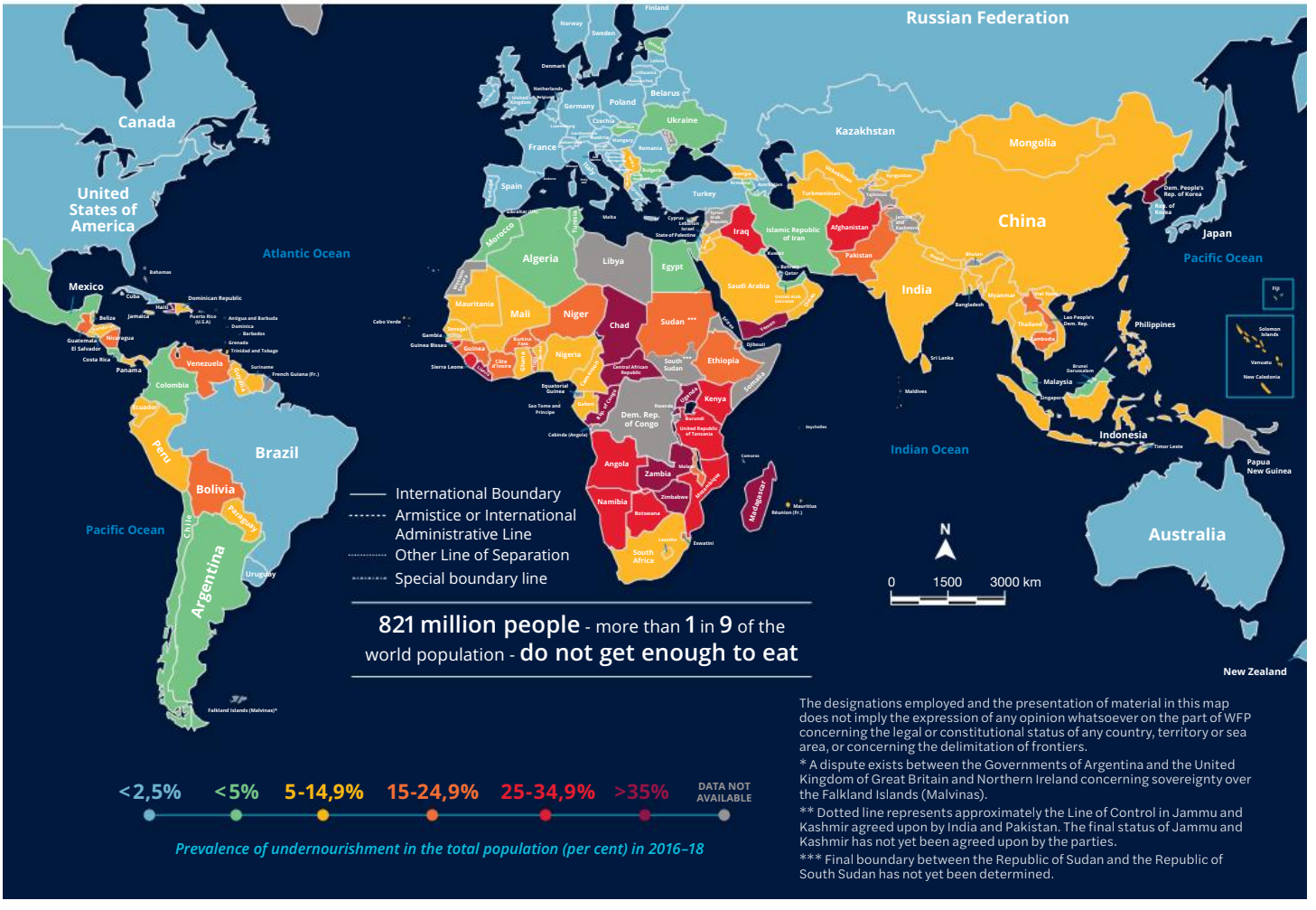
Almost half (45 per cent) of all deaths in children under the age of five were because they didn't have enough to eat, or because they did not eat enough of the right things, which is called **malnutrition**. When children suffer from malnutrition, it puts them at greater risk of dying from common infections.

In 2017, there were 51 million underweight children below five years of age – and 16 million of these were severely underweight. More than 50 per cent of all malnourished children live in South Asia, and 25 per cent live in Africa.

Source 4

World hunger map, 2018

Prevalence of undernourishment in the total population (per cent) in 2015–2017



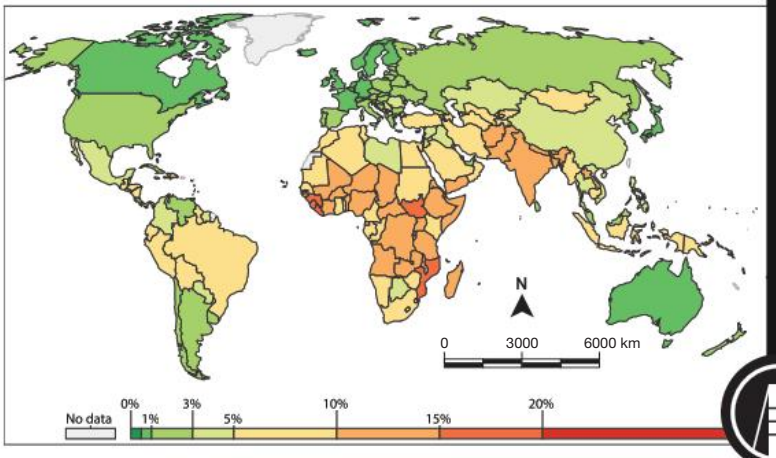
Source: World Food Programme, 2019

Aboriginal health in Australia

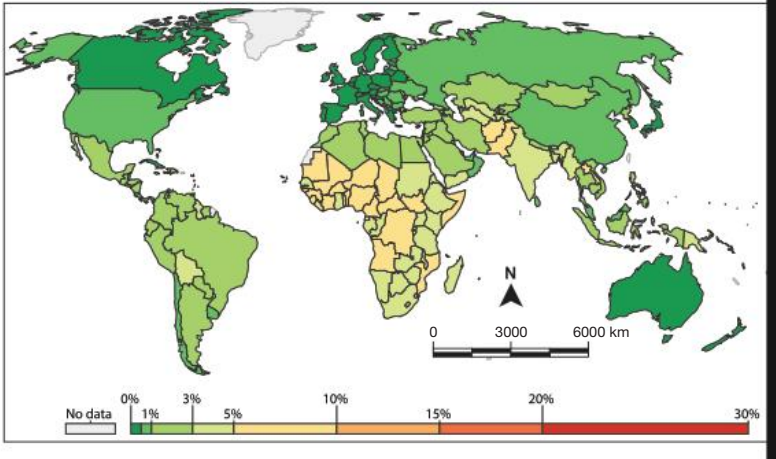
In Australia, a man can expect to live for 80 years, and a woman for 85 years. But the **life expectancy** for Indigenous people is much lower. An Aboriginal man can expect to live for only 69 years and an Aboriginal woman for only 74 years. In Australia, which is such a wealthy and liveable country, it is shameful that the health of the Indigenous population lags so far behind.

Aboriginal communities have higher rates of **infant mortality** and suffer more from infectious diseases, such as trachoma, which makes people blind. Australia is the only wealthy country in the world where people suffer from trachoma. Trachoma exists in remote Aboriginal communities that lack clean water and have overcrowded housing. Australia's Aboriginal population is also much more likely to contract diabetes and suffer heart disease than the rest of the population.

Infant mortality, 1985



Infant mortality, 2015



Source: Our World in Data

Source 6

World infant mortality rates, 1985 and 2015. Infant mortality refers to the number of deaths of children who are less than one year old per 1000 live births.

Source 5

The combination of drought and conflict in South Sudan in 2015 led to food shortages and high levels of malnutrition. Here, a two-month-old girl with severe malnutrition lies on a hospital bed next to her mother.

Learning Ladder G4.6

Show what you know

1 Identify where most of the world's most polluted cities are located.

2 Research and outline three things governments can do to help decrease pollution.

3 List some key factors that influence the health of the population.

4 How are wealthy countries different to other countries when it comes to health?

Interconnections

Step 1: I can identify and describe interconnections

5 How is the quality of the environment interconnected with the most liveable places?

Step 2: I can explain interconnections

6 Source 2: Australia has some of the most liveable cities in the world. Is there an interconnection with air pollution to help explain this pattern?

Step 3: I can identify and explain the implications of interconnections

7 Compare sources 4 and 6. Is there an interconnection between hunger and infant mortality?

Step 4: I can evaluate the implications of significant interconnections

8 What is the interconnection between Aboriginal Australians and health? What are the implications for Aboriginal Australians and how can the situation be improved?

Where are the world's happiest countries?

The United Nations annual poll of the happiest countries of the world selected Finland as the winner for 2018 and 2019 – and its Scandinavian neighbours were all in the top 10, too.

World Happiness Report

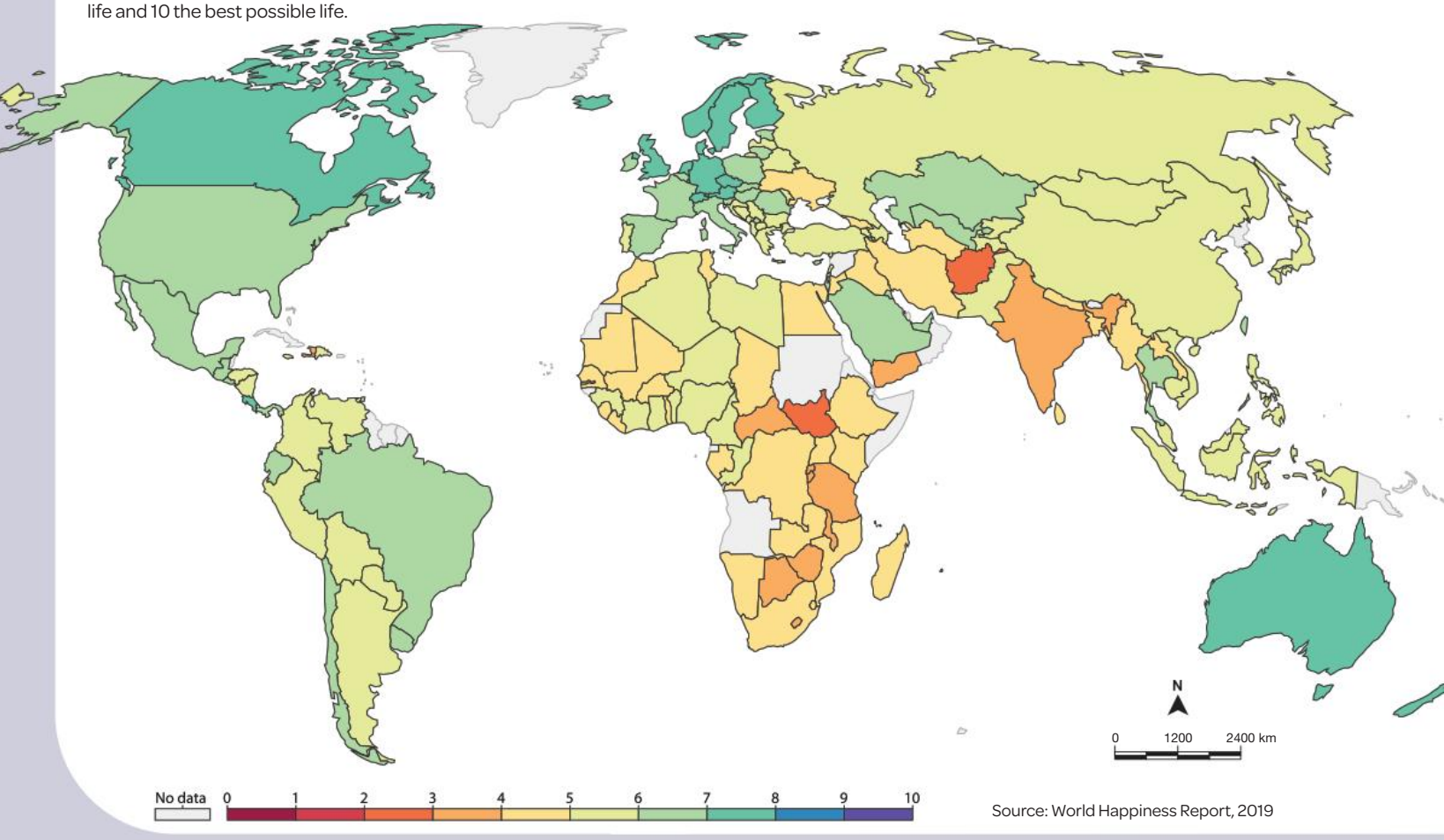
The happiest countries in the world have been ranked in the World Happiness Report 2019. The 2019 report combines the happiness rankings for 2016–2018, and, Finland ranked number 1, while its Scandinavian neighbours Denmark, Norway, Iceland and Sweden were all in the top 7.

Each year since 2012, the United Nations has measured the quality of life for citizens by surveying over 1000 people in more than 150 countries around the world. The surveys measure how happy citizens say they are – and this is added to data about wealth, life expectancy, social support, generosity, freedom and corruption to arrive at an overall score.

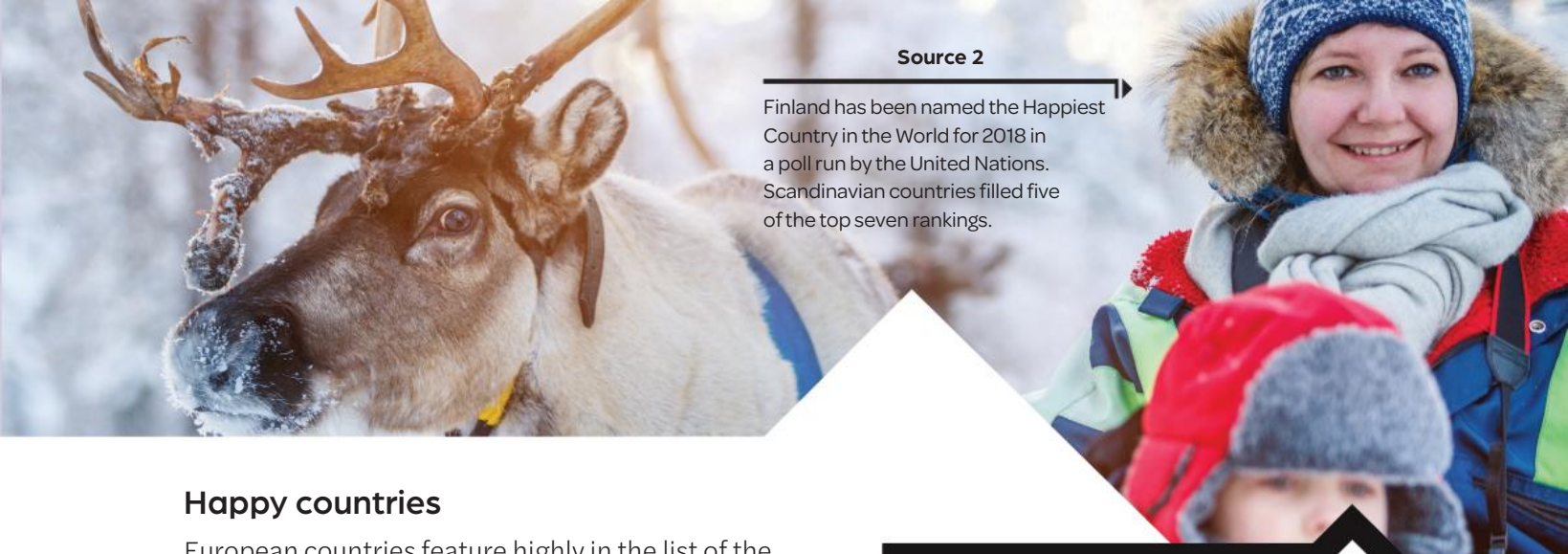
Source 1

The world's happiest countries, as ranked in the World Happiness Report 2019. Zero represents the worst possible life and 10 the best possible life.

The world's happiest countries, 2018



Source: World Happiness Report, 2019



Source 2

Finland has been named the Happiest Country in the World for 2018 in a poll run by the United Nations. Scandinavian countries filled five of the top seven rankings.

Happy countries

European countries feature highly in the list of the happiest countries in the world, holding 13 of the top 20 positions. Finland leapt from fifth last year to first this year to claim the title of the world's happiest country.

Finland is one of the most peaceful nations on Earth. Its residents enjoy high environmental standards, and access to more forest per square kilometre than any other European country. In 2019, Finland's Scandinavian neighbours – Denmark, Norway and Iceland – were second, third and fourth, with Sweden coming in seventh. Scandinavia just has to be the happiest region on Earth. On the other side of the globe, New Zealand and Australia are also happy places, too, coming in eighth and eleventh, respectively.

What makes these countries so happy? It's no surprise that the top-rated countries are all wealthy countries that enjoy a high quality of life. They also have a strong sense of community and respect for one another.

Unhappy countries

There is a strong link between unhappiness and the poorest and most dangerous nations on Earth. Countries in conflict, such as Syria (see pages 122–123), score poorly on the happiness index. Fifteen of the bottom 20 scores belong to countries in Africa that are suffering from conflict and poverty. The small African nation of Burundi is ranked the least happiest country in the world. Burundi has endured a conflict that has killed 1200 people, and forced 400 000 people from their homes.

Learning Ladder G4.7

Show what you know

1 What is the United Nations World Happiness Report?

2 Using SHEEPT, discuss why you think that Australia is rated as one of the happiest places on Earth.

Spatial characteristics

Step 1: I can identify and describe spatial characteristics

3 Why was Finland ranked the happiest country in 2018?

Step 2: I can explain spatial characteristics

4 Source 1: Use PQE to describe the distribution of happiness across the globe.
- a What patterns do you see? Are there particular areas in the world that are happier than others?
- b What data can you use to quantify the pattern you outlined?
- c What is an exception to the pattern you outlined?

Step 3: I can explain processes influencing places

4 What processes influence the world's unhappiest places?

Step 4: I can predict changes in the characteristics of places

5 Source 1: The two unhappiest countries shown are South Sudan and Afghanistan. Research why these countries score poorly on the World Happiness report and suggest what changes could be made to improve their ranking.

HOW TO

PQE, page 156
SHEEPT, page 158

How can we measure liveability?

Some of the key characteristics of a liveable city are that it is safe and comfortable, with good services available to the population. Australian cities perform well in liveability rankings.

Measuring liveability

Every person will have their own view about what makes a place more liveable or less liveable. A person's ideas about the liveability of a place will vary according to their age, background, income and lifestyle choices.

Every year the Economist Intelligence Unit (EIU) publishes a Global Liveability Index, where it ranks 140 major cities around the world, from most liveable to least liveable. In 2018 and 2019, the EIU rated Vienna in Austria as the most liveable city – this came after a string of seven years where Melbourne was in the number one position.

Damascus in Syria was assessed as the least liveable city from 2013 to 2019 because of the civil war that has raged for seven years (see pages 122–123).

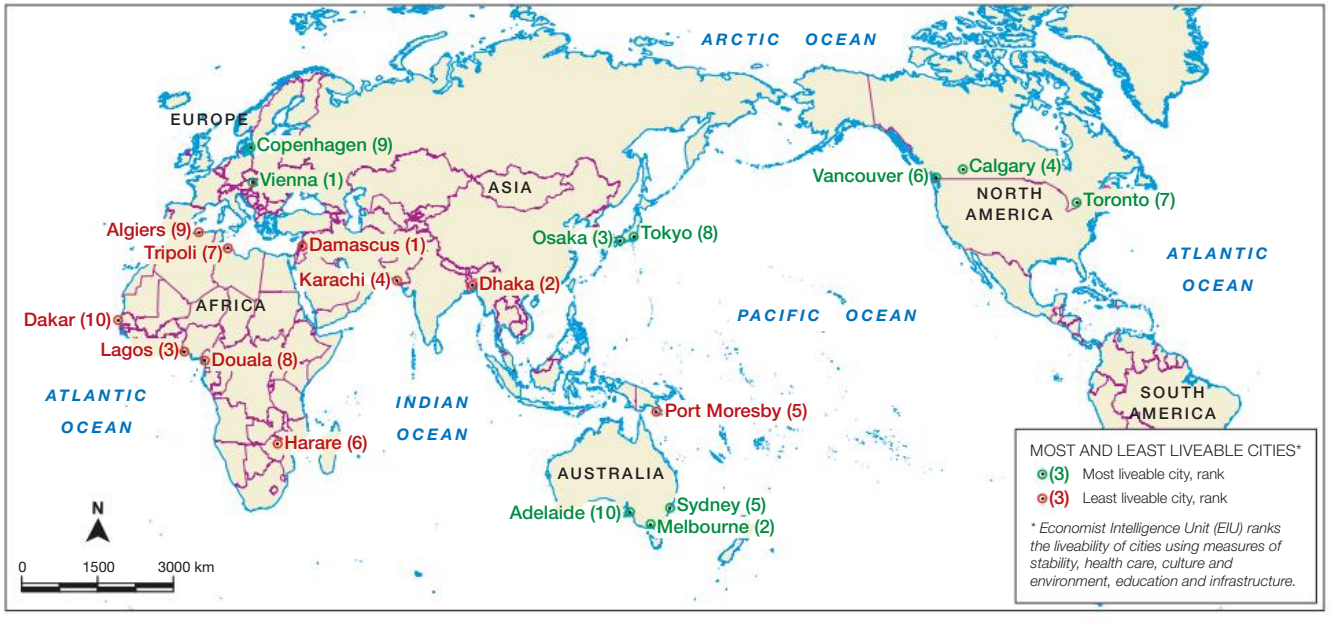
The EIU uses these considerations (or criteria) to determine the liveability of places. Each consideration is given a percentage to show its importance.

1 *Stability* (25%): Extent of small and violent crime, the threat of terrorism and military and civil conflict.

Source 1

The 10 most liveable and least liveable cities, from the 2018 Global Liveability Index

Ten most liveable and least liveable cities, 2018



Source: Matilda Education Australia

Source 2

Vienna is the capital city of Austria. It scored 99.1 per cent to be judged the world's most liveable city for 2018. It attained perfect scores for security, health care, education and infrastructure in the Global Liveability Index. Improvements in security have seen Vienna replace Melbourne in top place.

2 *Healthcare* (20%): Health standards, the availability and quality of healthcare and the availability of medicine.

3 *Culture and environment* (25%): The comfort of the climate, level of goods and services, evidence of corruption and censorship, and availability of sporting and cultural activities.

4 *Education* (10%): Education standards and the availability and quality of private education.

5 *Infrastructure* (10%): Quality of roads, international and public transport, housing, water, energy and telecommunications.

Source 3

Damascus is the capital city of Syria, in the Middle East. It scored 30.7 per cent in the Global Liveability Index, and was judged the world's least liveable city for 2018. It scored poorly in all categories. The lowest ranking was 20 per cent for stability because Damascus is in the middle of a civil war between rebels and government forces that has forced millions to flee.

Learning Ladder G4.8

Show what you know

1 What are the characteristics of a liveable city?
Hint: Use SHEEPT to help you answer the question.

2 Why does Damascus score so poorly in the 2018 Global Liveability Index?

Collect, record and display data

Step 1: I can collect, record and display data in simple forms

3 How has the data been shown in Source 1? What is one advantage of showing data in this way?

Step 2: I can recognise and use different types of data

4 Is Source 1 a primary or secondary source of data? Justify your response.

Step 3: I can choose, collect and display appropriate data

5 Review the five criteria developed by Economist Intelligence Unit (EIU). Rank them according to the importance you would give each category. Justify your response.

Step 4: I can use data to support claims

6 Imagine you were a geographer who needed to collect data to identify whether a place could be classified as liveable. Create a list of appropriate primary and secondary methods that would help you come to a clear conclusion.

HOW TO

Data collection, page 144
SHEEPT, page 158

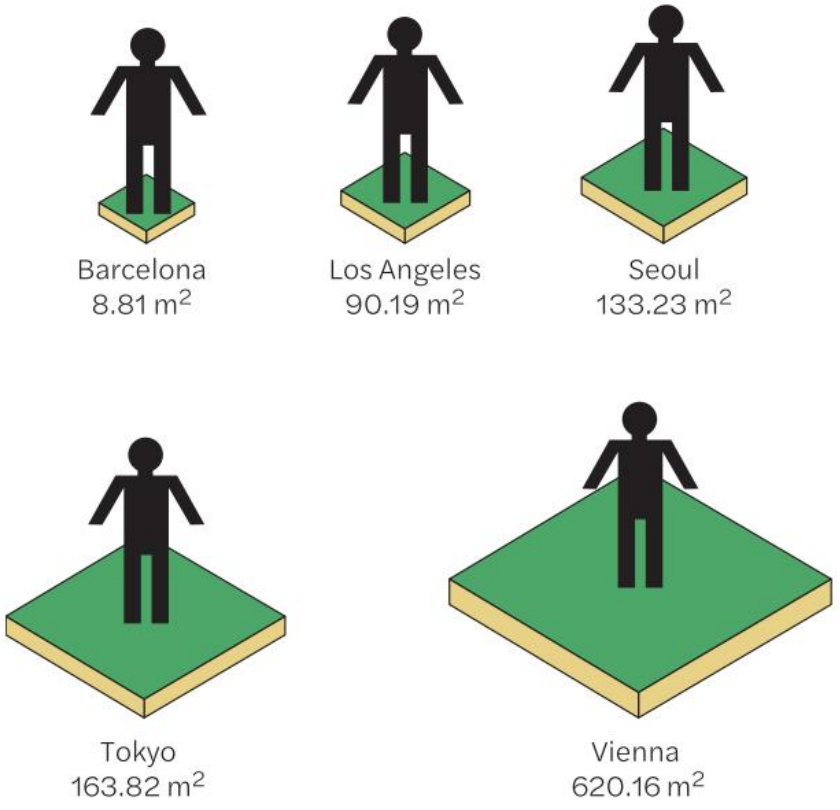
Why is Vienna the world's most liveable city?

Vienna was judged the world's most liveable city for 2018 and 2019 (see pages 130–131), after a comparison of 140 cities. It is one of the safest cities in Europe, and also offers great healthcare and education, as well as cheap and efficient public transport.

In addition, Vienna is one of the greenest large cities in the world. Half of the metropolitan area is made up of green spaces – with 620 square metres of green space for each of Vienna's 1.7 million inhabitants.

Vienna is surrounded by open space that was set aside back in 1905, and is one of the world's oldest **green belts** – a planned green space where no development is allowed. Since then, the green belt has been maintained and enlarged, and the latest urban development plan is looking to expand it even further.

Green spaces such as parks, sports fields, forests, meadows and wetlands give residents a chance for physical activity and relaxation. Trees produce oxygen, and help to filter out harmful air pollution that is usually a problem in large cities (see pages 124–125).

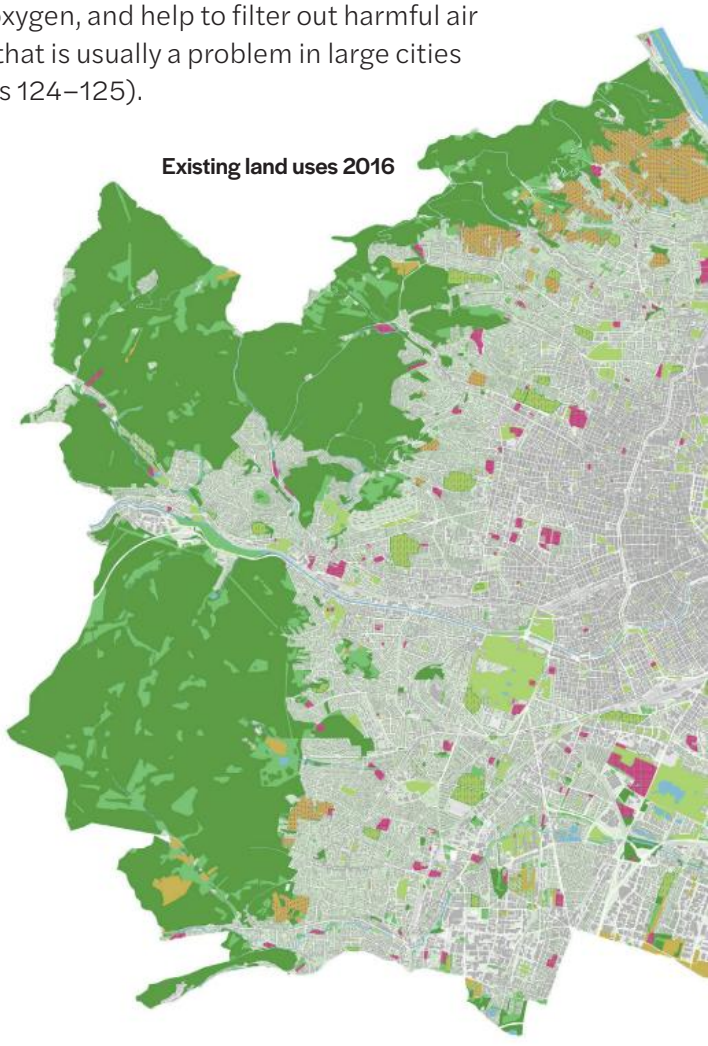


Source 1

Green space in cities around the world per capita

Source: Humanitarian Data Exchange, 2018

Existing land uses 2016



Source: Municipal Department 18 - Urban Planning and Development, 2016

Source 2

The large park at Schönbrunn Palace, Vienna, was opened to the public in 1779. The gardens and the palace were named a World Heritage Site in 1996. Urban parks and gardens provide safe routes for walking and cycling, and are good places for other recreation, such as picnics. Parklands play a critical role in cooling urban areas where buildings and roads heat up the environment.

Source 3

Green space in Vienna

Learning Ladder G4.9

Show what you know

1 Using SHEEPT, discuss why Vienna was voted the world's most liveable city in 2018 and 2019.

2 How do green spaces improve the liveability of a place?

Analyse data

Step 1: I can use geographic terminology to interpret data

3 Source 3: Where are the largest areas of green space found in Vienna?

Step 2: I can describe patterns and trends

4 Source 1: Look carefully at the pictograph and answer the following questions.

- a How many square metres of green space per person does each resident of Vienna have?
- b Which city in the pictograph has the least amount of green space per resident?
- c How could you calculate the amount of green space per resident for your town or suburb?

Step 3: I can explain the reasons behind a trend or spatial distribution

5 Source 3: Which three types of green space dominate the areas on the fringe of the city of Vienna? Why do you think they are located here?

6 Source 3: Which type of green space is only located in the suburbs of Vienna? Why do you think they are located here?

Step 4: I can analyse relationships between different data

7 Use SHEEPT factors to explain why Vienna is the world's most liveable city.

HOW TO SHEEPT, page 158

What challenges do low- and high-income countries face?

Countries around the world have different challenges to improve the liveability of places for their people. Those challenges depend very much on where you live.

Different challenges

In poorer **low-income countries**, some of the challenges to improve liveability are to provide a secure supply of food, give access to clean water (see page 64), provide somewhere for people to shelter, and supply education for all.

In richer **high-income countries**, governments are solving problems such as reducing travel times, improving technology, developing entertainment facilities and making places greener and more sustainable.

Low-income countries

Low-income countries have an income of $1045 or less per person, per year. Happily, the percentage of people living in low-income countries has fallen by more than 80 per cent.

In 1994, there were 3.1 billion people living in 64 low-income countries. But by 2014, there were 613 million people in 31 of the world's poorest countries. Most low-income countries are now in Africa – the only low-income countries outside Africa are Afghanistan, Cambodia, Haiti and Nepal.

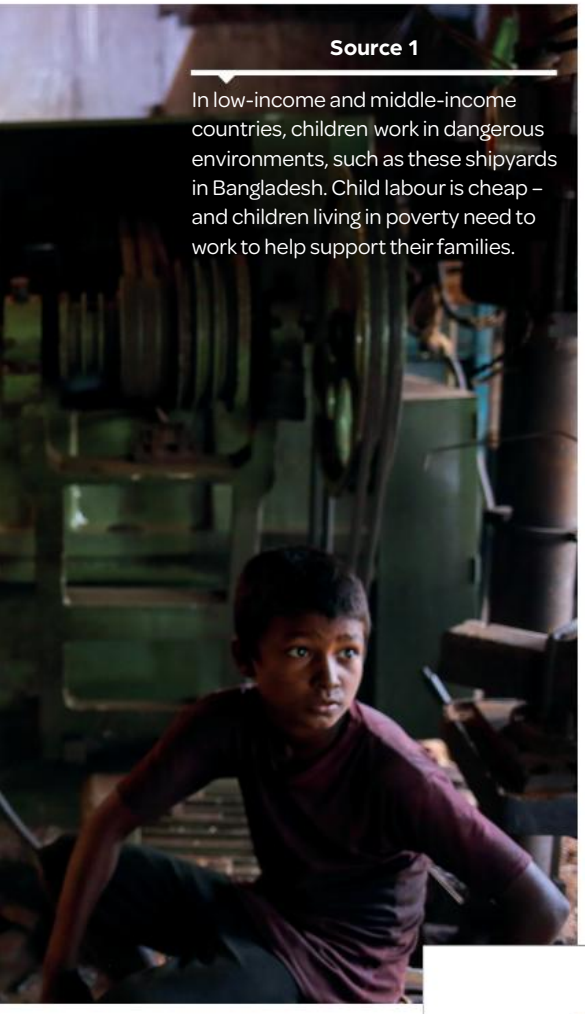
Improving young lives

Ninety per cent of people aged between 10 and 24 live in low-income and **middle-income countries**. In general, young people in these countries have less access to education, healthcare and good work opportunities than young people in high-income countries. Children in low-income and middle-income countries also tend to have more family responsibilities than children in high-income countries.

Young women in low-income and middle-income countries face extra challenges. About 90 per cent of births to teenagers occur in low-income and middle-income countries – and the leading cause of death for young women ages 15 to 19 in low-income and middle-income countries is complications from pregnancy and childbirth.

Source 2

Students at a primary school in Kenya are having a lunch supplied by a school feeding program. Students receive a healthy meal, which is extra encouragement to come to school.



Source 1

In low-income and middle-income countries, children work in dangerous environments, such as these shipyards in Bangladesh. Child labour is cheap – and children living in poverty need to work to help support their families.

Education is the key to improving the liveability of people in low-income and middle-income countries, because:

- a child born to an educated mother is twice as likely to survive to the age of five
- educated mothers are 50 per cent more likely to immunise their children against disease
- individual earnings increase by 10 per cent for each year of school completed.

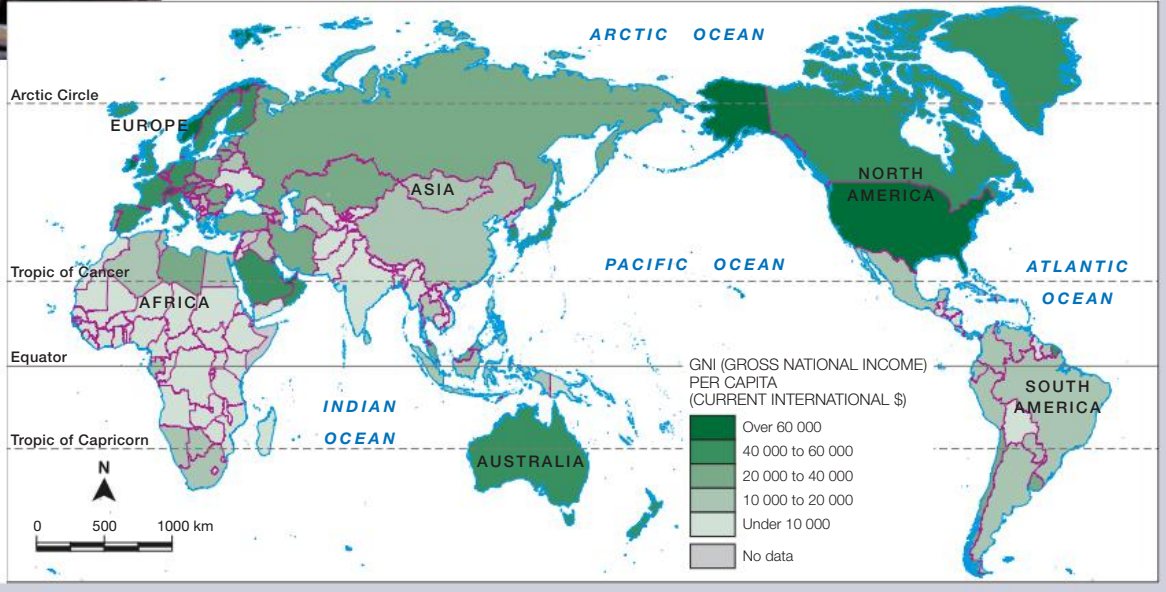
School feeding programs

Statistics from the United Nations show that 66 million primary school-age children in the world go hungry every day – with 23 million of these hungry children living in Africa. Further, 75 million school-age children do not attend school – of these, 55 per cent are girls and 47 per cent live in Africa.

To overcome this, feeding programs have been set up to supply meals for children who attend school. Meals are given to children at school during morning and afternoon meal and snack times. These meals might be a bowl of porridge or some crackers rich in nutrients. Families whose children regularly attend school might also receive packs of basic food items, such as rice and cooking oil.

Gross national income

Source: Matilda Education Australia



Source 3

Gross national Income per head of population. Gross national income is the total amount of money earned by a nation's people and businesses.

School feeding programs provide both educational and health benefits to the most vulnerable children in the world. They reduce hunger, improve the health of children, increase the numbers of children at school – and give parents a reason *not* to send their child to work.

School feeding programs in low-income countries often begin through funding by **humanitarian organisations** such as the United Nations World Food Programme. Schools have also been used to introduce other health programs, such as health education.

Improving liveability in high income countries

As cities grow and change, governments and urban planners are working to make cities more liveable. For people who live in cities in wealthy countries, this means:

- reducing transport times
- creating and protecting open space
- providing resources for recreation and entertainment
- providing affordable housing
- making sure there is work available
- providing a clean and sustainable environment.

Transport

As cities grow, traffic problems increase – as well as noise and air pollution. Australian cities (and many cities) have largely been designed for cars.

To manage the increasing volume of cars on the road, urban planners have introduced a number of measures to control city traffic. These include:

- introducing special traffic lanes for cars with passengers
- introducing 'park and ride' systems to encourage drivers to park their cars and travel into the city by bus, train or tram
- banning cars from the Central Business District and allowing only public transport, pedestrians and bicycles
- charging car drivers a toll when they enter the city centre
- restricting the times or days people can access the city by car.

Liveable cities promote public transport, walking and cycling instead of driving. Effective public transport systems are those within easy walking distance and provide a frequent and convenient service.

Source 4

The Marina Reserve in the inner-city Melbourne suburb of St Kilda is community space that has been created for young people. It includes a huge skatepark and an off-leash dog area.

Bike paths encourage people to commute to work or school by bicycle, as well as to ride for fun. Recently, over 500 cities in 49 countries had bike-sharing programs, where people could rent a bike for a period of time. A bike-sharing scheme was introduced in Paris in 2007 – and by 2012, bicycle trips in the city had grown by 41 per cent.

Open space

In liveable communities, most people live near an open space such as a park or playground. Parks provide green spaces in urban areas for plants and animals – they also cool urban areas and purify the air. For nearby residents they provide a space for activities such as exercise, ball sports, jogging and walking dogs.

The inner-city area of Prahran in Melbourne has among the least open space per head of population in Victoria. Stonnington Council is investing $60 million to build an urban oasis on top of a carpark. The community space, completed in 2019, will be 9000 square metres in size, and feature a forest, gardens, lawns and water features, as well as spaces for community events.

Source 5

An artist's impression of the urban park on top of a carpark in Prahran, Melbourne. In urban areas, parks provide healthy green spaces for residents to enjoy.

Resources for youth

In planning to make cities more liveable, the views of young people need to be considered. Public transport needs to be safe and reliable, and it needs to service local schools and shops, as well as sports and entertainment facilities.

Public spaces and facilities need to be designed to cater for the interests of young people. Young children need playgrounds and parks. Teenagers require sports grounds, stadiums, skateparks, mountain-bike tracks, cafes, cinemas and music venues.

Educational facilities need to be designed to cater for different types of learners, with flexibility in learning spaces and freely available technology, such as wi-fi and fast internet.

Learning Ladder G4.10

Economics and business

Step 1: I can recognise economic information

1 Source 3: What is meant by gross national income?

Step 2: I can describe economic issues

2 Source 3: What insights does gross national income give us when considering a country's liveability?

Step 3: I can explain issues in economics

3 If school feeding programs are often funded through organisations such as the United Nations, what potential economic issues could arise over time as communities develop a stronger need for these kinds of initiatives?

Step 4: I can integrate different economic topics

4 What are some of the challenges low-income countries face to improve liveability?

5 How did liveability improve for low-income countries between 1994 and 2014?

6 What are some of the challenges high-income countries face to improve liveability?

Step 5: I can evaluate alternatives

7 Find infomation online about a program run by a humanitarian organisation that is aimed at improving liveability for people in low-income countries.

How does a pandemic affect liveability?

The coronavirus pandemic swept across the world in 2020, affecting global liveability by affecting health, employment, and access to goods and services. Governments scrambled to slow the spread of the virus for which there was no cure.

The World Health Organization (WHO) declared the coronavirus COVID-19 a **pandemic** on 11 March 2020. A pandemic is a disease that spreads in multiple countries around the world at the same time, usually affecting a large number of people.

At this time the pandemic had reached every continent except Antarctica. The outbreak of COVID-19 is believed to have begun at a wildlife market in Wuhan in China.

In mid-March 2020, 80 000 cases and more than 3000 deaths from COVID-19 had occurred in China, where the outbreak began. However, because we live in a highly interconnected world, the virus quickly spread to the rest of the world.

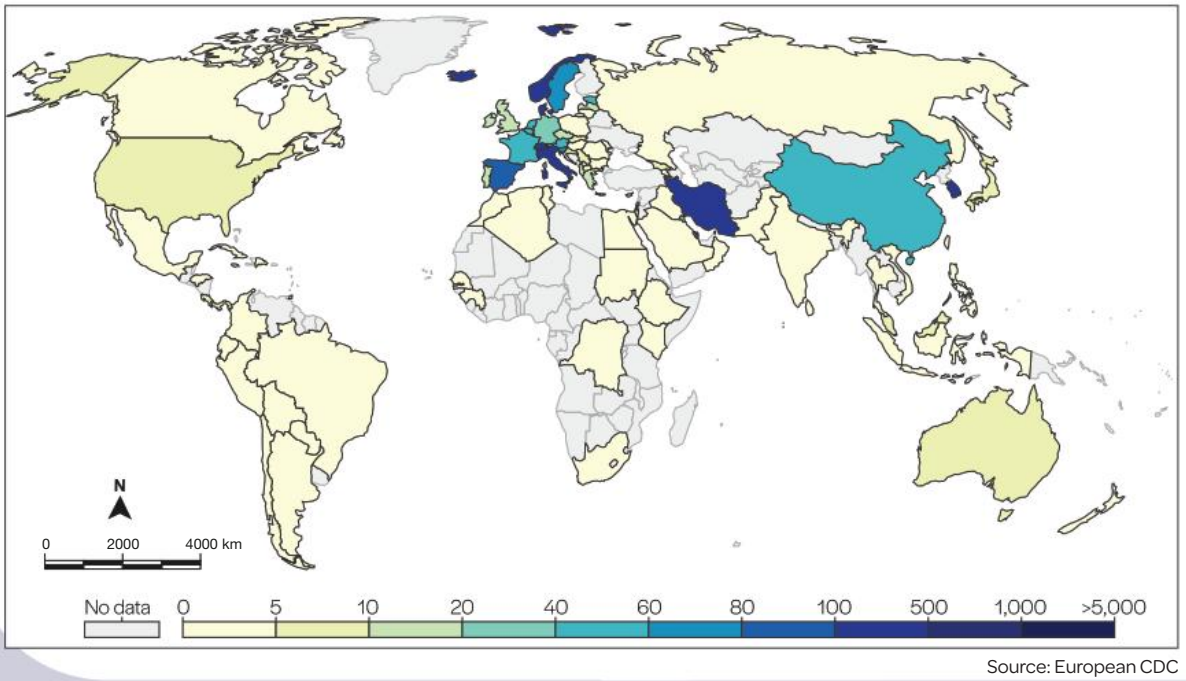
More than 60 000 cases of COVID-19 and 2500 deaths were reported in countries other than China. Europe became the new **epicentre** for the virus as it spread quickly in Italy and Spain, along with large outbreaks in South Korea, Iran and the USA.

The COVID-19 pandemic sparked a public health emergency around the world, with severe restrictions placed on the movement of people to slow the spread of the virus to assist medical resources to deal with the crisis. In Australia, travel bans were put in place, gatherings of people were banned, and people arriving back from overseas or in contact with a person infected with COVID-19 were forced to isolate themselves for 14 days.

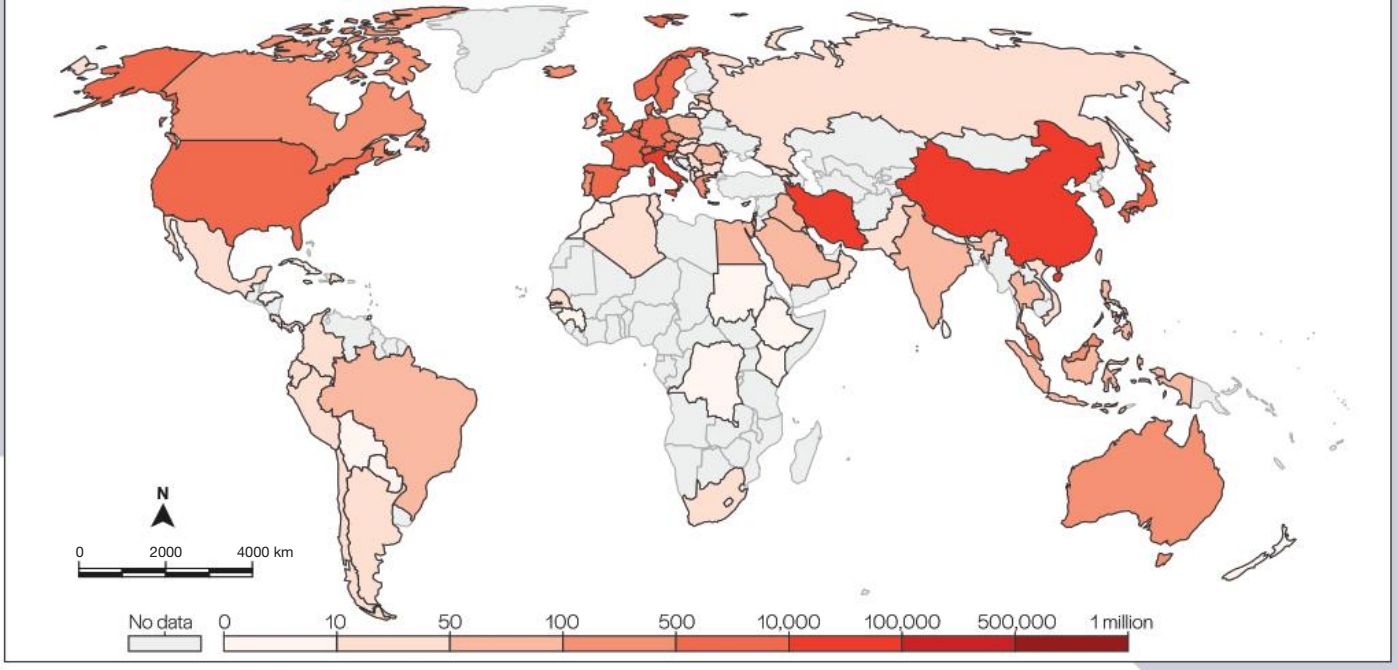
Source 1

Confirmed COVID-19 cases per million people on 14 March 2020

COVID-19 cases per million people by 14 March 2020



Source: European CDC



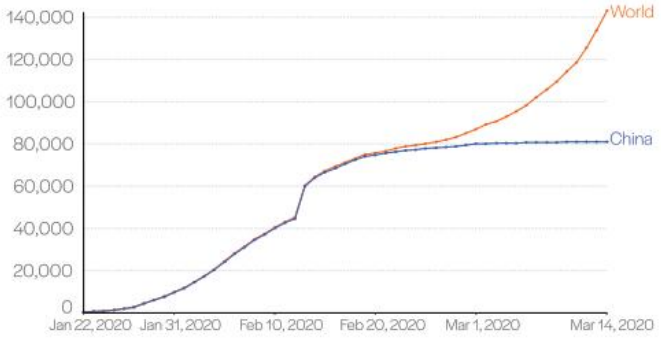
Number of cases of COVID-19 by 14 March 2020

Source: European CDC

Source 2

Confirmed COVID-19 cases worldwide on 14 March 2020

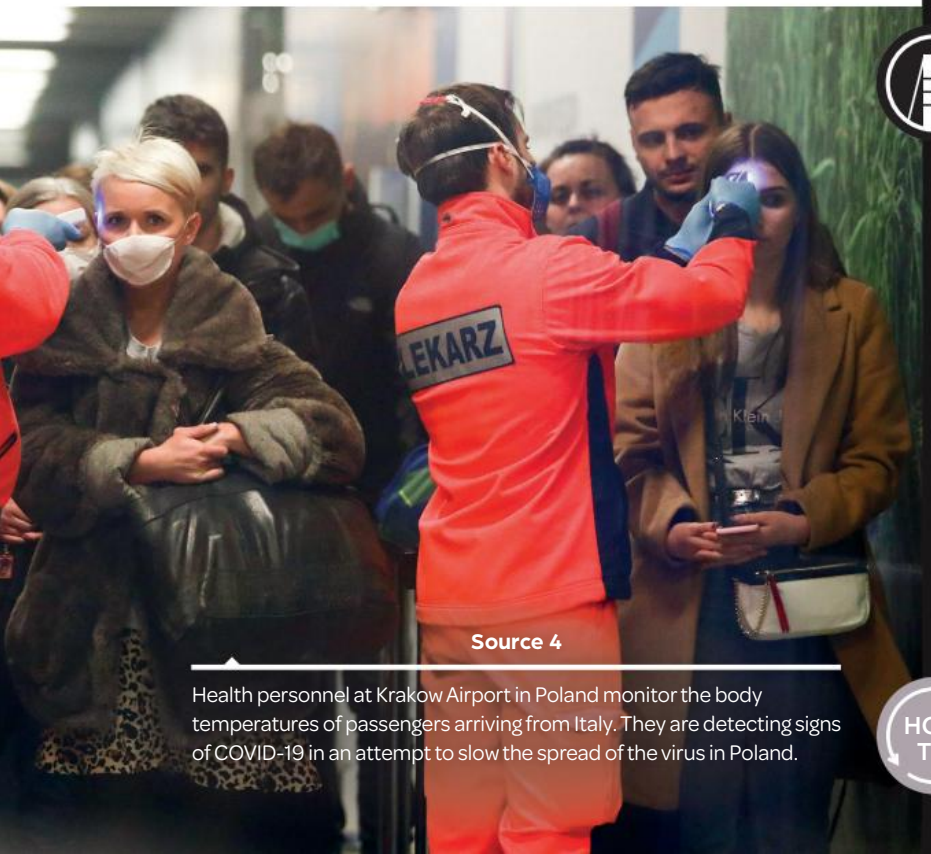
Early growth in COVID-19 cases



Source: European CDC

Source 3

Graph showing cases of COVID-19 virus by 13 April 2020



Source 4

Health personnel at Krakow Airport in Poland monitor the body temperatures of passengers arriving from Italy. They are detecting signs of COVID-19 in an attempt to slow the spread of the virus in Poland.

Learning Ladder 4.11

Show what you know

1 What is a pandemic?

2 How do you think the COVID-19 pandemic spread from Wuhan in China?

3 Source 4: What action is being taken here to slow the spread of the COVID-19 pandemic in Poland?

Analyse data

Step 1: I can use geographic terminology to interpret data

4 What is an epicentre? What was the original epicentre of the COVID-19 pandemic?

Step 2: I can describe patterns and trends

5 Source 2: USE PQE to describe the global spread of the COVID-19 virus by 14 March 2020.

Step 3: I can explain the reasons behind a trend or spatial distribution

6 Source 3: Explain the reasons behind the trends shown in this line graph.

Step 4: I can analyse relationships between different data

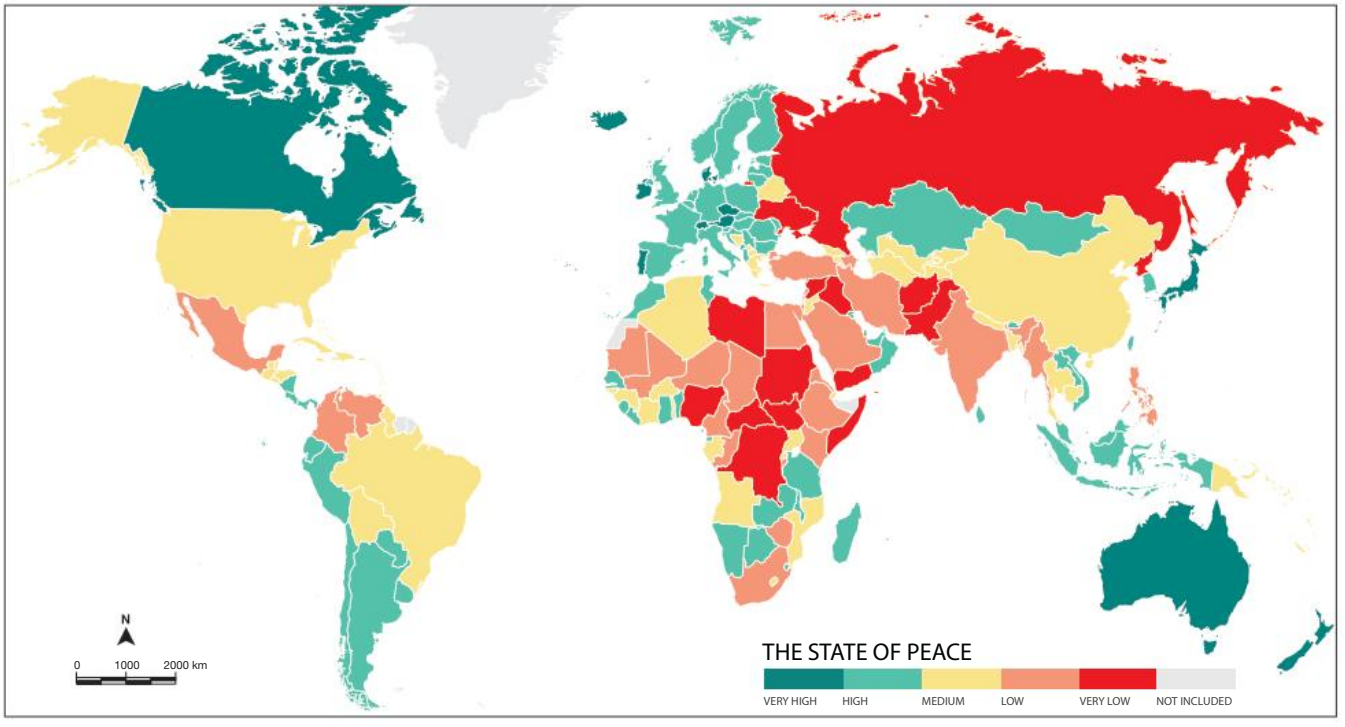
7 Source 1: Which countries were most greatly affected by the COVID-19 pandemic in March 2020? Why do you think this was the case?

HOW TO PQE, page 156

Masterclass

Learning Ladder

States of peace on a global scale, 2018



Source 1

Step 1

a **I can identify and describe spatial characteristics**

Identify and describe the different spaces you can see in Source 2.

b **I can identify and describe interconnections**

Give an example from Source 1 of a country where refugees are likely to come from. Give a reason for your selection.

c **I can identify responses to a geographical challenge**

Give examples of responses made by people living in war-torn countries.

d **I can collect, record and display data in simple forms**

Explain what the colour red in Source 1 represents.

e **I can use geographic terminology to interpret data**

Source 1: Is the northern or southern hemisphere the most peaceful?

Step 2

a **I can explain spatial characteristics**

Refer to Source 5 on page 137. Explain why planners are making this change to Prahran.

b **I can explain interconnections**

Refer to Source 3 on page 135. Explain why there is an interconnection between high-income countries and liveable cities.

Work at the level that is right for you or level-up for a learning challenge!

Source 2

Aerial image of Maharashtra, India

c **I can compare responses to a geographical challenge**

What two geographical challenges is the school feeding program trying to address (see page 135)?

d **I can recognise and use different types of data**

List two ways the data from Source 1 could have been collected.

e **I can describe patterns and trends**

Source 2: Use PQE to describe the distribution of peace on a global scale.

Step 3

a **I can explain processes influencing places**

Refer to Source 2. Why do you think this strip of houses has developed and where have people come from to move here?

b **I can identify and explain the implications of interconnections**

How has the interconnection between low-income migrants and open city land led to the development of the slum in Source 2?

c **I can compare strategies for a geographical challenge**

List three strategies to improve liveability for the people living in slums in Maharashtra in Source 2.

d **I can choose, collect and display appropriate data**

Look at Source 1 on page 130. For each city, select the criteria that they most need to improve to increase their liveability score.

e **I can explain the reasons behind a trend or spatial distribution**

Use SHEEPT to explain the pattern shown in Source 1.

Step 4

a **I can predict changes in the characteristics of places**

What changes might be introduced to a city centre to relieve traffic congestion (see page 136)?

b **I can evaluate the implications of significant interconnections**

Use Source 2 on page 115 to identify environments where people have had to adapt to extreme conditions.

c **I can evaluate alternatives for a geographical challenge**

What are key challenges for young people in low income countries (page 134)? What are the alternatives to improve their lives?

d **I can use data to support claims**

Refer to Source 2. Discuss whether this piece of data could be used to represent liveability in India. What other data would need to be collected to gain a clear understanding of this place?

e **I can analyse relationships between different data**

Which three countries have the most liveable cities in Source 3 (see next page)? Is there a relationship between these countries and their category in the Global Peace Index in Source 2?

Step 5

a **I can analyse the impact of change on places**

What impact did the outbreak of COVID-19 have on countries around the world in 2020 (see page 138)?

b **I can explore spatial association and interconnections**

Explain the spatial association between the patterns in Source 1 on page 128 and Source 3 on page 135.

Masterclass

c I can plan action to tackle a geographical challenge

Look at pages 132 and 133. How has Vienna taken action to improve the liveability of the city?

d I can evaluate data

Refer to Source 3. How relevant is data on healthcare when considering the liveability of a place? Use specific examples.

e I can draw conclusions from analysing collected data

Using data from the three sources, summarise the key elements that influence a place's liveability.

Source 3

The top 10 cities for liveability, 2018

Country	City	Rank	Overall Rating (100 = ideal)	Stability	Healthcare	Culture & Environment	Education	Infrastructure
Austria	Vienna	1	99.1	100	100	96.3	100	100
Australia	Melbourne	2	98.4	95	100	98.6	100	100
Japan	Osaka	3	97.7	100	100	93.5	100	96.4
Canada	Calgary	4	97.5	100	100	90	100	100
Australia	Sydney	5	97.4	95	100	94.4	100	100
Canada	Vancouver	6	97.3	95	100	100	100	92.9
Canada	Toronto	7	97.2	100	100	97.2	100	89.3
Japan	Tokyo	8	97.2	100	100	94.4	100	92.9
Denmark	Copenhagen	9	96.8	95	95.8	95.4	100	100
Australia	Adelaide	10	96.6	95	100	94.2	100	96.4

(100 = ideal; 0 = intolerable)

Capstone

How can I understand world liveability?

In this chapter, you have learnt a lot about world liveability. Now you can put your new knowledge and understanding together for the capstone project to show what you know and what you think.

In the world of building, a capstone is an element that finishes off an arch or tops off a building or wall. That is what the capstone project will offer you, too: a chance to top off and bring together your learning in interesting, critical and creative ways. You can complete this project yourself, or your teacher can make it a class task or a homework task.

Scan this QR code to find the capstone project online.

mea.digital/GHV7_G4

G5

Fieldwork

HOW DO WE USE DATA TO ANSWER GEOGRAPHIC QUESTIONS?

page 144

fieldwork task 1

page 146

HOW DO YOU USE WATER IN YOUR WORLD?

fieldwork task 2

page 148

HOW LIVEABLE IS YOUR PLACE?

fieldwork

page 150

HOW DO GEOGRAPHERS USE SURVEYS?

G5.1

How do we use data to answer geographic questions?

Fieldwork is an important part of Geography. It is one of the ways that geographers *learn by doing*, and it is a tool for discovering new things, learning about patterns and relationships, answering big questions and exploring the world around us.

Conducting fieldwork

When conducting fieldwork, geographers collect data. There are two main kinds of data:

- **quantitative data**
- **qualitative data**.

Quantitative data tends to be recorded in numbers; for example, the height of a building, the number of people in a population or the flow rate of a river.

Qualitative data tends to be more observational. You might write down descriptions of a place, conduct a field sketch or take photos as evidence to answer your research question.

Both aspects of data collection are very important, and you should try to collect both quantitative data and qualitative data in your fieldwork.

The steps you will follow to conduct your fieldwork study are:

- Step 1: Research question and hypothesis
- Step 2: Data collection
- Step 3: Data analysis.

Before you begin your own fieldwork task, let's explore each of these steps.

1 Research question and hypothesis

A **research question** is an overarching idea to be investigated. A good research question is one that is measurable and quantifiable. You need to be able to collect a clear range of data and answer the question within the limitations you are presented with. For example, will your fieldwork be conducted at school? Will you be able to survey members of the public?

After developing a research question, you will need to write a hypothesis. A **hypothesis** is an 'educated guess' about the answer to the research question. It's making a statement about what you think might happen.

Source: CartoonStock.com

2 Data collection

Before you begin any fieldwork study, you need to develop a list of **primary methodologies** and **secondary methodologies**. You also need to agree, as a class, on your data collection methods.

Primary methodologies are things that you will do in the field in order to find evidence to answer your research question, and to prove or disprove your hypothesis.

Secondary methodologies are ways that you can collect data back in the classroom to help you answer the question; for example, research using websites, books or other publications.

You can record your methods in a table like the one on the right.

3 Data analysis

Once you have been out in the field and collected data using primary and secondary methods, you need to communicate your findings.

You can communicate your research via a report, or display it as a visual poster or presentation. When you communicate findings, you need to ensure you highlight any patterns, *interconnections* or significant data that allow you to answer the research question – and to prove or disprove your hypothesis.

In your study of Geography this year, you will explore water as a resource – its spiritual, economic, cultural and aesthetic value. You will also look at what makes a *place* liveable. Now you are going to conduct your own research in your local area to answer a research question and write a mini fieldwork report.

Primary data collection methods	Secondary data collection methods
Surveys	Online research
Field sketches	Research published in a textbook
Photographs	Podcasts or audio recordings

Source 1

The fishing village of Reine in the Lofoten Islands, Norway

G5.2

fieldwork task 1

How do you use water in your world?

Domestic water use accounts for only 12 per cent of Australia's total water use – yet Australia has one of the highest rates of water consumption per person in the world. The average daily water use is 340 litres per person, or 900 litres per household. Average water consumption ranges from 100 litres per person in some coastal areas, to over 800 litres per person in the **arid** inland areas.

1 Research question and hypothesis

Research question

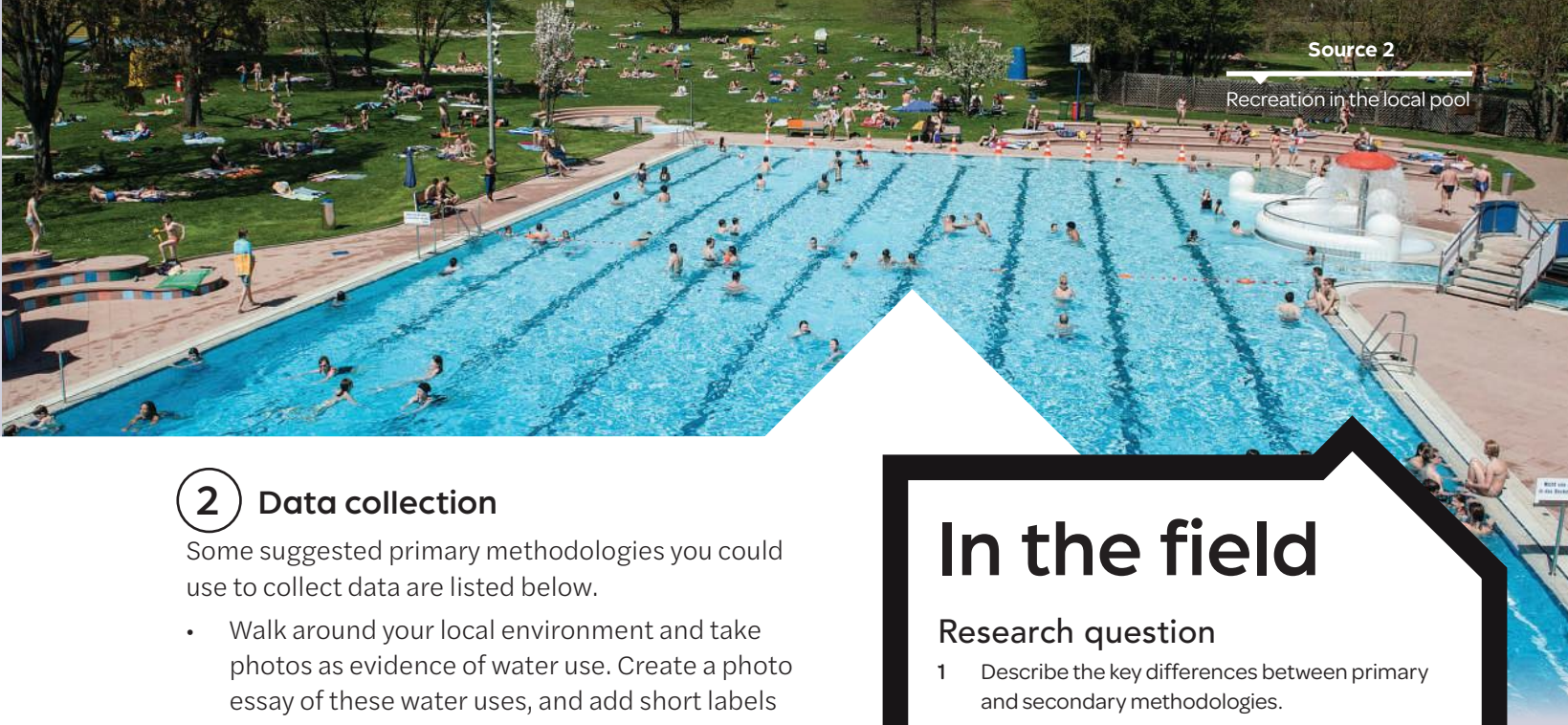
How is water used in the local community?

Hypothesis

Water is used in a range of ways for both natural and human environments.

Source 1

Exploring the edge of the lake



Source 2

Recreation in the local pool

2 Data collection

Some suggested primary methodologies you could use to collect data are listed below.

- Walk around your local environment and take photos as evidence of water use. Create a photo essay of these water uses, and add short labels to explain each use.
- Create a survey for your classmates or family to identify which type of domestic water use they think contributes most to our daily water consumption per person. Multiple-choice questions work best, as you can then create bar graphs to display your data. Questions you could ask include the following:

? Which domestic water use do you think contributes most to our daily water consumption per person?

☐ Toilets ☐ Sinks ☐ Hoses

☐ Shower ☐ Other:

? How is water used in the local community?

☐ Pools ☐ Dams ☐ Lakes

☐ Fountains

- Using appropriate techniques, complete a field sketch of water use, movement or value in your local community.

3 Data analysis

Once you have collected the data, you need to present and analyse your results. Use the steps listed in 'In the field' to help you complete your fieldwork analysis.

In the field

Research question

1 Describe the key differences between primary and secondary methodologies.

2 List the primary and secondary methods you will use to investigate the research question.

Data collection

3 Outline the characteristics and history of your local region in four or five sentences.

4 Name two primary fieldwork techniques you used to complete your fieldwork.

5 Name two secondary resources you used in the lead up to the fieldwork.

6 Answer this research question: 'How is water used in the local community?' Consider:
- How many different uses were present in your local area?
- Do you think that water is used wisely in these places?
- Which domestic water use do you think consumes the most water?

Data analysis

7 Which domestic water use was the most reported?

8 Why do you think this is?

9 Were you surprised by these results? Why or why not?

10 Was the hypothesis correct or supported by the evidence? Why or why not?

11 Record five key pieces of evidence that support your answer – these could be data, photos, sketches or surveys.

Evaluation of methods

12 Which methods were the most successful for collecting data to answer the research question? Why?

13 Which methods were the least successful for collecting data to answer the research question? Why?

14 Suggest three ways that water could be better conserved in your local region.

G5.3

fieldwork task 2

How liveable is your place?

Within any community, there are things that can be improved to increase the overall liveability of that place. For example, Source 1 shows an empty housing development piled with bricks and overgrown with weeds. As Geographers, we can help town planners develop ideas about how to redesign *places* such as these – and make more useable *spaces* for the community.

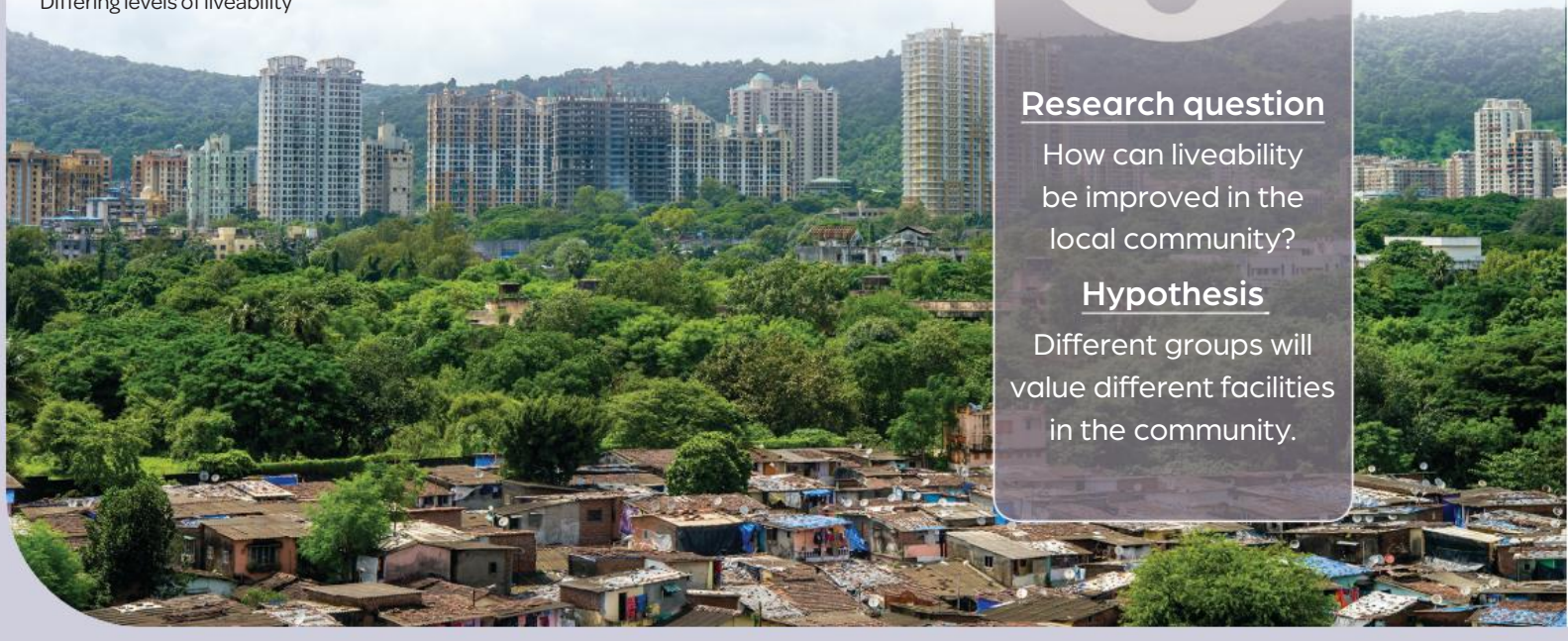
1 Research question

Source 1

An empty lot, ready for building to begin

Source 2

Differing levels of liveability



Research question

How can liveability be improved in the local community?

Hypothesis

Different groups will value different facilities in the community.

Source 3

Students checking survey and map materials

2 Data collection

Some suggested primary methodologies you could use to collect data are listed below.

- Walk around your local community and take photos of places where **infrastructure** could be improved to increase **liveability**. Create a photo essay of these examples, adding short annotations or labels to explain how they are being used or how they could be improved.
- Create a survey for your classmates or family to identify which areas in the community require improvement. Multiple-choice questions work best, as you can then create bar graphs to display your data. Questions you could ask include the following:

? Which aspects of the community do you value?

☐ Hospitals ☐ Schools ☐ Housing estates

☐ Shopping centres ☐ Parklands ☐ Other:

? Which aspects of the community need to be improved?

☐ Hospitals ☐ Schools ☐ Housing estates

☐ Shopping centres ☐ Parklands ☐ Other:

- Using appropriate techniques, complete a field sketch of a location that could be altered to improve the liveability of your local area. Annotate the changes that you suggest for this place.

3 Data analysis

Once you have collected the data, you need to present and analyse your results. Use the structure listed in 'In the field' to help you complete your fieldwork analysis.

In the field

Research question

1 Describe the key differences between primary and secondary methodologies.

2 List the primary and secondary methods you will use to investigate the research question.

Data collection

3 Outline the characteristics and history of your local region in four or five sentences.

4 Name two primary fieldwork techniques you used to complete this fieldwork.

5 Name two secondary resources you used in the lead up to the fieldwork.

6 Answer the research question: 'How can liveability be improved in the local community?' Consider:

- What is the definition of liveability?
- What facilities make your local region or area liveable?
- What facilities could be improved? Why?
- Brainstorm different groups of people within your local community, and suggest what facilities they might value. Give some reasons to back up your ideas.

Data analysis

7 Which facilities do people think make a place more liveable?

8 Are there particular areas in your community that require improvement? Describe these places.

9 Why do you think this is?

10 Were you surprised by these results? Why or why not?

11 Was the hypothesis correct or supported by the evidence? Why or why not?

12 Record five key pieces of evidence that support your answer – these could be data, photos, sketches or surveys.

Evaluation of methods

13 Which methods were the most successful for collecting data to answer the research question? Why?

14 Which methods were the least successful for collecting data to answer the research question? Why?

15 Based on your research, redesign an area in your local region to improve the liveability for the local community.

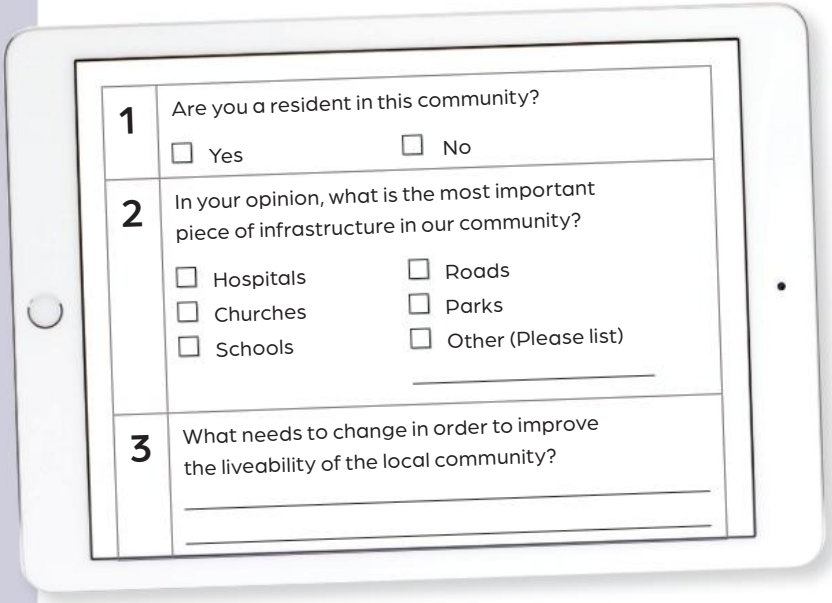
How do geographers use surveys?

In Geography, surveys are useful ways to collect data in the field. Surveys could be in the form of a questionnaire, where you ask questions about a topic to get an understanding of people's views.

You can also do a vehicle survey, where you tally the number of vehicles that pass in a particular amount of time. Surveys provide you with a sample of what is occurring in a natural or human *environment*.

Surveys can be written by hand or prepared on software such as Survey Monkey or Google Forms.

Some sample questions for a questionnaire about liveability follow.



Source 1

A sample questionnaire

In the field

1 Are surveys a primary or secondary data collection method?

2 There are three main stages to fieldwork: defining the research question, data collection and data analysis. In which stage would a survey be a useful tool?

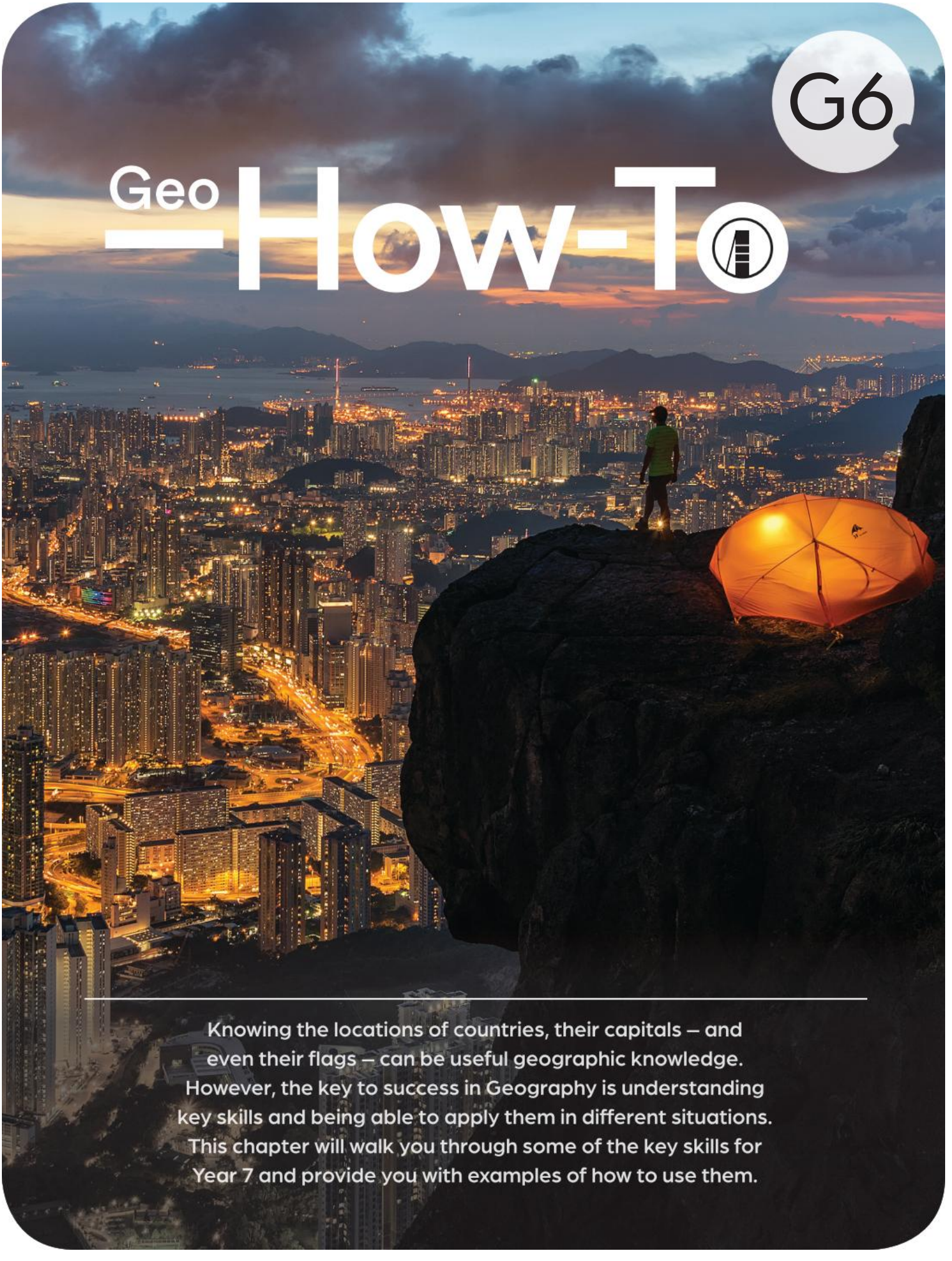
3 Write a survey question that would gather quantitative data about water use.

4 Write a survey question that would gather qualitative data about water use.

5 Why are multiple-choice questions often used in surveys?

6 Follow these steps to design a survey on a topic you are passionate about:

- a Write an objective for your survey. Think about who will be reading the data and what decisions will be made based on the data you collect. Make sure your objective is short and clear.
- b Write a title for your survey.
- c Write two or three sentences to introduce and explain your survey to the people who will be completing it. Decide whether your survey will be anonymous or not.
- d Choose how you will create your survey: on paper, on your computer using Word or Excel, or using an online platform such Survey Monkey or Google Forms.
- e Using the method you chose in part d, write 10 survey questions. Keep your questions short and specific. Try to use multiple-choice questions to make data analysis easier.
- f Swap your survey with someone else in your class. Proofread and evaluate each other's surveys. Give appropriate feedback to your classmate about how they can make their survey more effective.
- g With your teacher's permission, conduct your survey in your class, school or community.



G6

Geo How-To

Knowing the locations of countries, their capitals – and even their flags – can be useful geographic knowledge. However, the key to success in Geography is understanding key skills and being able to apply them in different situations. This chapter will walk you through some of the key skills for Year 7 and provide you with examples of how to use them.

HOW TO

Mapping with BOLTSS (NA)

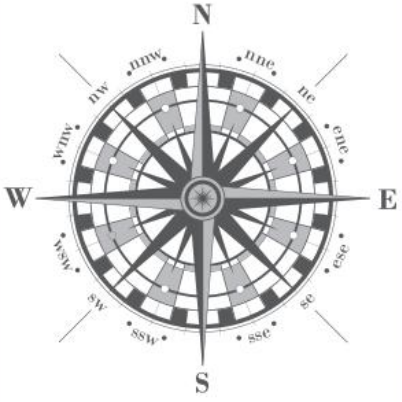
Every map needs **BOLTSS**! BOLTSS is an acronym – every letter of this word is the first letter of a key step to ensure that your map can be understood by its audience. When you create a map, use the BOLTSS checklist so you can be sure you have completed your mapping task correctly. The NA is to remind you to be neat and accurate.

B Border

Borders are important, because they show the edges of the mapping field. A border provides a clear area for you to construct your map, and makes it look clear and neat.

O Orientation

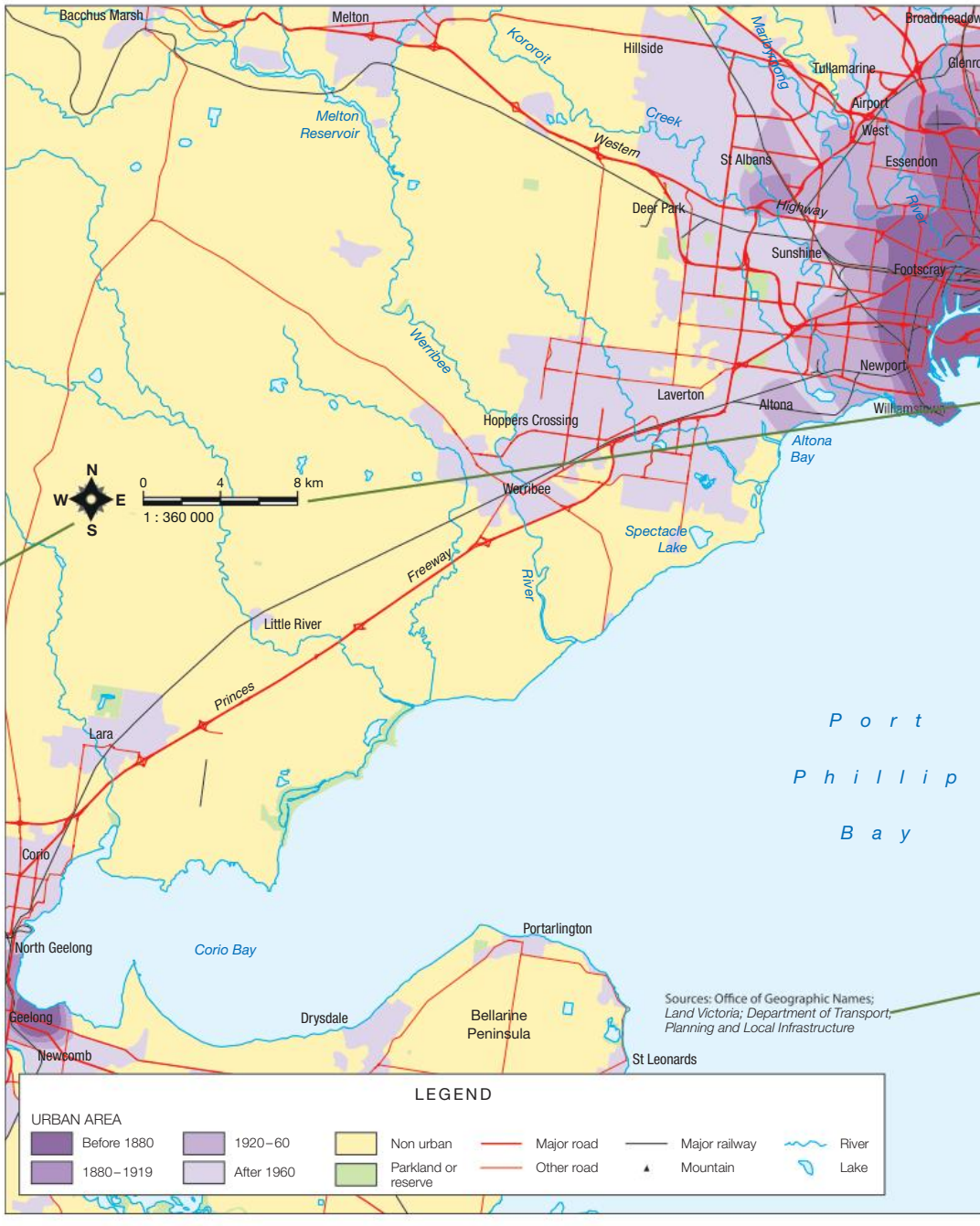
An orientation (or compass) helps us understand direction when we read the map. Use all 16 points of the compass to give accurate directions. Orientations should be drawn as a 16-point compass.



Source 1

A 16-point compass

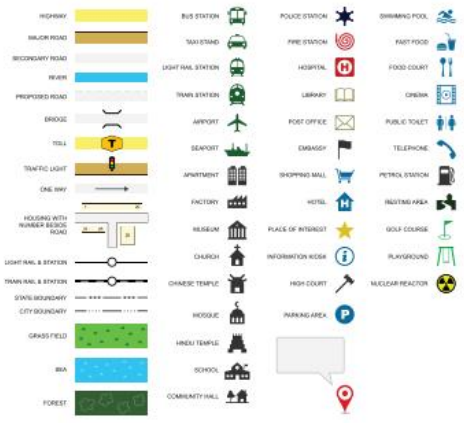
Urban growth in Melbourne



Source: Matilda Education Australia

Source 2

A sample legend



L Legend

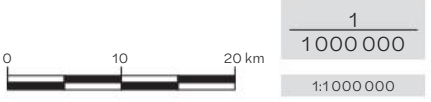
A legend – sometimes called a 'key' – is vital for understanding the map. Without a legend, we would not know what the colours and symbols stand for, and we would not be able to interpret patterns or the way something is spread out (which is called 'distribution').

T Title

A title tells us what the map shows, and gives us some understanding about it. Make sure you always add the date and the time to your sketch maps – this will allow you to monitor change over time in a location. The title of this map is 'Urban growth in Melbourne'.

S Scale

A scale gives us information about how big something is in real life. So while a house on a map might be 2 cm across, it might actually represent a house that is 20 m wide in real life. There are many different types of map scales: linear, ratio and fraction.



Source 3

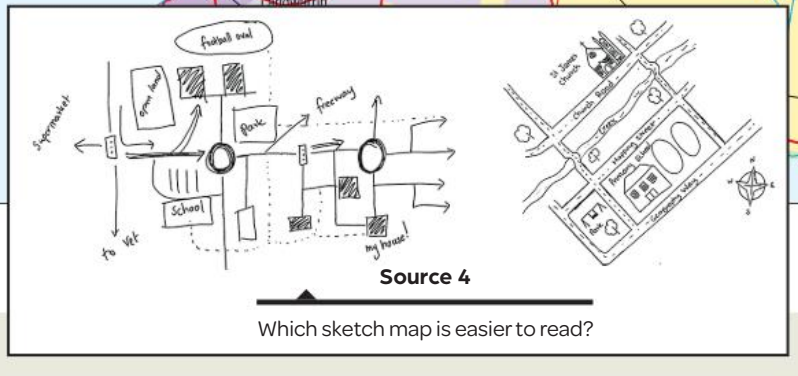
Map scales: linear, fraction and ratio

S Source

When you create a map, it is important that you let the reader know where you got the information – which is known as your source. The source can also indicate whether or not the map is trustworthy.

(NA) Neatness and Accuracy

When we read a map, we rely on it being neat and easy to read – but we also expect that the data has been displayed accurately. So when you construct a map, it is important to correctly show the patterns and distributions you see in the data.



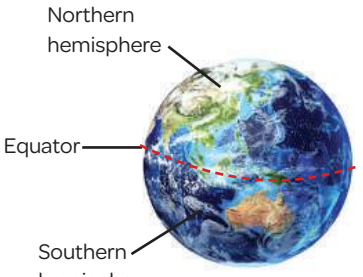
Source 4

Which sketch map is easier to read?

HOW TO

Mapping skills

Direction



Source 5

Earth

Imagine trying to find the location of a party without using any directional terms. How would you know where to go and where you needed to end up? Direction is a very important concept in Geography because without it we are all lost!

Source 6

A compass

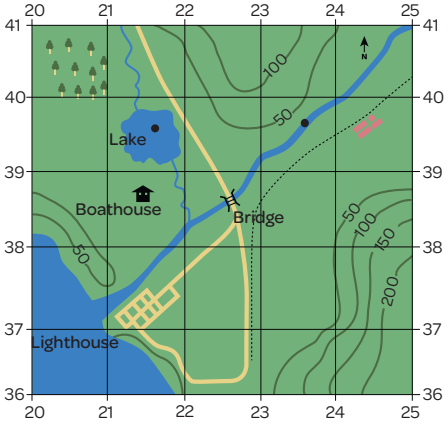
Up until now, direction may have been described to you as 'left' and 'right', 'above' or 'below'. While these are helpful, in Geography we also need to use compass points: north, south, east and west.

Consider the world globe (Source 1). Around the centre there is a line of **latitude** called the **equator**. North of the equator is the northern hemisphere. Here we find continents such as North America, Europe, parts of Asia and Africa. South of the equator is the southern hemisphere – this is where we live!

Sometimes, we mistakenly use the word 'above' instead of 'north', or 'below' instead of 'south'. If you say something is above the equator, what you are really saying is that it is floating in the air over the top of it! If you say something is below the equator, you are really saying that it is buried beneath it! Be careful how you use directional terms in Geography to ensure you are sending people in the right direction.

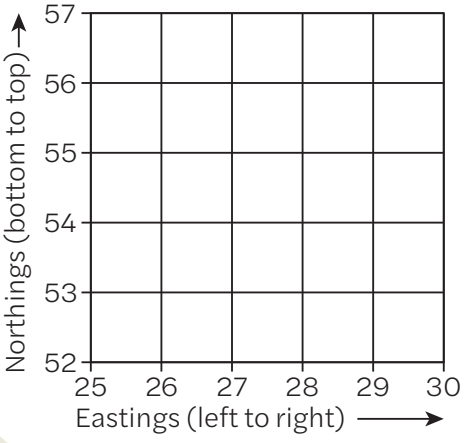
Source 7

A map with grid references



Source 8

An example of grid references



Grid referencing

It is not always easy to describe a specific point on a map using directional terms. For example, you may want to highlight the exact position of the boathouse using the map in Source 7. If you spent time explaining where this was, you would be describing the relative location of that place. For example, 'It is north–north–east of the lighthouse and west of the bridge'. The alternative is to use the grid references or area reference (AR) to show the exact or absolute location of that place.

To read an area reference, we first look at the numbers (or letters) associated with the vertical lines, reading from left to right – these are called eastings. We then look at the numbers associated with the horizontal lines, reading from the bottom of the map to the top – these are called northings. In this case, the boathouse is located at the four-figure grid reference AR2138. This reference takes us to the bottom left-hand corner of the grid square that the boathouse is located in. The lake is located in AR2139 and the bridge is located in AR2238.

Scale

Look at Source 5 again. Here we have an image of the Earth. Logically, we know that this image of the Earth is not to scale. In reality, the Earth is over 12 700 km in diameter and would not fit in this book!

Scale is important in Geography as it allows us to make maps and other images, and shrink them down to a size where we can see patterns, distributions and changes over time. Scale can be written in a number of ways. Typically, scale is displayed using a line that acts like a ruler, showing you how many centimetres on the map represent the real distance. Scale can be used to determine size and distance.

Source 9

An example of a linear scale

Source 10

Obviously this map is not to scale. It is a large area that has been shrunk down to fit on this page. The scale on this map helps us determine how big things are in real life.

HOW TO

PQE

In Geography, we use maps and graphs so that we can understand what is happening around us. In many cases, these maps and graphs provide us with information about patterns and the location (or distribution) of specific items.

The formula PQE helps us to describe these patterns and their distribution. P stands for pattern, Q stands for quantify (or 'how many') and E stands for exception.

P Pattern

A pattern is a trend in the data. When you are looking for a pattern, you need to read the legend and interpret what the colours or symbols mean.

On a graph or map, you might notice that all the data points tend to be clustered in one spot, or that the data points are distributed unevenly. You might need to use compass points or the names of places to describe where on the map these clusters appear. For example, when observing the map in Source 11, we notice that western USA prefers mint chocolate chip and OREO cookies and cream ice-cream, while the eastern side prefers vanilla and chocolate.

Descriptive words you can use include: *clustered, even, uneven, highly distributed, north, south, east, west, increase, decrease* and *fluctuate.*

Q Quantify

When we quantify our pattern, we need to use numerical data to provide evidence of what we see.

You could obtain data by using the legend, by using the scale to measure, or by conducting a count. You need to ensure that the data you provide relates directly to the pattern you recorded earlier.

For example, we noticed that western USA prefers mint chocolate chip and OREO cookies and cream ice cream, while the eastern side prefers vanilla and chocolate. To quantify, we could count the number of states that like these ice-cream flavours. Six states in the west prefer mint chocolate chip and four prefer OREO cookies and cream.

E Exception

An exception is a trend on the map or graph that doesn't 'fit in' with our original pattern statement.

When you spot an exception on a map or graph, it is good to quantify it to provide a comparison to our original operations. For example, we noticed that western USA prefers mint chocolate chip and OREO cookies and cream ice cream, while the eastern side prefers vanilla and chocolate. To quantify this, six states on the west coast prefer mint chocolate chip and four prefer OREO cookies and cream. However, Wisconsin, which is on the east side of the USA, has also voted mint chocolate chip as its favourite flavour – which is an exception to our original pattern.

What is the difference between qualifying data and quantifying data?

PQE helps us describe patterns and distributions. When we describe, we 'say what we see'. In a PQE analysis, we do not explain or give a reason why we see patterns, this is done in a SHEEPT analysis (page 158).

To quantify means to use percentages, counts, ratios or data from the legend to provide more details about the different patterns you are writing about. To qualify a statement means you use words such as 'large', 'many', 'small scale', 'enormous', 'broad' or 'tiny' to describe a pattern or change.

By using quantifiable data, we can more easily see key differences between locations or even monitor change over time. Imagine that your PQE analysis stated: 'There are a lot of people who like ice-cream in the USA'. Does this sentence allow you to create a detailed visual of what is happening around the country? Or does this quantified statement provide more detail: 'Six states in the west prefer mint chocolate chip and four prefer OREO cookies and cream'?

How do I start my PQE sentences?

When writing a PQE analysis, start sentences with the following key terms:

Pattern: Overall …

For example:

Overall, the west side of the USA prefers mint chocolate chip and OREO cookies and cream ice cream, while the east side prefers vanilla and chocolate.

Quantify: To quantify …

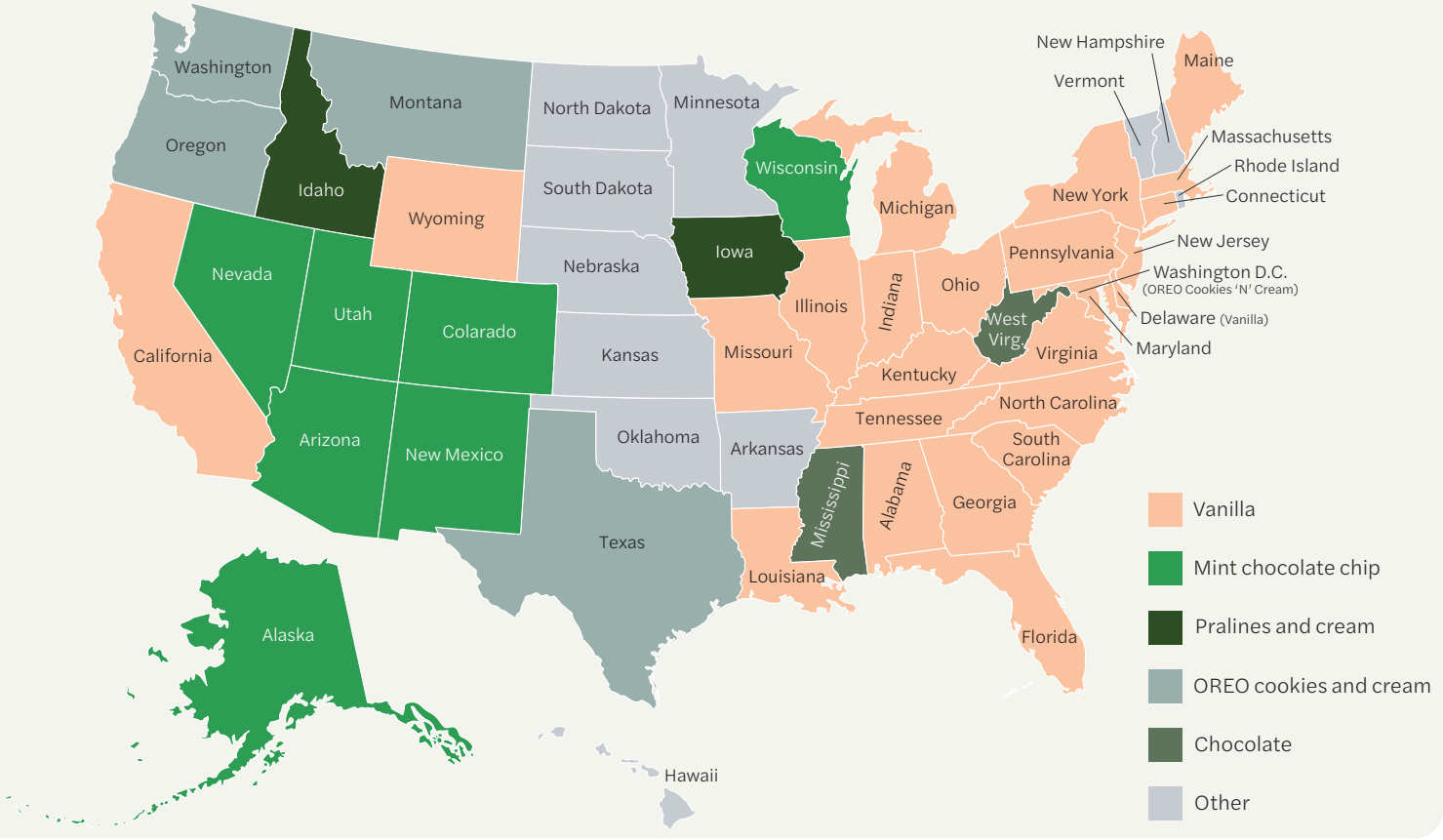
For example:

To quantify, six states on the west coast prefer mint chocolate chip and four western states prefer OREO cookies and cream.

Exception: However …

For example:

However, the state of Wisconsin, which is on the east side of the USA, has also voted mint chocolate as their favourite flavour, which is an exception to the pattern.



Source 11

Map of the United States showing favourite ice-cream flavours

HOW TO

SHEEPT

SHEEPT is an acronym that helps you remember the reasons why a spatial pattern occurs. This acronym stands for: Social, Historical, Economic, Environmental, Political and Technological.

S Social

Social factors are anything to do with people. Social factors include population, culture, language and religion.

H Historical

Historical factors are anything to do with our past. Historical events, buildings, people and changes to climate all influence what we see in our world today.

E Economic

Economic factors are those relating to money. In Geography, income, costs of things and how much money is spent can provide us with information about a *place*. Tourism is a huge economic factor for many regions.

E Environmental

Environmental factors are those relating to the natural or human environments on Earth. Humans can manipulate the environment to suit their needs.

How do I write a SHEEPT analysis?

SHEEPT is usually used to explain why patterns or distributions may be occurring in a particular region. It can also be used to expand our thinking when annotating images or considering new geographical content. When completing a SHEEPT analysis, you do not need to use each of the terms directly. The following is an example of how we can write a SHEEPT analysis for an image. The highlighted terms indicate the use of a SHEEPT term. Can you identify all the SHEEPT terms used?

Source 12

The Parthenon in Athens attracts tourists wanting to find out about ancient Greek culture, history and democracy.

Source 12 is an image of the Parthenon in Athens. This is a historical site that was once used as the city treasury in ancient Greece; however, today is it largely a tourist site. Tourism is important for Greece's economy and many locals are employed in the industry as tour guides or restaurant workers. Many tourists enjoy visiting Greece as it is well known for its warm, sunny weather; beautiful beaches; and rocky cliff faces. When tourists travel to historical or other sites in Greece, they are expected to follow local laws and customs. Due to the age of this historical site, it is constantly renovated by large machinery and monitored by officials to ensure tourists and locals are safe when exploring the grounds.

P Political

Political factors are those to do with the government or leading groups, and usually involve laws and policies.

T Technological

Technological factors relate to the different kinds of technology that we have access to. This could be in the form of gadgets, **spatial technology** – or even medical technology.

HOW TO

Sketches and annotating

Field sketches are an excellent way of recording data when you are investigating a research question.

Sketches allow you to annotate movement, patterns or any interconnections you see. Field sketching is not a test of your artistic skills – the idea is to record a simplified version of what you can see.

T Title

Provide a heading for your sketch that tells readers what it is and where it is located. You might wish to record both the absolute and relative locations.

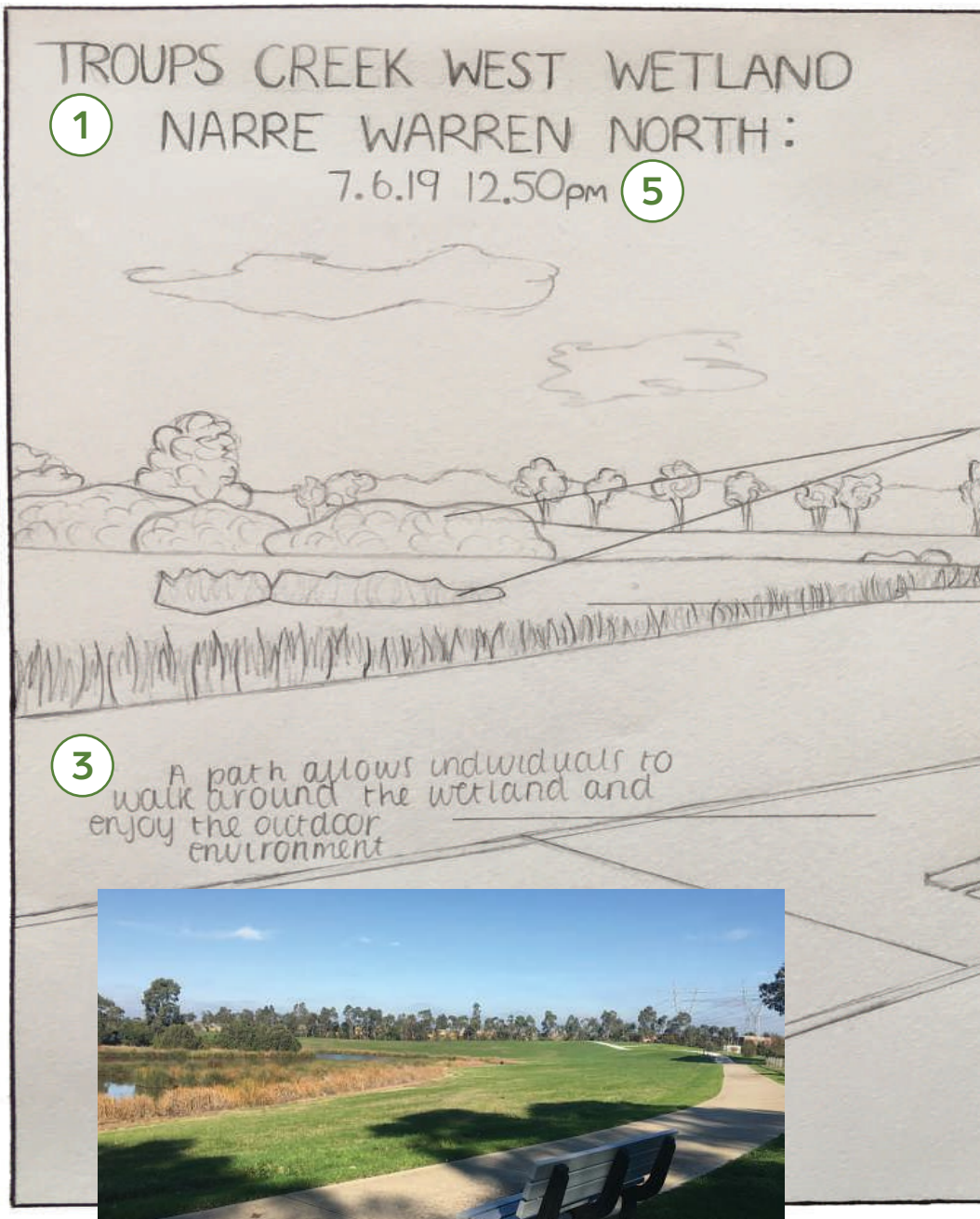
O Orientation

An orientation shows the direction that you were facing when you made your sketch. You need to use a compass so you can record a correct orientation.

A Annotations

Annotations (or notes) are the most important thing to complete when drawing a field sketch.

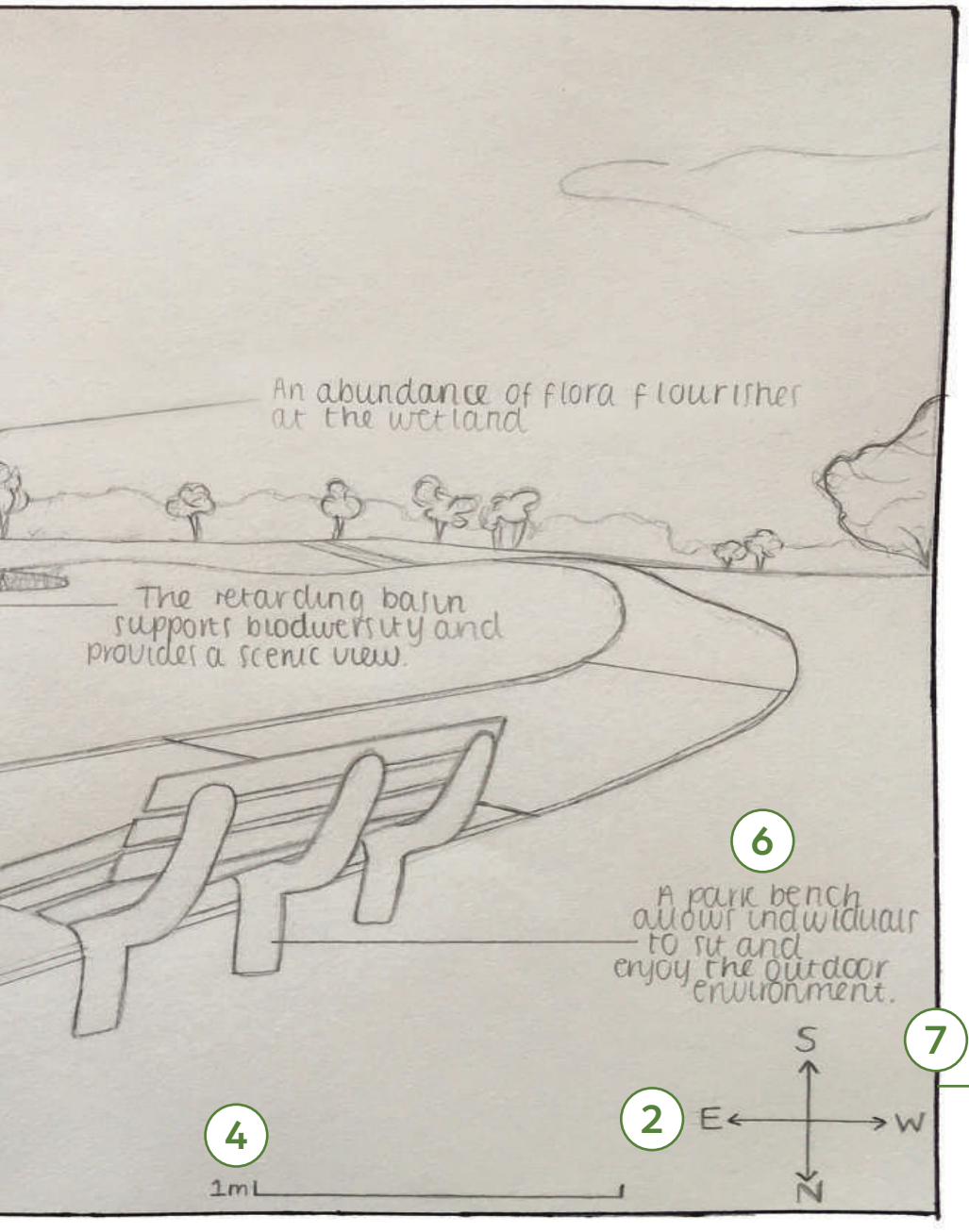
Annotations allow you to record details about what you see, and explain how elements of your drawing relate back to the research question. Make sure that the lines to your annotations are made with a ruler – and that they do not overlap!



When you are making a field sketch, you need to remember TOASTIE!

TOASTIE will help you remember the key skills when making a field sketch.

It stands for Title, Orientation, Annotations, Scale, Time, Information and Edge.



Source 13

An annotated sketch

S Scale 4

Most sketches are not made to scale. However, all geographical maps and sketches require a scale to give the reader some indication of size.

To estimate a scale, use a ruler or pace out the area you have sketched. Then use a ruler to identify how large the same area is on your drawing.

For example, you might estimate that the path you are looking at is 1 m wide, and when you measure your drawing of the path it is 1 cm wide. So your rough estimated scale is 1 cm = 1 m.

T Time 5

By recording the time your sketch was completed, you can analyse how the environment changes over the course of a day or a month – or even years!

I Information 6

The annotations on your sketch need to be longer than one word. Annotations should be at least one sentence, and they should inform the reader and help them to identify patterns.

E Edge 7

Always include a border so it is clear where your sketch starts and ends.

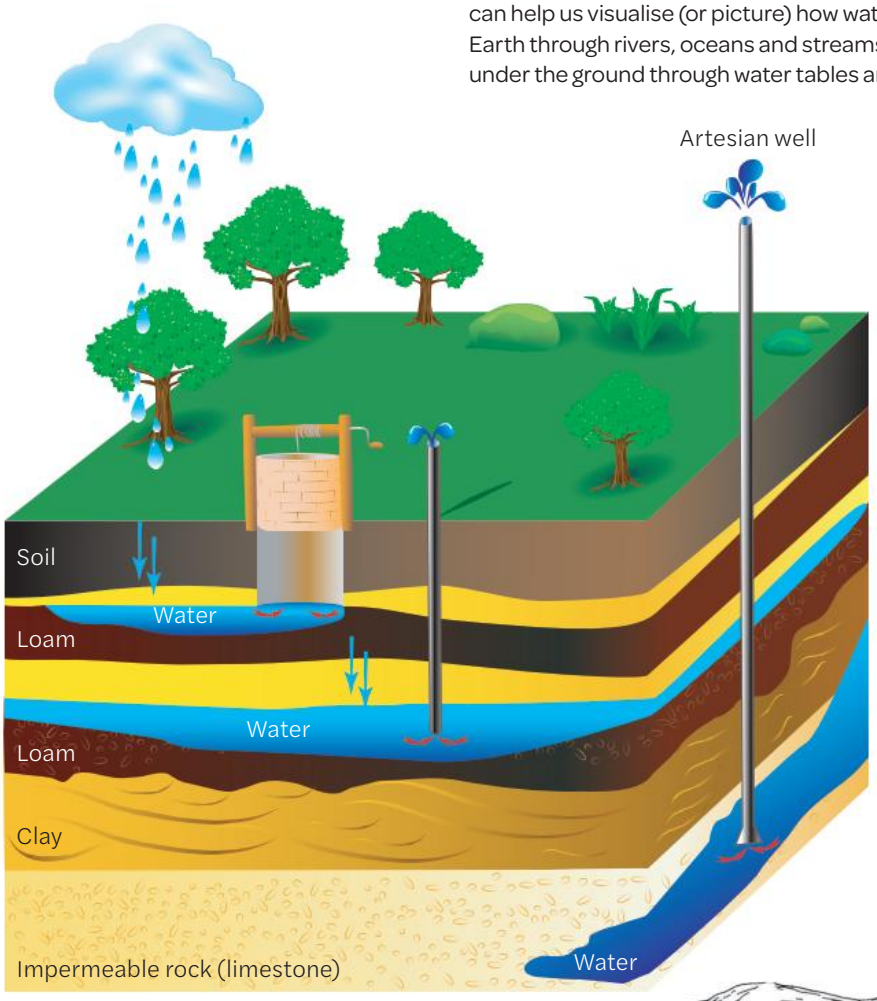
HOW TO

Visual communication

Block diagrams

Block diagrams are a useful way of drawing landscapes in order to show what is happening above ground and below ground.

For instance, when we consider the movement of water, block diagrams can help us visualise (or picture) how water can move on the surface of Earth through rivers, oceans and streams – and also how it can move under the ground through water tables and pipes.

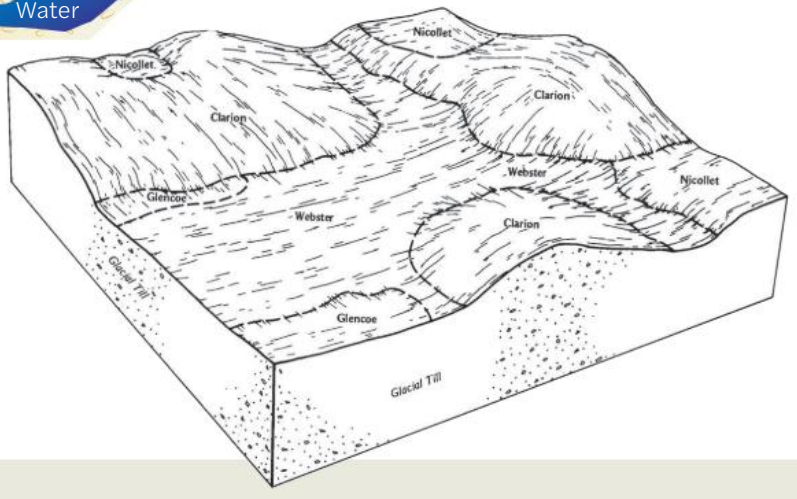


When you create a block diagram, make sure you draw a three-dimensional (3D) object that has an equal amount of drawing room both above and below the surface of Earth.

Annotations are important on a block diagram, as they help your audience to interpret your drawing.

Source 14

A block diagram

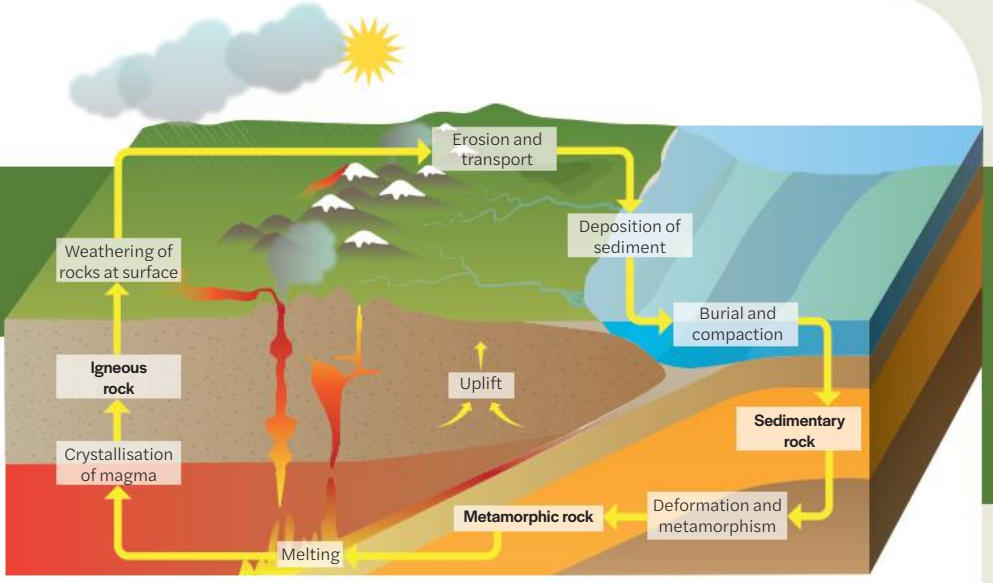


Source 15

Sketch of a block diagram

Flow diagrams

Flow diagrams are helpful to show processes, or to show how different parts of the environment are *interconnected*. Arrows show the movement between stages, or show how different items are connected.



Source 16

A flow diagram

Photo essays

A photo essay is a way of presenting information visually. It is ideal for showing characteristics of a place or a process.

A photo essay usually includes a series of photos with specific annotations or captions. The captions provide brief background information about the key features of the image, or the meaning behind the selected image.

Source 17

A photo essay

Preparing for the flood with sandbags

Heavy rainfall could create a problem

Floodwaters are rising

The massive clean-up

HOW TO

Graphing

Simple graphs

Graphing is an important way of displaying geographic information. It shows us patterns and changes over time.

When you are creating a graph, the word to remember is SALTS! SALTS is an acronym based on the first letters of four key things about graphs: Scale, Axis, Legend, Title and Source.

S Scale

The scale of your graph will depend on the data you are trying to visualise. To find out the axis scale you need for a graph, first find out the 'range' of the numbers, which means finding the lowest value and the highest value, and then fill in the numbers in between so you can mark your data points easily.

A Axis

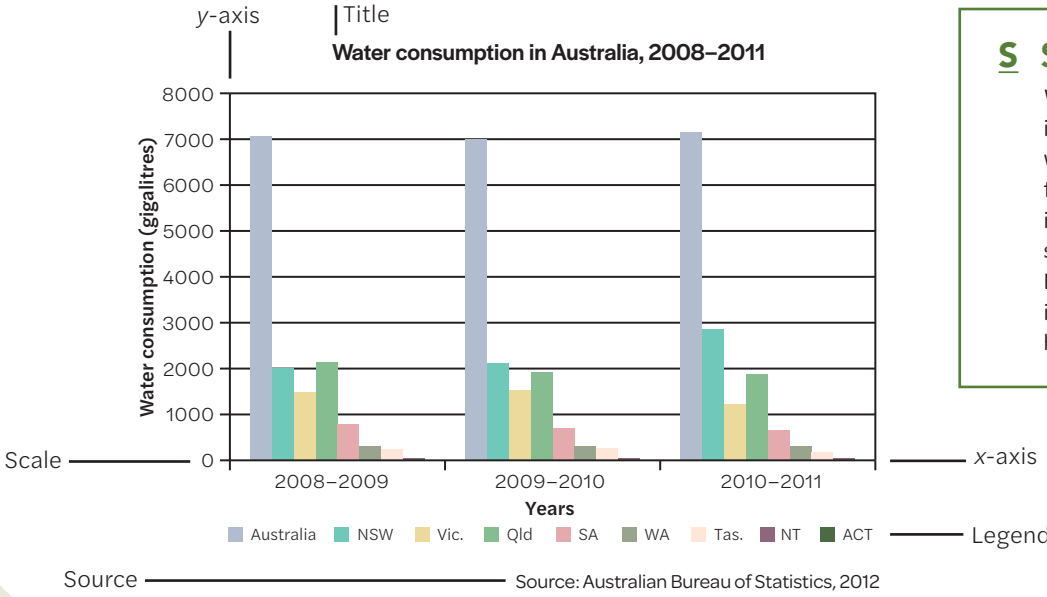
Each graph has an *x*-axis and a *y*-axis. The *x*-axis is the horizontal axis and the *y*-axis is the vertical axis. Make sure you label each axis!

L Legend

A graph often uses colours to represent data. A legend shows the audience what these colours mean and how to read the data.

T Title

A title lets your audience know what your graph is showing.



S Source

When you graph information, it is important to acknowledge where you gained the data from. Maybe you collected it yourself or maybe you sourced it from a website. By stating the source of your information, the reader knows how reliable it is.

Source 18

A bar graph featuring SALTS

Climate graphs

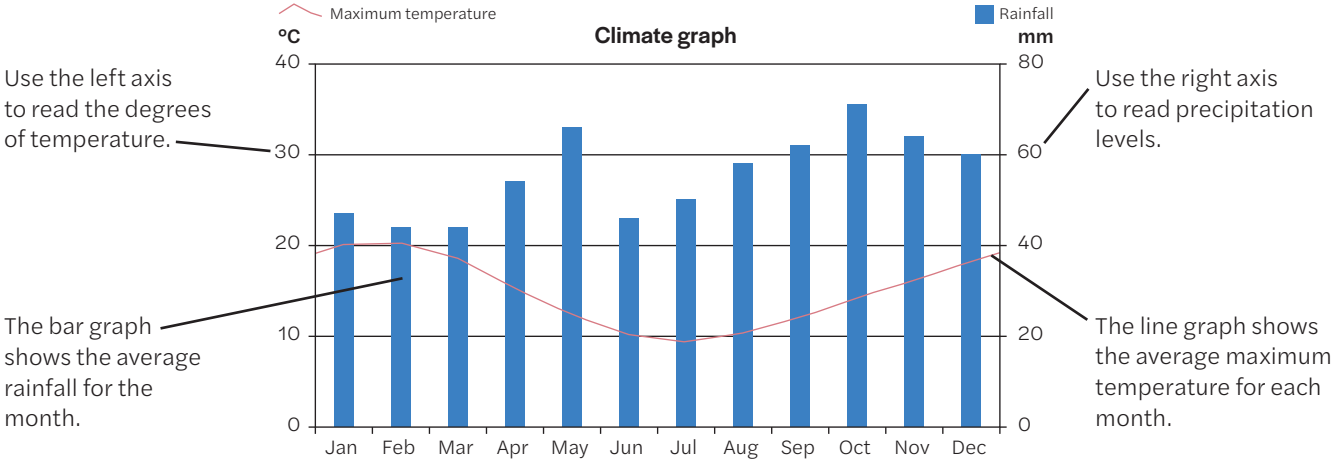
Put very simply, a climate graph is two graphs in one. It shows two types of data on one graph. Climate is the average temperature and level of precipitation (rainfall, snow etc.) that a region usually receives over a year.

How do I read climate graphs?

This climate graph shows:

- the temperature (in degrees Celsius) on the left *y*-axis
- the amount of precipitation (in millimetres) on the right *y*-axis
- the months of the year on the horizontal axis, or *x*-axis
- the red line (or maximum temperature) varying throughout the year, peaking December to March and decreasing from April to July
- the amount of precipitation varying, shown with the blue bars. It tends to be highest in spring from August to November – with the exception of another peak in May.

The best way to describe the patterns we can see in a climate graph is by using two PQE analyses – one for temperature and one for precipitation.



Source 19

A climate graph

What is the difference between weather and climate?

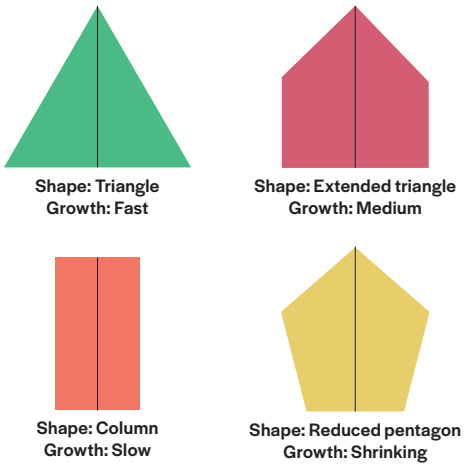
Look outside your window and describe today's temperature and the amount of rainfall there has been. Is it cloudy? Has there been a thunderstorm or is it beautiful sunshine? What you have just described is the weather. Weather changes daily and is usually predictable up to about 10 days in advance. Apps on your smartphone and the last five minutes of the evening news show you these predictions of daily weather.

Now close your eyes and describe the climate of Australia. Do you imagine Australia being hot and dry? Just because we can describe Australia as hot and dry, does not mean it is like this everywhere, all year round. Unlike the weather, climate helps us describe the yearly (annual) average temperature and level of precipitation (rainfall, snow etc.) in a region or country. Climate graphs help us visualise the climate of a region or country. Climate change describes how the average temperature and precipitation levels of a location have been altered over time.

Population pyramids

Population pyramids are graphs that show the number of females and males in particular age groups in a population, and they are like bar graphs turned on one side.

Population pyramids can be made on a local, national or global scale. On a population pyramid, female data is normally shown on the right side and male data on the left. The length of each bar represents the number of males or females within that age group.



Source 20

Various population pyramids. The shape of the pyramid tells you about the population.

The shape of the pyramid tells us a lot about the population

Population pyramids come in different shapes: triangles, columns, pentagons and so on. The shape tells you about the population. If the shape is:

- a triangle: growing population, with more young people than old people
- a box: slow or stable growth, with equal numbers of old and young people
- an upside-down pyramid: aging or declining population, with more old people than young people.

How do I interpret a population pyramid?

The population pyramids in Source 21 show Australia's population in 1955 and 2018.

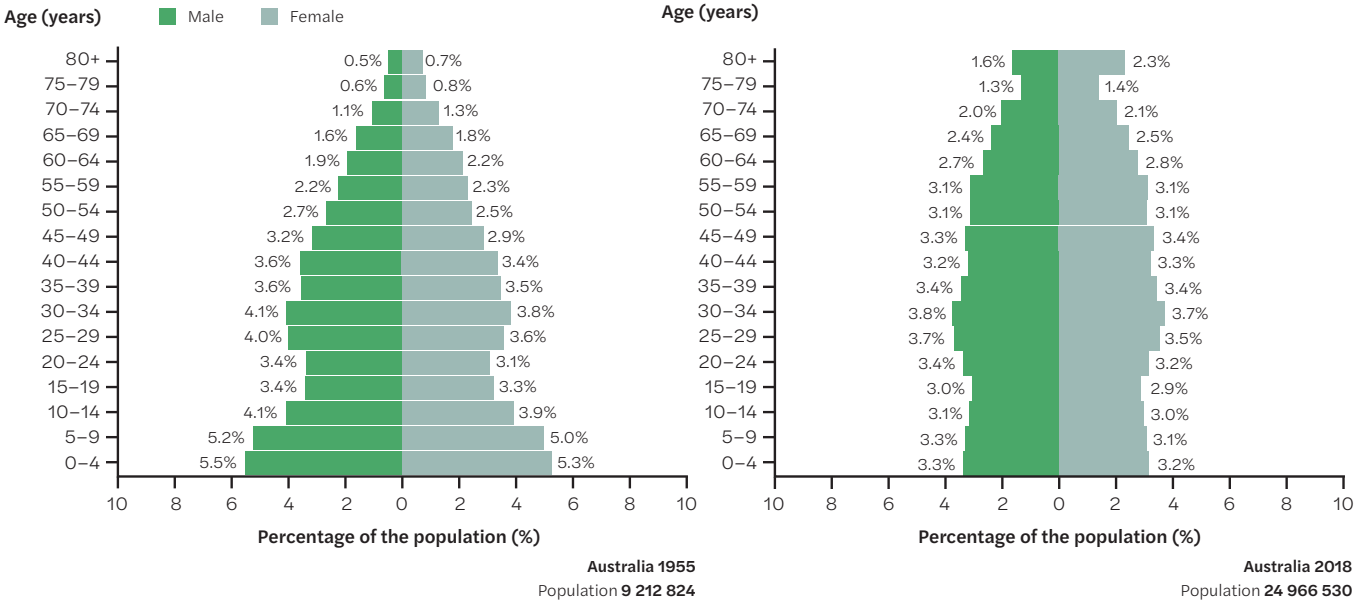
In 1955, there were lots of young people in the age range 0–14. Approximately 5.5 per cent of the population were males aged 0–4 years old, and 5.3 per cent were females aged 0–4 years old. We also had many working-age people. For example, 4.1 per cent of the population were males aged 30–34, and 3.8 per cent were females aged 30–34.

In 2018, there are significantly fewer young people in our population and more old people. The total population also grew to 25 million people.

Source 21

Population pyramids showing Australia's population in 1955 (left) and 2018 (right)

Australia's population in 1955 and 2018



Australia 1955
Population **9 212 824**

Australia 2018
Population **24 966 530**

Source: PopulationPyramid.net

HOW TO

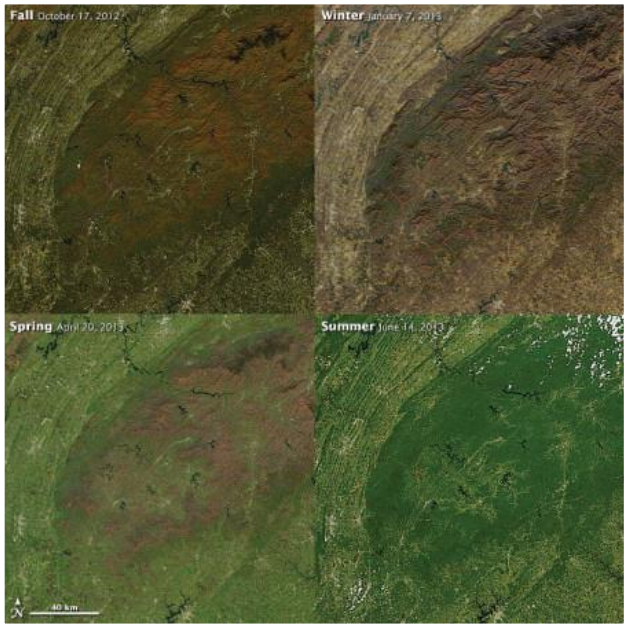
Satellite images

Satellite images are pictures of Earth taken from space.

Satellites orbit the Earth and take photos constantly. We can use this data to see a change in land cover or other spatial patterns over time. Satellite images taken during the day give us the most information.

Source 22

Satellite images taken at night provide different information than those taken during the day. This photo of Italy shows the extent of the urban areas.



Source 23

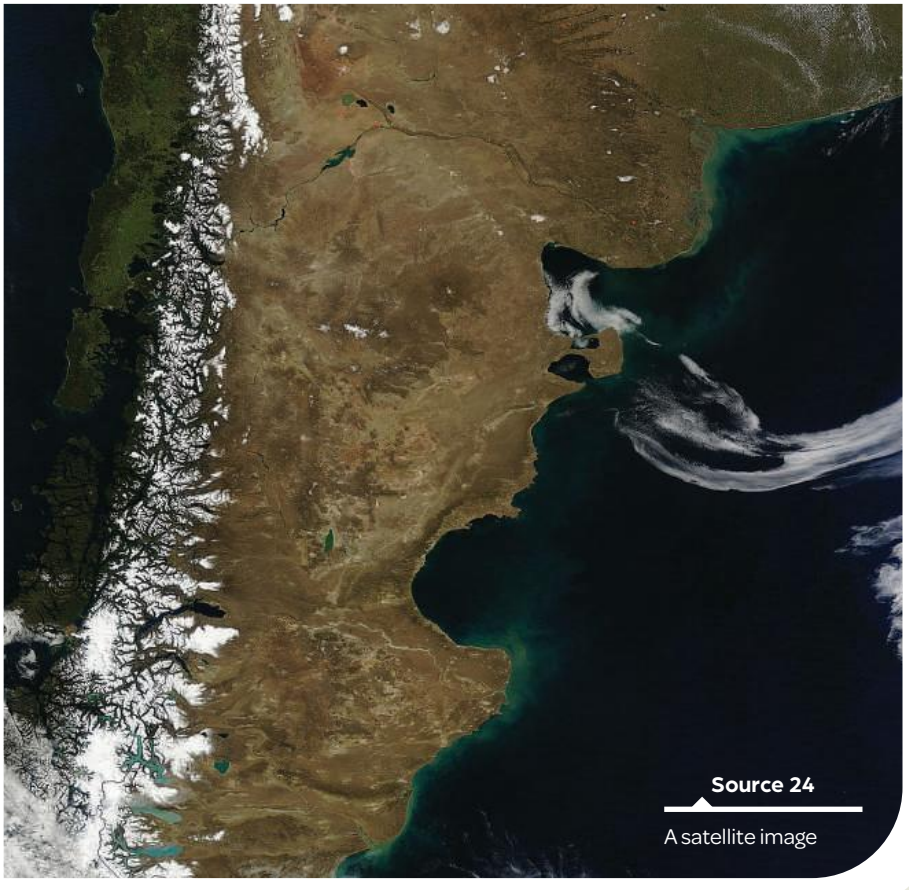
This satellite image was taken at the same place over four seasons. Satellite images are useful to show change over time.

How can I use colour to interpret satellite images?

When you are trying to interpret a satellite image, look for colours and shapes. Colour will normally give you some idea about land cover. For example, green usually indicates vegetation, blue is the colour of water and brown is usually desert or barren land. White can indicate snow or clouds, so here you need look at shapes. Clouds tend to look fluffy and, depending on the time of day, can cast a shadow onto the ground. Snow is usually on the tops of mountains, and you can see where it is melting or following the slopes. Looking for shapes is also helpful when you are trying to identify rivers or reservoirs, which can be seen as blue lines.

How can satellite images show change over time?

Seasonal variations can sometimes be very clear in satellite images – in spring and summer, green vegetation flourishes, while during winter, white snow may fall or vegetation may die, leaving brown, bare ground.



Source 24

A satellite image

Glossary

abrasion the process of scraping or wearing something away

aesthetics visual beauty

aid agency an organisation that provides assistance to communities and individuals who need it; e.g. World Vision

air pollution the release of harmful particles or materials in the atmosphere

air mass large body of air that is all the same temperature and humidity, and at the same level of pressure

aquifer underground layer of water-bearing rock where groundwater can be extracted

arid receiving little or no rain

atheist person who has no religion or belief in any god

benefit positive outcome

block diagram three-dimensional diagram that shows how a system or feature works

bore a deep well drilled into the ground to tap into underground water storages

carrying capacity the amount of material that can be held in a contained area such as a river

catchment an area where water is collected by the natural landscape

climate the average weather in a certain place, over a period of time

climate change a change in climate patterns, often refers to an increase in global temperatures apparent from the late 20th century onwards. Also referred to as global warming.

climate graph a graph showing average rainfall and temperature for an area over a period of time

community a group of people connected in some way and with a distinct identity

community of place a community based on a connection to a specific place or region

condensation a process by which a gas (for example, water vapour) is changed to a liquid (for example, water drops)

Connection to Country the deep spiritual, physical, social and cultural relationship between Indigenous Australians and the land

constitution a document stating the fundamental principles by which a nation, state or organisation is governed

continent one of Earth's seven main continuous expanses of land; e.g. Asia

contour lines lines on a map that join points of the same height above or below sea level

convectional rainfall rain that occurs when land heats the air above it, forcing the air to rise

cost resources that are consumed to achieve an outcome

cumulonimbus cloud dense, vertical cloud, formed from water vapour carried by powerful upward air currents; associated with heavy rain and storms

dam barrier constructed to hold back water

decentralisation movement of jobs, people and resources out of large cities and into regional areas

delta triangular region of sediment at the mouth of a river

density amount of material or number of objects in a specific area

deposit drop or place in an area, such as the deposition of sediment by a river

deposition formation over time of a layer of soil or rock

desalination process of removing salt from seawater

desert area that receives less than 250 millimetres of rain every year

developed wealthy country with advanced industrial and economic infrastructure

dew point temperature below which water begins to condense and dew (tiny droplets of water) is formed

drainage basin area of land where precipitation collects and drains into a river, bay, or other body of water

drought long period of very low rainfall, leading to a shortage of water

economic issue or problem problem involving the allocation or consumption of resources

ecosystem a community of plants, animals and other organisms in their physical environment

environmental resource any material from the environment that is useful or valuable to society; these can be renewable, non-renewable or perpetual resources

equator a line separating the Earth halfway between the the poles, dividing the Earth into northern and southern hemispheres

erosion removal and relocation of soil or rock by water, wind or ice

evaporation process by which a liquid (for example, water) is changed to a gas (for example, water vapour)

flood large amounts of water overflowing onto dry land

floodplain area of ground next to a river that floods when the river waters rise

flow-on effect indirect effect caused by the outcome of other actions

fossil fuel fuel made from the decomposed remains of things that lived millions of years ago (for example, coal, oil)

freedom power or right to act, speak, or think as one wants within the boundaries of the law

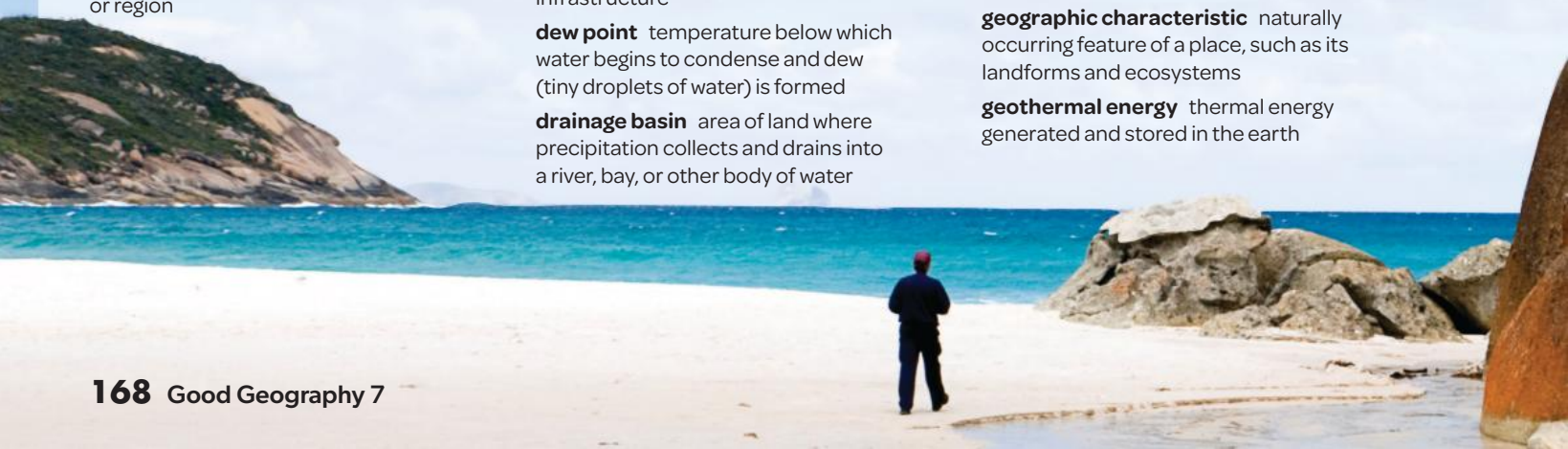
fresh water any naturally occurring water that is not salt water, including water in ice sheets, ice caps, glaciers, icebergs, ponds, lakes, rivers, streams, and groundwater

frontal rainfall rain that occurs when a mass of cold air pushes up warm air

frostbite damage to body tissues caused by exposure to extreme cold, typically affecting the nose, fingers, or toes

geographic characteristic naturally occurring feature of a place, such as its landforms and ecosystems

geothermal energy thermal energy generated and stored in the earth



glacier mass or river of ice that slowly moves down a mountain or valley, carving a u-shaped valley as it goes

gorge narrow valley between hills or mountains, usually with steep rocky walls and a stream running through it

GPS Global Positioning System – a satellite navigation system used to determine the position of an object or person on the ground

green belt undeveloped areas around cities set aside for open space

green wedge undeveloped areas within cities that have been set aside for open space

groundwater water that is located under the earth's surface in rock or soil

headwater source of a river or stream

high-income country country with an average annual income of US$12 376 or more per person

humanitarian organisation organisation that provides aid or assistance to people in need, for example, Red Cross

hydroelectricity electricity that is produced by water-powered generators

hypothermia life-threatening medical condition resulting from having an abnormally low body temperature

hypothesis proposed explanation used as the starting point for further investigation

ice cap covering of ice over the ground in a large area, especially in the polar regions

ice sheet layer of ice covering a large area of land for a long period of time

ice shelf floating platform of thick ice attached to a land mass

iceberg large floating mass of ice that has detached (or calved) from a glacier or ice sheet and is floating in open ocean

infant mortality death of children who are one year old or younger

infiltration process where water (rain, hail or snow) soaks into the soil

infrastructure physical and organisational requirement needed for the operation of a society, for examples, roads, water supplies

interconnections relationship between all living things, non-living things and processes; a key concept in geography

internally displaced person person forced to flee their home and shelter elsewhere within their country's borders

irrigation watering of crops and pastures from a water source other than precipitation (for example, with water from a river or lake)

latitude a measurement in terms of something's distance north or south of the Earth's equator

less economically developed country (LEDC) low-income country experiencing severe barriers to development; also referred to as developing countries

levee a wall built next to a river to stop it from overflowing

life expectancy the average number of years a person is predicted to live

liveability measure of how easy it is to live in a particular place based on factors such as climate, safety, healthcare, schools, employment and transport

liveable easy or pleasant to live in

lock a device used for raising and lowering boats between different levels on waterways, such as a weir

low-income country country with an average annual income of US$1045 or less per person

malnutrition lack of proper nutrition from one's diet, leading to health problems

meander bend or curve in a river or road

middle-income country country with an average annual income of US$1046–$12 375 per person

more economically developed country (MEDC) a country with a strong economy, in which most people have access to good education, health care, and employment opportunities

monsoon seasonal wind, occurring in the Asia and Pacific regions, that brings large amounts of rain

multi-faith embracing and respecting multiple religious faiths

multicultural embracing and respecting multiple cultures and backgrounds

natural hazard natural process, such as a landslide, which could cause damage, injury or loss of life

natural disaster natural event, such as a landslide, which causes widespread damage and loss of life

need items or services required for survival

nomadic choosing to move from place to place over time to find better conditions, rather than living in one location

non-renewable resource resource that cannot be regenerated or replenished within a human timescale once it is used up (for example, coal, oil)

oasis place in a desert where groundwater has come to the surface creating a green or fertile area

orographic rainfall rain that occurs when warm, moist air is lifted over a mountain

paddy field planted with rice that grows in water

pandemic a disease that spreads in multiple countries around the world at the same time, usually affecting a large number of people

per capita for each person

perpetual resource natural resource with an unlimited supply (for example, wind, sun)

phenomenon something that is observed to exist or happen

photo essay series of photographs used to present information visually

plunge pool deep basin at the foot of a waterfall created by the action of the falling water

polar the cold environments around the North and South Poles

population distribution pattern showing the number of individuals living in an area

population density measure of how many people live in a particular region or area

population pyramid graph showing the number of males and females living in age groups in a population

PQE acronym for Pattern, Quantify and Exceptions, used to describe spatial patterns or graphs

precipitation water that falls from the atmosphere to the ground as rain, snow, hail or sleet

primary methodology data-gathering activity undertaken in the field, such as field sketches

qualitative data non-numerical data based on qualities or characteristics

quantitative data numerical data based on measurements or counts

rain gauge device that measures the amount of rain that falls in an area

recycle convert into reusable materials

refugee a person threatened by conflict or a natural disaster who is forced to flee their home to seek safety, food and shelter in another country

renewable energy energy generated from a renewable resource such as sun, wind or water

renewable resource a natural resource that can regenerate or replenish within a human timescale (for example, trees)

research question idea to be investigated, or problem to be solved through research

reservoir human-made or natural water storage area that collects and retains water

reverse osmosis process in which a solvent is pushed through a membrane into another solution

run-off water that flows over the surface of the land and into rivers and lakes

rural–urban fringe region on the edges of cities that is close to rural areas or towns

safe water water that is safe to drink and free from contamination

salt pan shallow region where salt water has evaporated, leaving a layer of salt on the ground

SALTS acronym for Scale, Axis, Legend, Title and Source

satellite image image of Earth taken from space

saturated zone area deep below the soil where all the spaces between soil and rock particles are filled with groundwater

sea change decision to move to a coastal location for a better lifestyle

sea level average level of the sea, at a given point

secondary methodology data-gathering activity undertaken outside of field studies, such as research

secular something that is not connected to any religion or spiritual matter

sedimentary rock formed over a long period by sediment deposits

semi-desert region that is dry but receives more regular rainfall than a desert

SHEEPT acronym for Social, Historical, Environmental, Economic, Political and Technological factors

sketch simple drawing made to record data when in the field

social enterprise companies whose objectives are to benefit the community as well as to make a profit, where surplus income is are reinvested into social projects

spatial technology computer systems that interact with real-world locations in some way

spring groundwater from an aquifer that makes its way to the earth's surface

stream gauging station location where the speed, height or volume of a body of water can be measured

tectonic plate massive slab of solid rock that moves extremely slowly across the surface of the Earth

terrace flat area on the side of a hill, used for agriculture

TOASTIE acronym for Title, Orientation, Annotations, Scale, Time, Information and Edge

transpiration water vapour leaving plants through their leaves

tree change decision to move to a rural location for a better lifestyle

tropical used to describe the climate in the areas of the world between the Tropic of Cancer and the Tropic of Capricorn

turbine machine for producing power where a wheel or rotor, usually fitted with vanes or blades, is made to revolve by a fast-moving flow of water, steam or other fluid

urban based in or relating to a city or large town

urbanised living in or based in cities

valley low area of land between hills or mountains

virtual water total amount of water needed to produce a crop or product

want items or services that are useful but not required for survival

water balance the flow of water in and out of a system

water cycle the natural process by which water circulates between the earth's oceans, atmosphere, and land, involving precipitation, drainage in streams and rivers, and return to the atmosphere by evaporation and transpiration

water poor lacking in natural water resources

water resource natural body of water that can be used for different purposes

water rich having a large amount of natural water resources

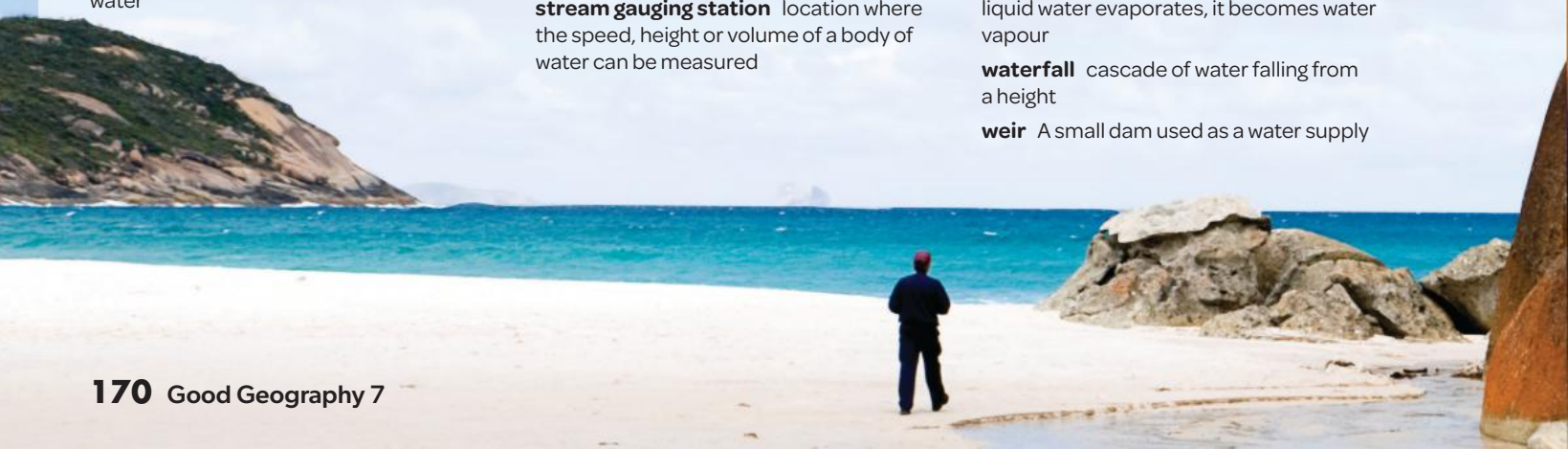
water scarcity not having enough natural water to meet the needs of a community or region

water table the level below the earth's surface where water is found

water vapour water in its gas state; when liquid water evaporates, it becomes water vapour

waterfall cascade of water falling from a height

weir A small dam used as a water supply



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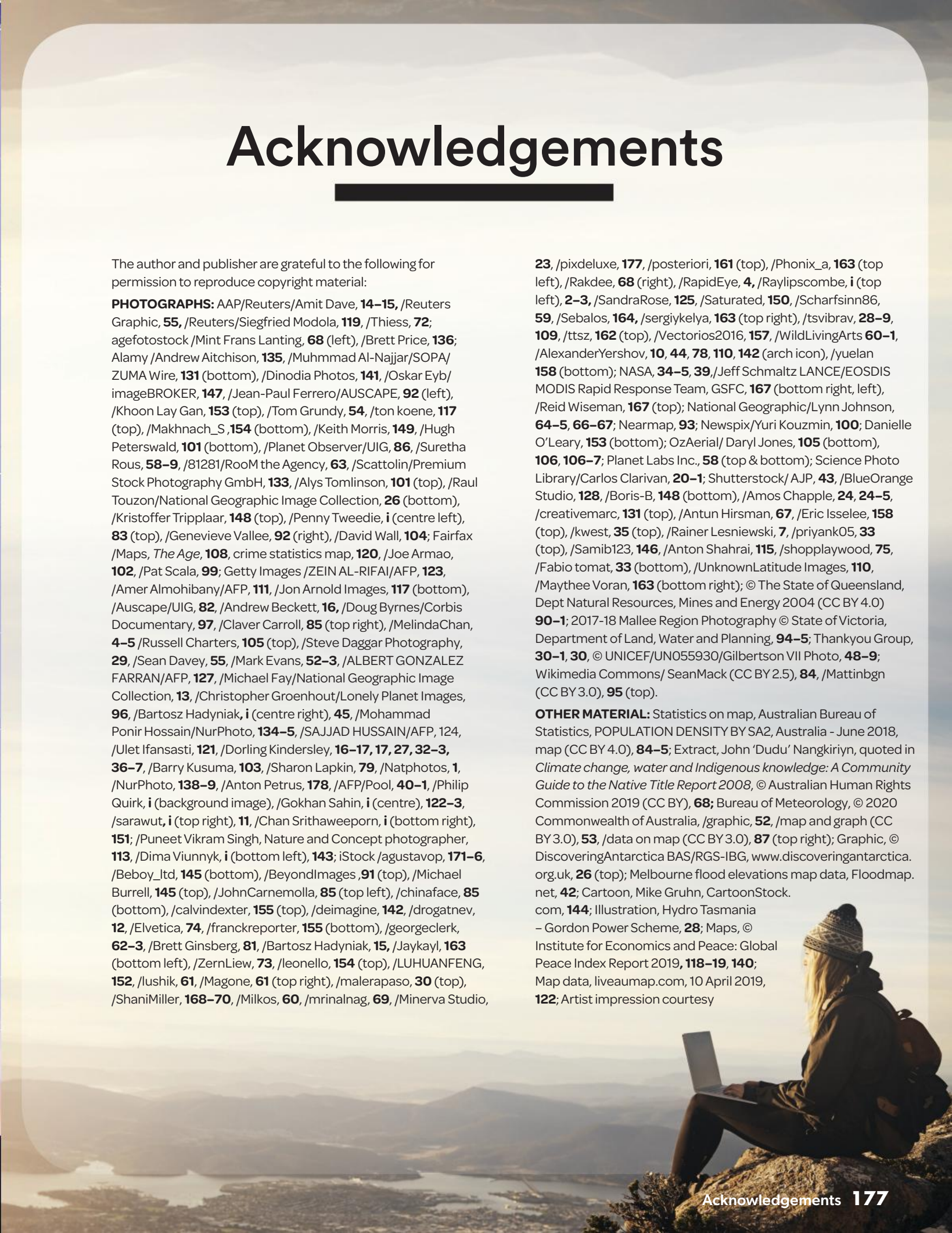

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