civics+
citizenship

geography

economics
+business

good
Geography
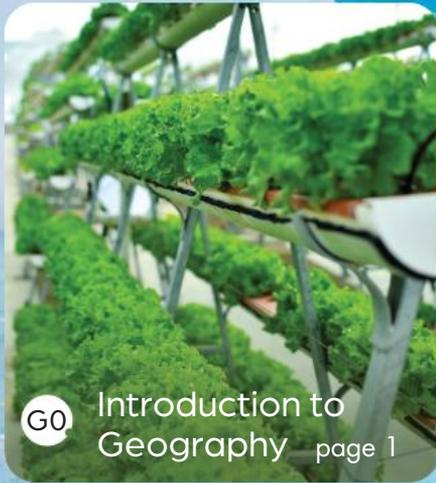
DANIELLE
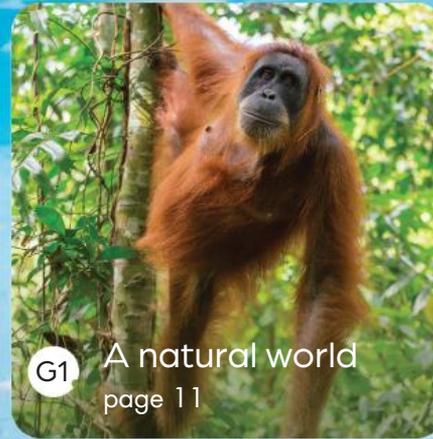**O'LEARY**

BEN
LAWLESS

contents

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HOW
TO

Introduction to
Geography

G0

WHY DOES GEOGRAPHY MATTER? page 2

HOW DO I STUDY GEOGRAPHY?

HOW DO I USE MAPS IN GEOGRAPHY?

HOW DO I USE THIS BOOK?

Why does Geography matter?

Geography is the study of our world — its characteristics, patterns and changes over time. In Geography we focus on two main ideas: human activity and natural processes. We consider changes in the characteristics of places and the consequences of these changes, we look at spatial distributions and find patterns, we consider interconnections over time and at different scales. Geography is key to understanding the world around us and our role in it.

Thinking like a geographer

As a Year 9 Geography student, you have already studied and practised many geographic concepts and skills and you have a rich bank of geographic knowledge to draw from. You have explored how humans influence the *space* in which they live and, in return, how the natural *environment* influences how we as humans live. You may have practised 'thinking like a geographer' while you engaged with important issues, such as climate change and the construction of new coal mines in Australia, as well as positive initiatives such as the clean-up of the Great Pacific Garbage Patch.

This year you will continue to explore contemporary geographic issues using maps, images, graphs and other sources of data. You will explore spatial patterns. You will also conduct your own fieldwork to answer research questions about different phenomena and interconnections. You will consider how your own choices and actions can result in positive changes in our increasingly interconnected world.

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 continue to develop your geographic skills. These skills will remain with you and will help you in all aspects of your life. Some of these valuable new skills include reading maps, interpreting data, creating visual representations, navigating and understanding how other people experience the places in which they live.

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

Do you want to visit the Sahara Desert? Are you concerned about the impact of climate change on the canals of Venice? Do you daydream about purchasing a round-the-world plane ticket?

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 (GIS), 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.

N

0   100   200 m

(3) Understanding Geography makes us informed, global citizens

Studying Geography helps us understand ourselves and our planet. There are two main areas of study in Geography: physical (or natural) geography and human geography. Physical geography is the study of the Earth – its landscapes, landforms and natural processes – some of which have been occurring over hundreds of thousands of years. Human geography is the study of how we interact with our natural world.

This year, you will investigate the Earth's environments and how these environments sustain life; how humans change these environments for food and fibre production; the impacts of globalisation and consumerism on people and places; and the role of tourism, trade and technology in our interconnected world. The study of Geography will empower you to be an active global citizen who makes informed decisions.

Learning ladder G0.1

1   Brainstorm all the skills and concepts you have learned in Geography so far. Discuss as a class.

2   Discuss the difference between geographical knowledge and geographical skills with a partner. Provide examples of each.

3   Consider how your Geography skills have helped you in different subject areas.
Hint: Did you need to read maps on camp? Have you used your knowledge of processes in science?

4   'Being able to think like a geographer today is more important than at any other time in human history.' Hold an informal class debate on this topic. Remember to respect all of your classmates as they express their opinions.

How do I study Geography?

In Year 9 Geography you will focus on five geographical skills: spatial distributions and patterns, patterns and interconnections, changes and implications, communicating data and digital and spatial technologies. You will also practise the important skills of research and writing. On the next couple of pages, you can read an introduction to some of these skills before practising them in your first geographical study. The Geo How–To section on pages 131–151 will also give you step–by–step support when you begin to apply these skills.

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: space, place, interconnection, change, environment, scale and sustainability.

Using geographic language is important when writing your responses. Remember, you do not have to use the exact terms in your responses. Instead, try to use the concept to make your writing more geographical.

Space

In a geographical context, *space* does not refer to 'outer space'; instead, it refers to the ways in which we use, change and distribute things on Earth's surface. For example, this environment can be broken up into two key spaces: the natural mountain space and an agricultural space.

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 is an example of both a natural and a human environment.

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 periods of time. In this place, we can observe a change over time from the natural mountainous landscape to extensive rice terraces and farmland.

Scale

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

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 solar power or wind generated electricity. Small-scale farming can be sustainable; however, when we overuse Earth's resources we degrade its nutrients and alter natural processes.

Source 1

Terraced rice fields in Mù Cang Chải, Yên Bái Province, Vietnam

Interconnection

Interconnection is the idea that two things or phenomena are related, interact or are linked in some way. For example, there is a strong interconnection between the success of an agricultural harvest and the economy of the local region.

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 an agricultural field and rice terraces in Vietnam.

Learning ladder G0.2

1. Identify the place shown in Source 1 on page 3.
2. Locate an image of a natural landscape online. Annotate the image with the SPICESS terms, explaining how each term relates to the image.
3. Create a photo essay that illustrates the variation of natural landscapes around the world.
4. For each of the images collected for the photo essay in the previous question, discuss as a class how that place or environment may change over time.

How do I use maps in Geography?

Maps are vital in Geography to visualise spatial patterns and identify *interconnections* between phenomena. There are many different types of maps that all have slightly different uses.

Physical maps

Physical maps show the terrain or natural features of a location. For example, in the map of Africa in Source 1, you can see the large expanse of desert in the north of the continent and the forests around the Congo Basin.

Source 1

This physical map shows the natural features of Africa.

Cartograms

Cartograms are maps that have been distorted by data. For example, in the map in Source 2, countries that are larger in size are those that are the most popular with tourists, while narrow, squished looking countries are those that have far fewer visitors. The UK and Europe are large because they are very popular tourist destinations, while Australia is narrow because it is less popular.
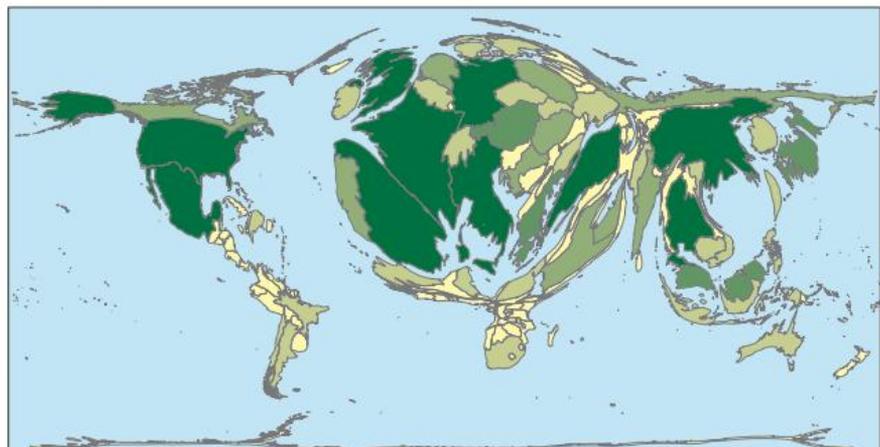
Source 2

The cartogram is another way to represent data; for example, how popular particular countries are as tourist destinations.

A physical map of Africa

LEGEND

Forest
Desert
Grassland
Mountains

Source: Matilda Education Australia

Popularity of different destinations for tourists, 2017

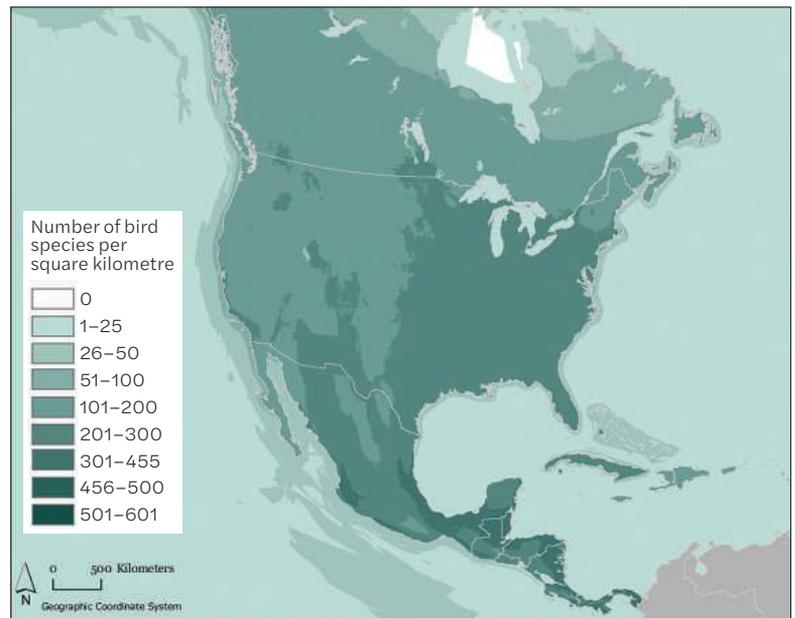Source: Matilda Education Australia, UN World Tourism Organisation

Choropleth maps

Choropleth maps use darker and lighter shades of colour so that the reader can instantly see a pattern. The choropleth map in Source 3 uses darker shades to represent the areas with the highest areas of species richness and the lighter shades represent the areas with the lowest levels of species richness. It is best to use the same colour in different shades, such as light to dark green, to clearly show the pattern.

Source 3

A choropleth map showing species richness (birds) in North America

Number of bird species per square kilometre

	0
	1–25
	26–50
	51–100
	101–200
	201–300
	301–455
	456–500
	501–601

0   500 Kilometers

N   Geographic Coordinate System

Source: SEDAC

Australia's climate zones and ocean currents

Source: Matilda Education Australia

INDIAN OCEAN

South Equatorial Current

Gulf Current

Hiri Current

PACIFIC OCEAN

Leeuwin Current

Nhulunbuy

Cairns

Northern Territory

Charters Towers
Concurry

Queensland

Western Australia

South Australia
Coober Pedy
Kati Thanda (Lake Eyre)

Ballina

New South Wales

Newcastle

West Australian Current
Albany

ACT

Victoria

East Australian Current

Launceston

Tasmania

Antarctic Circumpolar Current

LEGEND

Climate zone
- Tropical wet (hot and wet all year)
- Tropical wet or dry (hot with wet summers and dry winters)
- Sub-tropical wet (hot or warm, wet summers and mild winters)
- Sub-tropical dry winter (hot or warm, wet summers and dry winters)
- Maritime hot summer (hot summers, cool winters and wet all year)
- Maritime warm summer (warm summers, cool winters and wet all year)
- Mediterranean (hot and warm, dry summers and mild, wet winters)
- Semi-desert (hot all year with 250–500 mm rain)
- Desert (hot all year with less than 250 mm rain)

Ocean current
- → Warm
- → Cold

N

0   300   600 km

Climate maps

In Geography, **climate** is important for determining land cover and how liveable a place is. While weather is what we observe day to day through our classroom window, climate is the average conditions (usually temperature and **precipitation**) within a region over a period of time. Climate is important when studying Geography as it gives us an indication of expected rainfall. In the map in Source 4 we can clearly see different climate zones on the continent of Australia.

Source 4

A climate map of Australia

Learning ladder G0.3

1 Suggest which map type would be best to display the following data:
   a   population distribution between regions
   b   location of forests in a country
   c   flow of rivers on a global scale
   d   differences in temperature across a country.

2 Locate a map showing the distribution of the world's human population. What map type is used to display this data? Why?

3 Source 2: Using your understanding of cartograms, list three places (continents or countries) that are not popular tourist destinations.

How do I use this book?

Good Geography has been built to help you thrive as you move through the Level 9 Geography curriculum and to demonstrate your progress in every lesson. This book explores two geographical topics: biomes and food security, and geographies of interconnection. 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. This means that learning content alone is not enough to give you a geographical understanding. In order to be a geographer, you need to be able to write geographically, read a variety of data, interpret data, and conduct and communicate your own research.

Each chapter in this book begins with a Learning ladder. This 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 five levels of progression for each of those skills. Read it from the bottom to the top. As you progress through the chapter, you will climb UP the Learning ladder.

Each skill described in the Learning ladder is a higher progression than the one before it. To be able to accomplish the higher-level skills, you need to be able to master the lower ones. Practising activities at all the levels will help you develop 'higher-order' skills, such as evaluating. This approach is called developmental learning and puts you in charge of your own learning progression.

Source 1

The Learning ladder helps you to take charge of your own learning!

learning ladder

	Spatial distributions and patterns	Patterns and interconnections	Changes and implications	Communicate data	Digital and spatial technologies
step 5	I can identify multiple spatial distributions and patterns	I can interpret causes of patterns and interconnections	I can interpret data to quantify predictions based on research	I can evaluate the success of research methods	I can draw conclusions from geographical information in digital and spatial technologies
step 4	I can use data to support exceptions to spatial distributions and patterns	I can use relevant sources to research further reasons for patterns and interconnections	I can make predictions and outline consequences of change over time	I can organise data collected according to relevance for a research question	I can manipulate data using digital and spatial technologies
step 3	I can describe spatial distributions and patterns	I can use data to support explanations of patterns and interconnections	I can explain the causes behind the change over time in a place	I can filter collected data	I can access and use spatial technology platforms such as GIS
step 2	I can use data to quantify spatial distributions and patterns	I can explain patterns and interconnections	I can describe how places have changed over time	I can successfully use data collection methods	I can construct paper maps using correct cartographic conventions
step 1	I can identify spatial distributions and patterns	I can provide short explanations for patterns and interconnections	I can identify that changes occur in the characteristics of places over time	I can list primary and secondary methods useful for my study	I can interpret different map types using cartographic conventions

Check your progress

Each chapter is divided into multiple sections. Each section is designed to cover one lesson, but sometimes your teacher might decide to spend more or less time on a particular section. A section is usually two pages long, but some are four pages. At the end of every section, you will find a block of questions to help you check your progress.
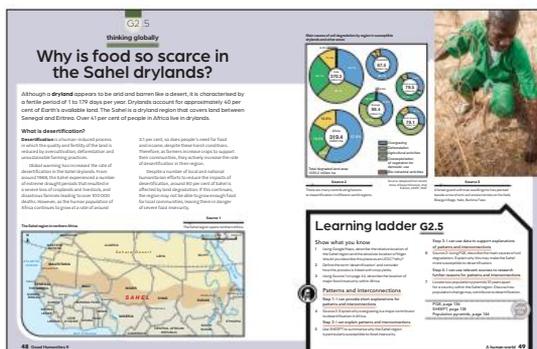
(1) Show what you know

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. Sometimes these questions will take you outside your classroom.

(2) Learning ladder

These activities are linked to the Learning ladder. You can complete one of the questions or several of them, depending on your progress. Throughout a chapter you will complete at least one activity for each level of the Learning ladder.

Case studies

Throughout every chapter, you will discover a variety of case studies that ask you to think about 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 a case study from elsewhere in Australia, and the global case studies describe places and events in other countries. Many of these link to interactive sources so you can explore further using your eBook.

Source 3

Case studies are an important part of your Geography course.
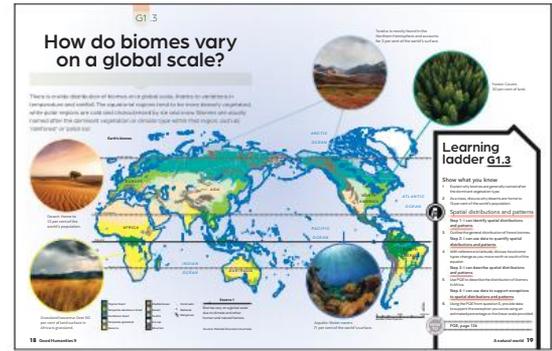
Source 2

Check your progress regularly. You can attempt one or several 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 *or* an Economics and business lesson. School is busy and you have a lot to cover; 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 connect your learning.

learning ladder

	Civics and citizenship	Economics and business
step 5	I can analyse issues in society	I can evaluate alternatives
step 4	I can explain different points of view	I can integrate different economic topics
step 3	I can explain issues in society	I can explain issues in economics
step 2	I can describe societal issues	I can describe economic issues
step 1	I can identify topics about society	I can recognise economic information

Geo How-To

At the end of the book, you will find a guide to fieldwork and a skills chapter called Geo How-To. The How-To chapter explains how to perform each skill and the steps involved in writing and research. There are *lots* of examples. Refer to it often, especially when completing the Learning ladder questions and Masterclass activities.

The Fieldwork chapter of your textbook explains all the skills you need for hands-on research and gives you several suggested tasks.

Source 4

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

Masterclass

At the end of each chapter is a review section, called the Masterclass. The questions here are organised by the steps on the Learning ladder. You can complete all of the questions *or* your teacher might direct you to complete just some of them, depending on your progress.

Source 5

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.
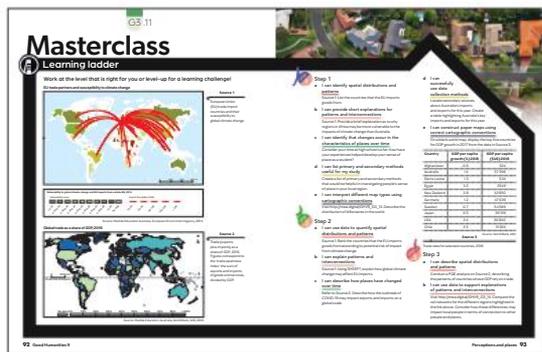

Source 6

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 G0.4

1   What skills do you think are important in Geography? How are they reflected in the Learning ladder?

2   How can you use the Learning ladder to monitor your progress in Year 9 Geography?

3   As a class discuss the idea of 'monitoring your own progress'. Why is this important?

4   Read through the steps of the Geography Learning ladder and consider where you may already be up to for each skill, based on your prior learning.

A natural
world

WHY IS STUDYING BIOME PRODUCTIVITY IMPORTANT?

How can I understand our natural world?

Earth is a big planet! To help with their study of Earth's environments, geographers divide the planet into distinct areas known as **biomes**. Each biome has its own unique climates, soils, vegetation and levels of productivity. The distribution of biomes on Earth is influenced by a number of natural and human factors.

learning ladder

step 5

I can identify multiple spatial distributions and patterns
I can take my PQE one step further to find links or relationships that exist in the natural world.

I can interpret causes of patterns and interconnections
I can use multiple sources to find links or relationships that exist in the natural world and can explain 'Why?'.

I can interpret data to quantify predictions based on research
I can use external data from research as evidence of the positive and negative impacts of a change I have predicted.

step 4

I can use data to support exceptions to spatial distributions and patterns
I can use data to answer 'Why?' about the exceptions identified in a PQE analysis of our natural world.

I can use relevant sources to research further reasons for patterns and interconnections
I can use sources other than this textbook to further research patterns I observe in the natural world.

I can make predictions and outline consequences of change over time
I can use my knowledge of natural processes and world regions to make an educated guess of the positive and negative impacts of change in the natural world.

step 3

I can describe spatial distributions and patterns
I can describe patterns, quantify them and point out exceptions (PQE) to describe our natural world.

I can use data to support explanations of patterns and interconnections
I can use data from a map or graph to explain patterns I observe in the natural world.

I can explain the causes behind the change over time in a place
I can use my knowledge of natural processes and world regions to explain why changes may occur over time in the natural world.

step 2

I can use data to quantify spatial distributions and patterns
I can read data and use it to measure key trends on a map or graph about the natural world.

I can explain patterns and interconnections
I can identify social, historical, economic, environmental, political and technological (SHEEPT) factors to help me explain the natural world.

I can describe how places have changed over time
I can use specific examples to describe changes over time in the natural world.

step 1

I can identify spatial distributions and patterns
I can find key trends on a map or graph about the natural world.

I can provide short explanations for patterns and interconnections
I can write descriptions of patterns and interconnections that I find in the natural world.

I can identify that changes occur in the characteristics of places over time
I can read information and answer questions about changes over time in the natural world.

| Spatial distributions and patterns | Patterns and interconnections | Changes and implications |

The tundra biome is distinctive because of its extremely cold climate and low rainfall. There are very few animal and plant species in this biome.

Warm up

Spatial distributions and patterns

1 Describe the distinctive features of the biome shown in Source 1.

Patterns and interconnections

2 Identify how the characteristics of the biome shown in Source 1 might be interconnected with the adaptations of local animal and plant species.

Changes and implications

3 Predict changes that might occur in the biome in Source 1 over the following time periods:
   a 6 months
   b 75 years.

Communicate data

4 What are the limitations associated with fieldwork in the tundra biome?

Digital and spatial technologies

5 Use an outline map of the world to colour where you predict tundra biomes are found on Earth. Annotating your map, explain the reasoning behind your predictions.

I can evaluate the success of research methods
I can look back and comment on the data collection methods I used and evaluate how successful they were in helping me answer a research question about the natural world.

I can draw conclusions from geographical information in digital and spatial technologies
I can interpret and analyse patterns by using different layers and features on spatial technology platforms.

I can organise data collected according to relevance for a research question
I can review the data I have collected in the field and display it using graphs, tables, annotations and captions.

I can manipulate data using digital and spatial technologies
I can work with layers and other features on spatial technology platforms to further explore data and interconnections.

I can filter collected data
I can review my collected data and select the most relevant data to answer a research question about the natural world.

I can access and use spatial technology platforms such as GIS
I can use spatial technology platforms to explore data and find patterns.

I can successfully use data collection methods
I can use primary and secondary data collection methods in the field and classroom to investigate the natural world.

I can construct paper maps using correct cartographic conventions
I can use a pencil, paper and ruler to construct a map that follows BOLTSS conventions.

I can list primary and secondary methods useful for my study
I can create a checklist of methods to investigate the natural world and categorise them as primary or secondary methods.

I can interpret different map types using cartographic conventions
I understand data found in different types of maps and graphs and use the data to answer questions about the natural world.

Communicate data

Digital and spatial technologies

How do we classify environments?

Earth can be divided into four main spheres: the atmosphere, hydrosphere, lithosphere and biosphere. The four spheres interact with each other as elements move within and between them.
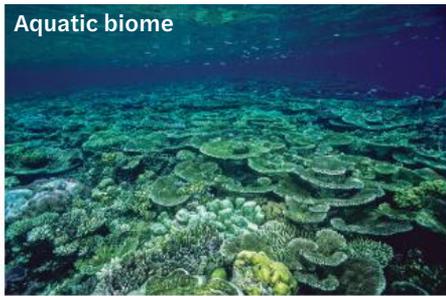
Source 1

Earth's four spheres all interact with each other.

The **atmosphere** includes the gases that surround Earth and are held in place by gravity. We tend to think of 'air' being oxygen, but Earth's atmosphere is approximately 79 per cent nitrogen and only about 21 per cent oxygen.
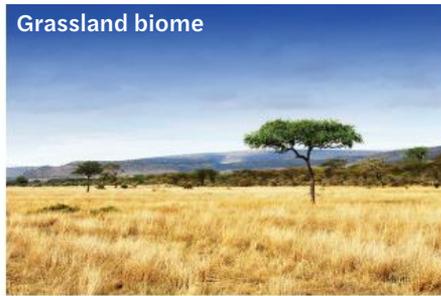
The **biosphere** encompasses any living thing, from bacteria and plants to all animals and humans.

The **hydrosphere** encompasses all the water on Earth in the oceans, lakes, rivers and streams. Only 2.5 per cent of water on Earth is fresh water, of which around 1.75 per cent is frozen in ice and glaciers. Almost 97 per cent of water on Earth is **saline** within the oceans.

The **lithosphere** is all the soil, rock and earth such as mountains, pebbles, sand and tectonic plates.

Aquatic biome

Grassland biome

Forest biome

Desert biome

Tundra biome

Within Earth's biosphere there are many biomes. However, most geographers identify five main types of biome on Earth. Some geographers break up the forest biome into temperate and taiga/boreal.
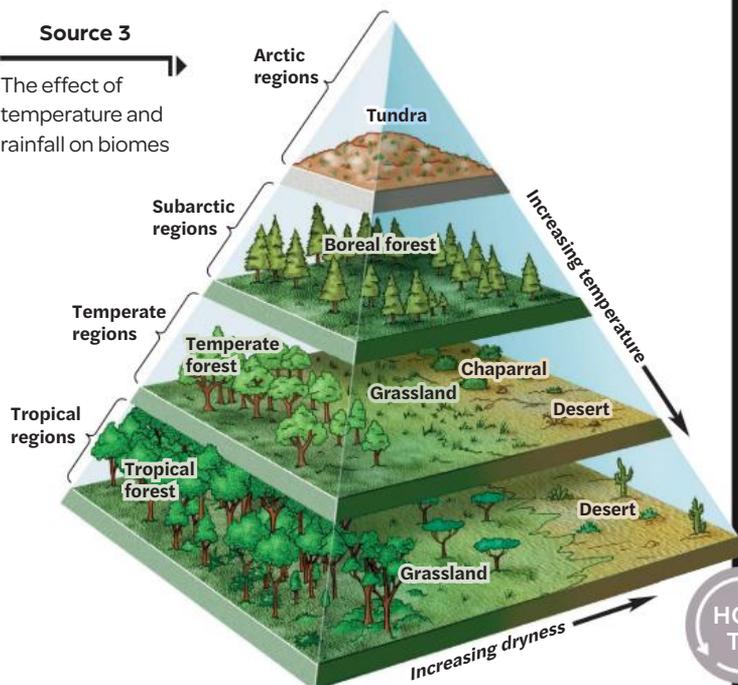
Biomes

The biosphere can be further broken up into sub-groups called biomes. Biomes are determined by the characteristics of places and **ecosystems**. Biomes vary depending on location, climate (average temperature and precipitation), soil type and human interaction.

There is no set number of biomes on Earth. Some geographers simply divide Earth into five main biomes – aquatic, grassland, forest, desert and tundra – while other geographers use a much more detailed set of biomes.

Temperature and rainfall are the main factors that determine biomes. High temperatures and low rainfall lead to deserts, while low temperatures and high rainfall create tundra.

Source 3

The effect of temperature and rainfall on biomes

Arctic regions

Tundra

Subarctic regions

Boreal forest

Temperate regions

Temperate forest

Chaparral

Grassland

Desert

Tropical regions

Tropical forest

Desert

Grassland

Increasing temperature

Increasing dryness

Learning ladder G1.1

Show what you know

1　What are the five types of biome that some geographers use to describe our planet?

2　Construct a four-way Venn diagram to illustrate how Earth's four spheres interact with each other.

Digital and spatial technologies

Step 1: I can interpret different map types using cartographic conventions

3　Consider Source 3. What information is shown here, and why is it useful in understanding about biomes?

Step 2: I can construct paper maps using correct cartographic conventions

4　Using a blank world map and correct conventions, show the distribution of the five global biomes.

Step 3: I can access and use spatial technology platforms such as GIS

5　Access http://mea.digital/GHV9_G1_1. to explore the world's biomes. Which are located in Australia?

Step 4: I can manipulate data using digital and spatial technologies

6　Access http://mea.digital/GHV9_G1_2. Identify the locations and biomes of the following latitudes and longitudes:

a　(52.1° N, 19.4° E)

b　(74.8° N, 41.4° W)

HOW TO

BOLTSS, page 132

Is there a pattern to biome distribution?

The types of biome in an environment vary depending on where you are in the world. Biome distribution is influenced by natural and human factors. In general, there is a pattern to the way biomes are distributed on the planet, and we can use this information to make predictions. As the climate changes, the pattern of biome distribution may continue to change.

Solar radiation and the latitudinal effect

The Sun's rays are a critically important input for processes within biomes, such as **photosynthesis** in plants. Plants use photosynthesis to create energy to grow. Animals, in turn, feed on plants to support complex ecosystems.
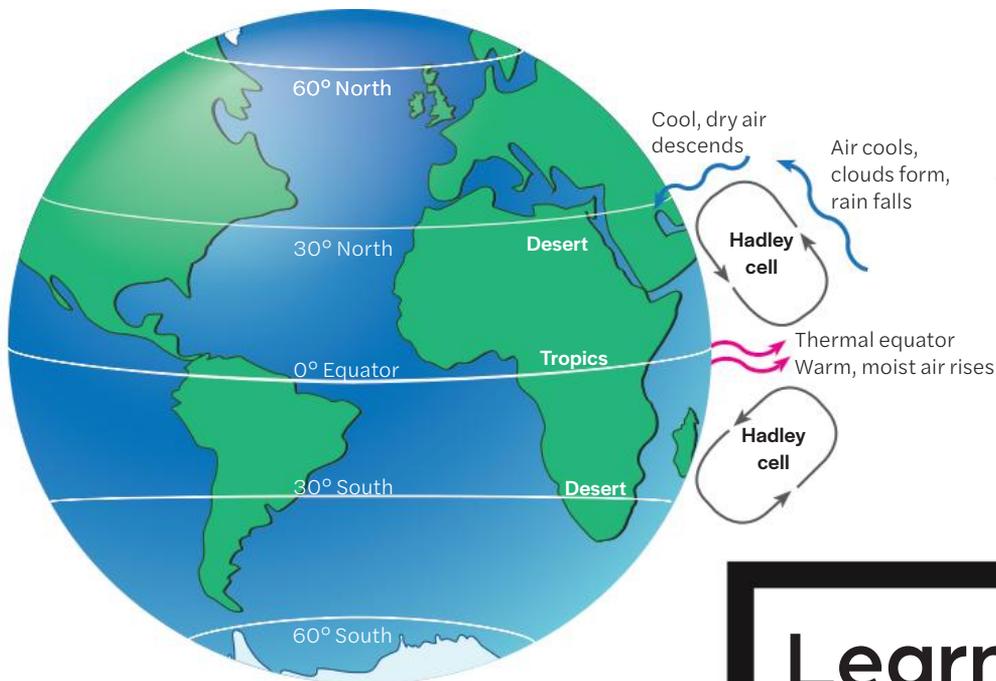
On Earth, the **equator** (zero degrees latitude) receives most of the Sun's rays (see Source 1), while the poles (90 degrees north and south of the equator) receive the least. Therefore, the equator tends to be associated with biomes such as forests and grasslands, where lush vegetation requires vast amounts of sunlight to grow. As you move away from the equator, the reduced energy provided by the Sun results in lower vegetation density, and biomes such as savannahs, deserts and taigas (snow forests) are more common. At 90 degrees north and south of the equator, the poles are characterised by tundras, polar ice and snow.
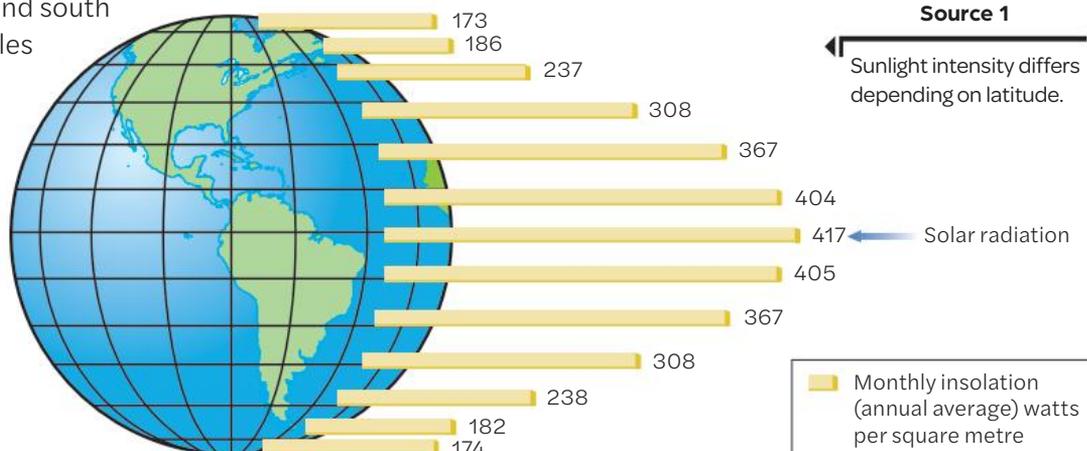
Atmospheric circulation

Precipitation is just as important as the Sun's energy for plant growth and the development of ecosystems. Like the Sun's rays, precipitation can also vary depending on latitude. The **Hadley cell** (see Source 2) is the name for the circulation of air in the atmosphere near the equator. At zero degrees latitude the warm air rises and water is evaporated, leading to cloud formation and large amounts of rainfall. This precipitation also contributes to the dense vegetation found near the equator. At approximately 30 degrees north and south the air descends, meaning there is less precipitation, less vegetation and more dry biomes, such as deserts.

Source 1

Sunlight intensity differs depending on latitude.

173
186
237
308
367
404
417 ← Solar radiation
405
367
308
238
182
174

Monthly insolation (annual average) watts per square metre

60° North

Cool, dry air descends

Air cools, clouds form, rain falls

30° North — Desert

Hadley cell

0° Equator — Tropics

Thermal equator
Warm, moist air rises

Hadley cell

30° South — Desert

60° South

Source 3

A rainforest biome in northern Ecuador, near the equator

Source 4

Most desert biomes are found along the Tropics of Capricorn and Cancer.

Source 5

Glaciers in Greenland within the Arctic Circle

Learning ladder G1.2

Show what you know

1 Outline two natural factors that affect the distribution of biomes on a global scale.

2 What kind of biome would you expect to see near the Tropic of Cancer?

3 Explain the process of the Hadley cell and its impacts on environments in different regions.

Changes and implications

Step 1: I can identify that changes occur in the characteristics of places over time

4 Consider Sources 3–5. Brainstorm two ideas to explain how biomes might change over time in a region due to changes in natural processes.

Step 2: I can describe how places have changed over time

5 Identify three places that are currently undergoing environmental change, then locate an image to illustrate each change.

Step 3: I can explain the causes behind the change over time in a place

6 Using the images you collected in question 5, provide one reason for environmental change at each location selected. Consider climate, atmospheric circulation and human needs.

Step 4: I can make predictions and outline consequences of change over time

7 Evaluate how the human population's increased need for resources may play a role in altering the world's biomes over time.
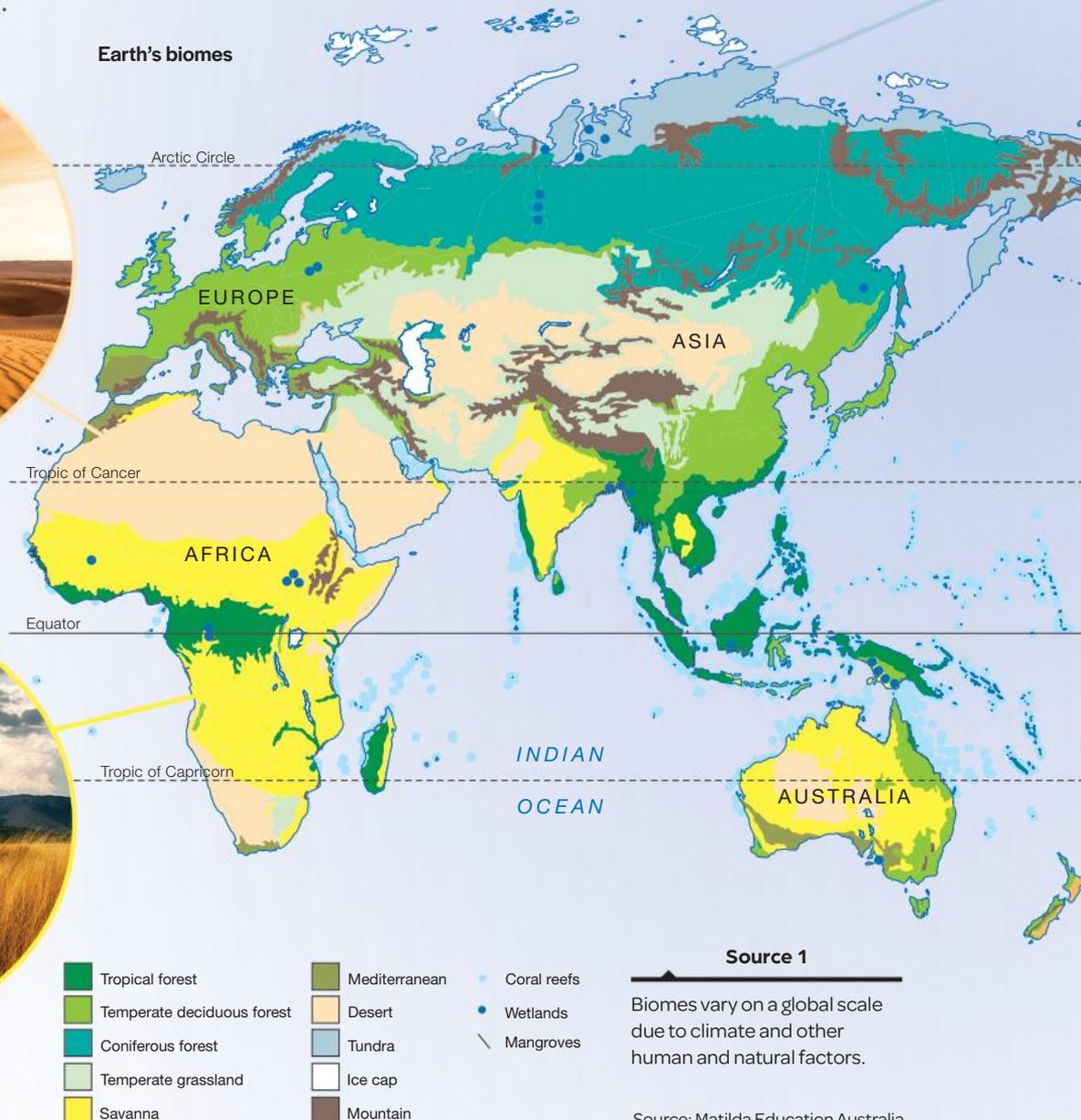
HOW TO

How do biomes vary on a global scale?

There is a wide distribution of biomes on a global scale, thanks to variations in temperature and rainfall. The equatorial regions tend to be more densely vegetated, while polar regions are cold and characterised by ice and snow. Biomes are usually named after the dominant vegetation or climate type within that region, such as 'rainforest' or 'polar ice'.

Earth's biomes

Desert: Home to 13 per cent of the world's population.

Grassland/savanna: Over 50 per cent of land surface in Africa is grassland.

Arctic Circle

EUROPE

ASIA

Tropic of Cancer

AFRICA

Equator

Tropic of Capricorn

INDIAN

OCEAN

AUSTRALIA

■ Tropical forest	■ Mediterranean
■ Temperate deciduous forest	■ Desert
■ Coniferous forest	■ Tundra
■ Temperate grassland	■ Ice cap
■ Savanna	■ Mountain

Coral reefs
• Wetlands
Mangroves

Source 1

Biomes vary on a global scale due to climate and other human and natural factors.

Source: Matilda Education Australia

Tundra: Is mostly found in the Northern Hemisphere and accounts for 3 per cent of the world's surface.

Forest: Covers 30 per cent of land.

ARCTIC

OCEAN

ATLANTIC

OCEAN

NORTH
AMERICA

PACIFIC

OCEAN

SOUTH
AMERICA

Aquatic: Water covers 71 per cent of the world's surface.

0   2000   4000 km

N

Modified Times Projection

Learning ladder G1.3

Show what you know

1　Explain why biomes are generally named after the dominant vegetation type.

2　As a class, discuss why deserts are home to 13 per cent of the world's population.

Spatial distributions and patterns

Step 1: I can identify spatial distributions and patterns

3　Outline the general distribution of forest biomes.

Step 2: I can use data to quantify spatial distributions and patterns

4　With reference to latitude, discuss how biome types change as you move north or south of the equator.

Step 3: I can describe spatial distributions and patterns

5　Use PQE to describe the distribution of biomes in Africa.

Step 4: I can use data to support exceptions to spatial distributions and patterns

6　Using the PQE from question 5, provide data to support the exception you wrote using an estimated percentage or the linear scale provided.

HOW
TO

PQE, page 136

How do biomes vary?

Earth's biomes vary in many ways. Climate and soil are two distinctive features of a biome. These have an impact on the animals and plants that will thrive in a particular area and affect the productivity of the biome.

Distinctive climates

Unlike weather, which changes daily, climate is the average temperature and average precipitation in a region usually measured over a year. As the growth of plant life and success of animal communities largely depends on the availability of sunlight and water, the latitudinal effect and Hadley cell play a major role in determining the local climate and type of biomes present in any given place on Earth.

We then classify each biome based on the type of vegetation or local climate. For example, the term 'tropical' tends to be associated with warm average temperatures and high precipitation. People like to visit tropical locations as they tend to be warm holiday spots, with lush forests and extensive wildlife to explore.

Variation in soil

Soil type also varies depending on location and can be influenced by climate through **weathering**, **leaching** and **erosion**. Soil is a **non–renewable resource**; it can take up to 500 years to develop a new one-centimetre layer of fertile top soil. The soil in biomes that have a high density of deciduous vegetation tends to be some of the most fertile in the world. This is because seasonal falling leaves create a natural compost layer on the earth.

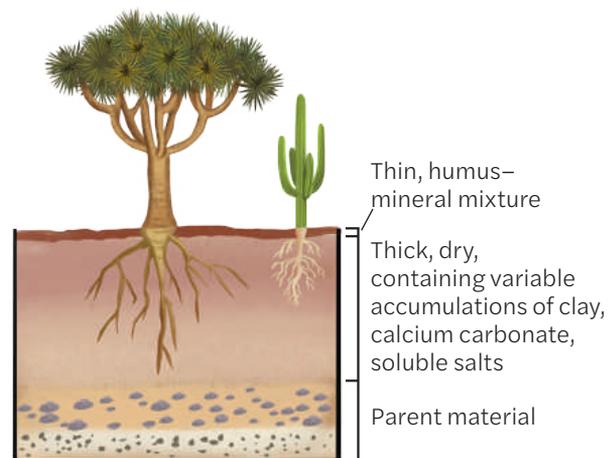**Coniferous forest soil**

Thick, acidic organic debris

Light-coloured, acidic

Humus, iron, aluminium

Parent material

Tropical rainforest soil

Negligible, because organic matter is decomposed and recycled quickly

Acidic, light-coloured

Iron and aluminium compounds mixed with clay

Parent material

Desert soil

Thin, humus–mineral mixture

Thick, dry, containing variable accumulations of clay, calcium carbonate, soluble salts

Parent material

Source 1

Soil type can influence the growth of vegetation and therefore the type of biome that exists in that location.
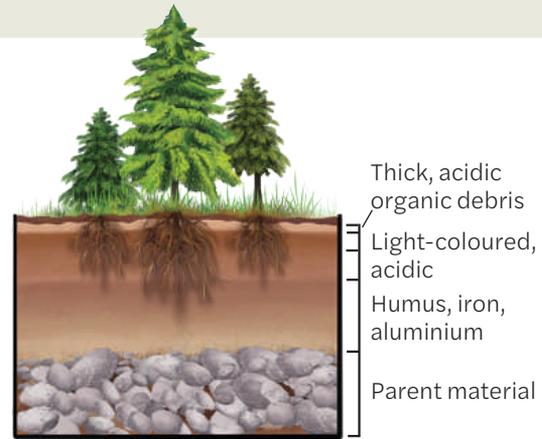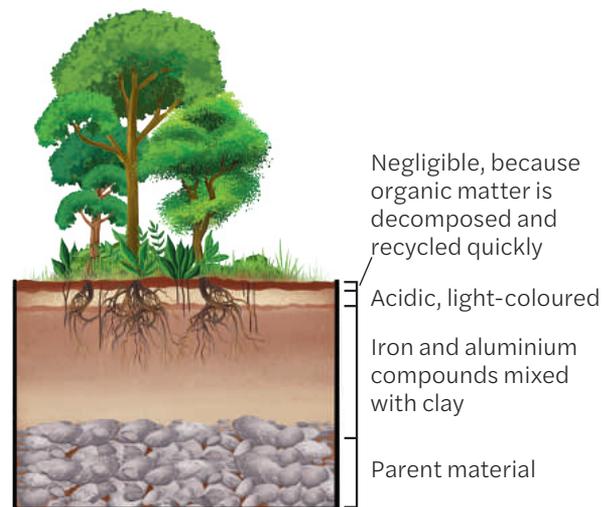
An example of how biomes can overlap within places
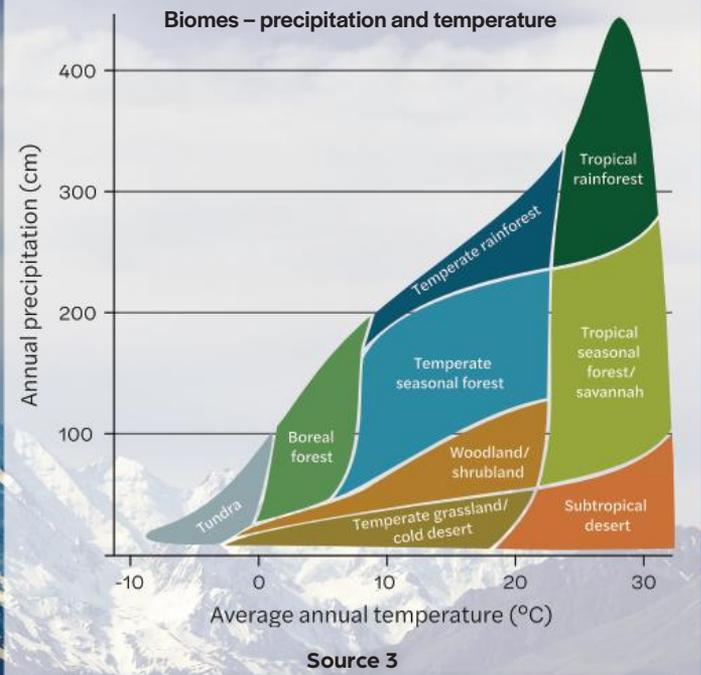

Biomes – precipitation and temperature

Source 3

With more precipitation and a mild climate, vegetation can grow and create lush biomes such as forests and grasslands.

Learning ladder G1.4

Show what you know

1   Discuss why water and sunlight are vital to the animals and plants within a biome.

2   Explain why soil type is strongly interconnected with whatever biome is present in that region.

3   Create a Venn diagram comparing the concepts of 'weather' and 'climate'.

Communicate data

Step 1: I can list primary and secondary methods useful for my study

4   Imagine your school principal has asked you to collect data to determine what biome your school is in. Create a list of primary and secondary methods that would assist you to collect this information.

Step 2: I can successfully use data collection methods

5   Apply one of the methods you outlined in question 4 to gather some relevant data. Discuss your findings as a class.

Step 3: I can filter collected data

6   Outline what data has been collected in Source 3. How would this information be helpful to Geographers?

7   Access http://mea.digital/GHV9_G1_3 and use the information to identify:
   a   the hottest month in Melbourne
   b   the wettest month in Melbourne.

Step 4: I can organise data collected according to relevance for a research question

8   Climate is determined by collecting data on average temperatures and precipitation. Using the weblink from question 7, create a summary table that shows the average maximum temperatures and mean rainfall for Melbourne over a calendar year.

A natural world 21

Why are Australia's biomes so varied?

Australia has a vast array of biomes. This is largely due to the size of Australia's landmass, which stretches from approximately 11 degrees to 44 degrees south of the equator. Australia's biomes are largely dependent on climate and human interaction.

Rainfall

Australia's rainfall is heavy in the tropical regions in the north of the country and in Tasmania, but much of the inland regions receive less that 200 millimetres of rain annually.

Along the coast of Australia, rainfall is between 800 and 1600 millimetres per year.
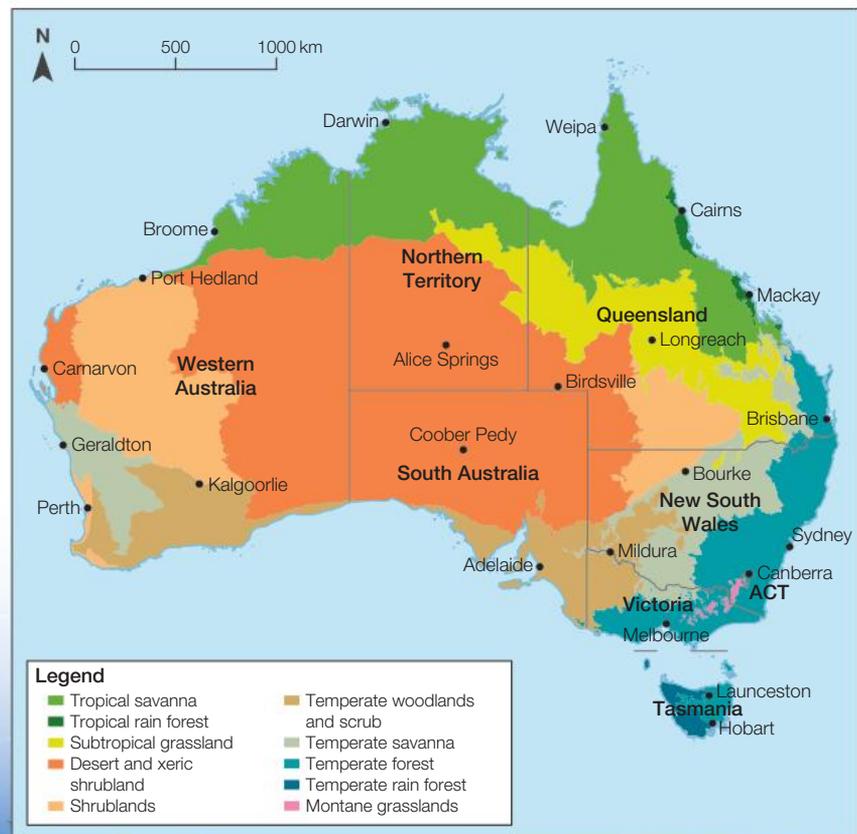
Temperature

Australia's temperature heavily affects it's biomes. Nearly the whole country has an average daily maximum over 15 degrees Celsius, while the far north of Australia is regularly higher than 27 degrees.

Only along the Great Dividing Range and in Tasmania do average daily maximums reach less than 10 degrees.

Source 1

Biomes vary on a regional scale within Australia.

Biomes of Australia

Legend
- Tropical savanna
- Tropical rain forest
- Subtropical grassland
- Desert and xeric shrubland
- Shrublands
- Temperate woodlands and scrub
- Temperate savanna
- Temperate forest
- Temperate rain forest
- Montane grasslands

Source: Matilda Education Australia, Wikipedia, Commonwealth of Australia 2019

Source 2

Australia has a vast range of biomes, from desert to rainforest, because of its varied climate.

Learning ladder G1.5

Show what you know

1   Create a list of the biomes present in Australia.

2   Consider your local area. Which biome best describes your local environment and why?

3   Develop a photo essay that highlights the biomes you listed in question 1. Annotate each photo with an explanation of why that biome may occur in Australia (consider natural and human factors).

Patterns and interconnections

Step 1: I can provide short explanations for patterns and interconnections

4   Provide a brief explanation of Australia's biome distribution with reference to its climate.

Step 2: I can explain patterns and interconnections

5   Using SHEEPT, explain why the biome types in Australia differ from those in Antartica.

Step 3: I can use data to support explanations of patterns and interconnections

6   Using the scale on Source 1, calculate the width of the desert and shrub biome in the centre of Australia from Carnarvon to Birdsville.

Step 4: I can use relevant sources to research further reasons for patterns and distributions

7   Research the percentage of Australia that is classified as:
   a   desert
   b   tropical
   c   grassland.

HOW TO

SHEEPT, page 138

How does natural productivity vary between biomes?

Biomes can also be described based on how productive they are. The **productivity** of a biome is linked to the rate of energy exchange between the living things in the biome. Lush, tropical rainforest biomes have a higher productivity than tundra biomes with their extremely cold, dry climates.
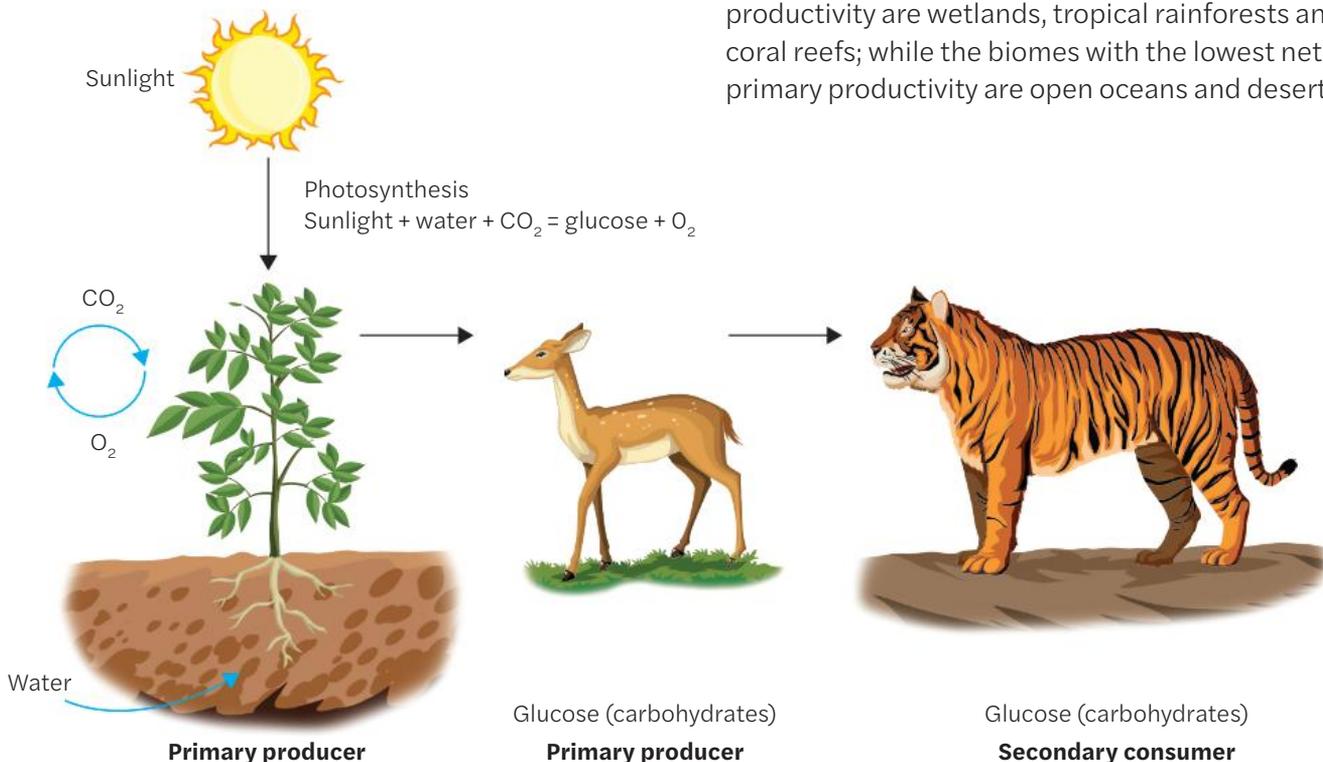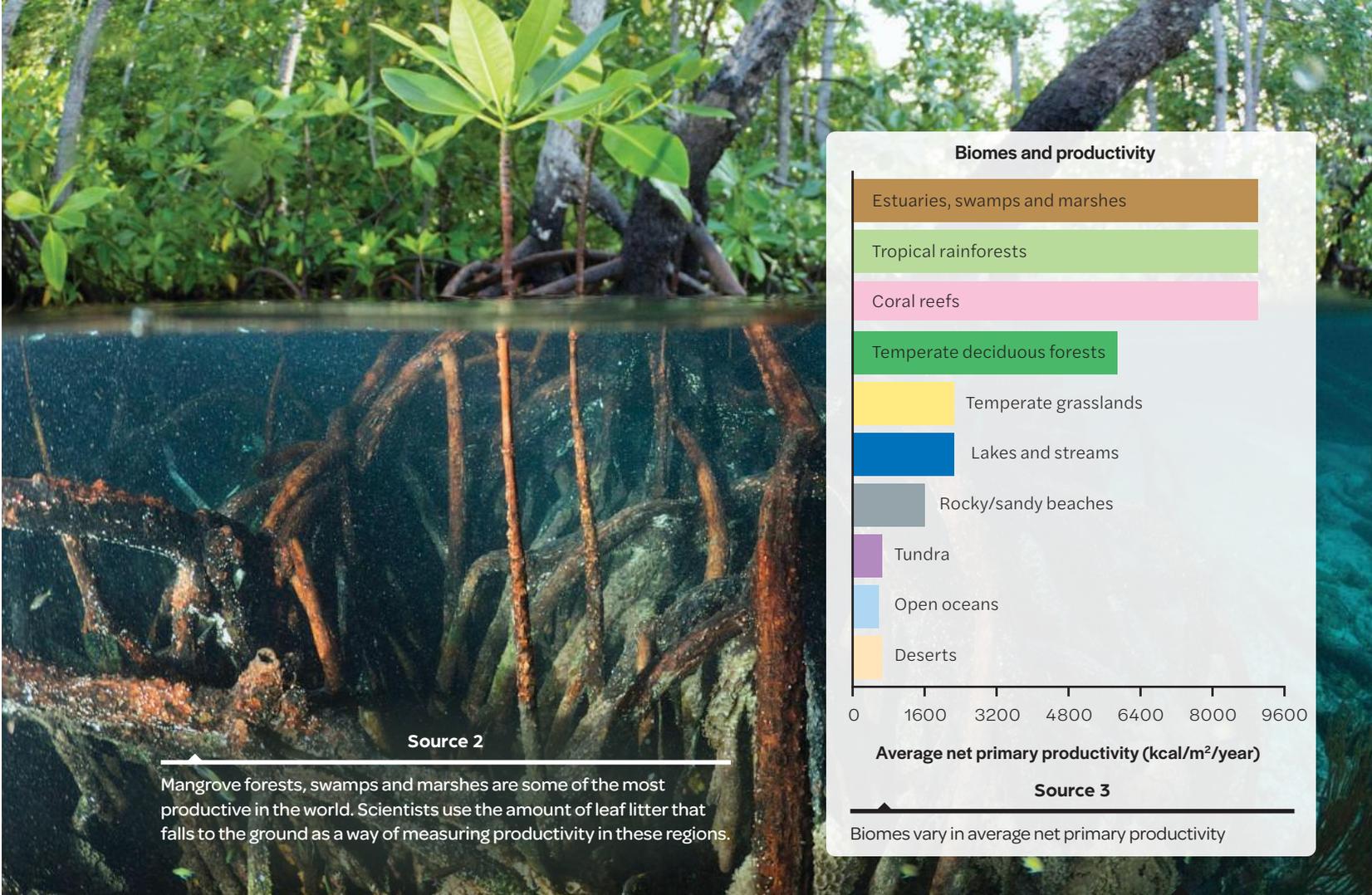
Producers and primary productivity

Producers are organisms that use sunlight, water and carbon dioxide to photosynthesise and produce their own energy. Green plants, such as trees or aquatic algae, are typical examples of producers. Plants tend to grow best in wet, tropical regions that allow maximum access to the Sun's rays.

As plants produce their own energy, they are classified as **primary producers**. Plants use some of the energy they create to grow, and the rest is stored. When an animal consumes a plant, it gains that stored energy and uses it for its own growth. The amount of energy a plant uses minus the amount they store is referred to as **net primary productivity**. Net primary productivity is a **quantitative** measure of how efficient a biome is. The biomes with the highest net primary productivity are wetlands, tropical rainforests and coral reefs; while the biomes with the lowest net primary productivity are open oceans and deserts.

Source 1

Primary productivity is vital for the success of consumer species.

Sunlight

Photosynthesis
Sunlight + water + CO_2 = glucose + O_2

CO_2

O_2

Water

Glucose (carbohydrates)

Glucose (carbohydrates)

Primary producer

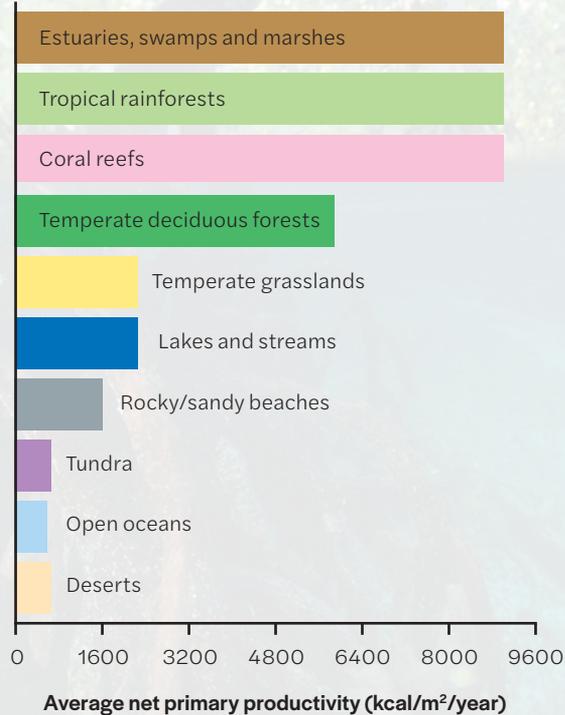**Primary producer**

Secondary consumer

Source 2

Mangrove forests, swamps and marshes are some of the most productive in the world. Scientists use the amount of leaf litter that falls to the ground as a way of measuring productivity in these regions.

Biomes and productivity

- Estuaries, swamps and marshes
- Tropical rainforests
- Coral reefs
- Temperate deciduous forests
- Temperate grasslands
- Lakes and streams
- Rocky/sandy beaches
- Tundra
- Open oceans
- Deserts

0   1600   3200   4800   6400   8000   9600

Average net primary productivity (kcal/m²/year)

Source 3

Biomes vary in average net primary productivity

Learning ladder G1.6

Show what you know

1 Provide one example each of a primary producer and a consumer.

2 Observe the flow diagram in Source 1. Using your drawing and annotation skills, create another example of a primary producer, primary consumer and secondary consumer. Incorporate the following terms in your diagram: photosynthesis, producer, consumer, net primary productivity and ecosystem.

Digital and spatial technologies

Step 1: I can interpret different map types using cartographic conventions

3 Explain what data is being displayed in source 3.

Step 2: I can construct paper maps using correct cartographic conventions

4 Create an overlay map to compare the distributions of net primary productivity and forest biomes.

a On a blank world map, complete BOLTSS and highlight the regions of the world with highest net primary productivity.

b Lay tracing paper over your base map. Using the outline, annotate the main locations of forest biomes on a global scale.

c How are the distributions interconnected?

Step 3: I can access and use spatial technology platforms such as GIS

5 Visit the NASA Earth Observatory website at http://mea.digital/GHV9_G1_4 and search for 'net primary productivity'. Use the materials provided to comment on how net primary productivity changes between years on a global scale.

Step 4: I can manipulate data using digital and spatial technologies

6 Visit the NASA Earth Observatory website at http://mea.digital/GHV9_G1_4 and search for 'net primary productivity'. Use the materials provided to comment on how net primary productivity changes in a particular region between seasons.

BOLTSS, page 132
Overlay maps, page 148

HOW TO

Why is studying biome productivity important?

Highly productive biomes such as swamps, marshes, rainforests and coral reefs are vital for the success of many animal communities. For example, it is estimated that tropical forests are home to more than two–thirds of the world's known animal and plant species. These places also are important for humans as a source of food, timber and other resources that are traded around the world.

Interconnection between biomes and productivity

Biomes that have high net primary productivity also tend to have a high species richness. **Species richness** is the number of different species within a **community**. Humans and other animals rely on primary producers, such as plants, to provide food for herbivores, which in turn are eaten by carnivores (see page 24). Therefore, the net primary productivity of a biome has a direct influence over the diversity of species (the **biodiversity**) within a place. These interconnections can be seen in Source 1.

In South America, the Amazon Rainforest is home to a staggering 16 000 different species of trees. It is one of the most productive places in the world, and supports a wide range of animal life including dolphins, monkeys, jaguars and sloths (Source 3).
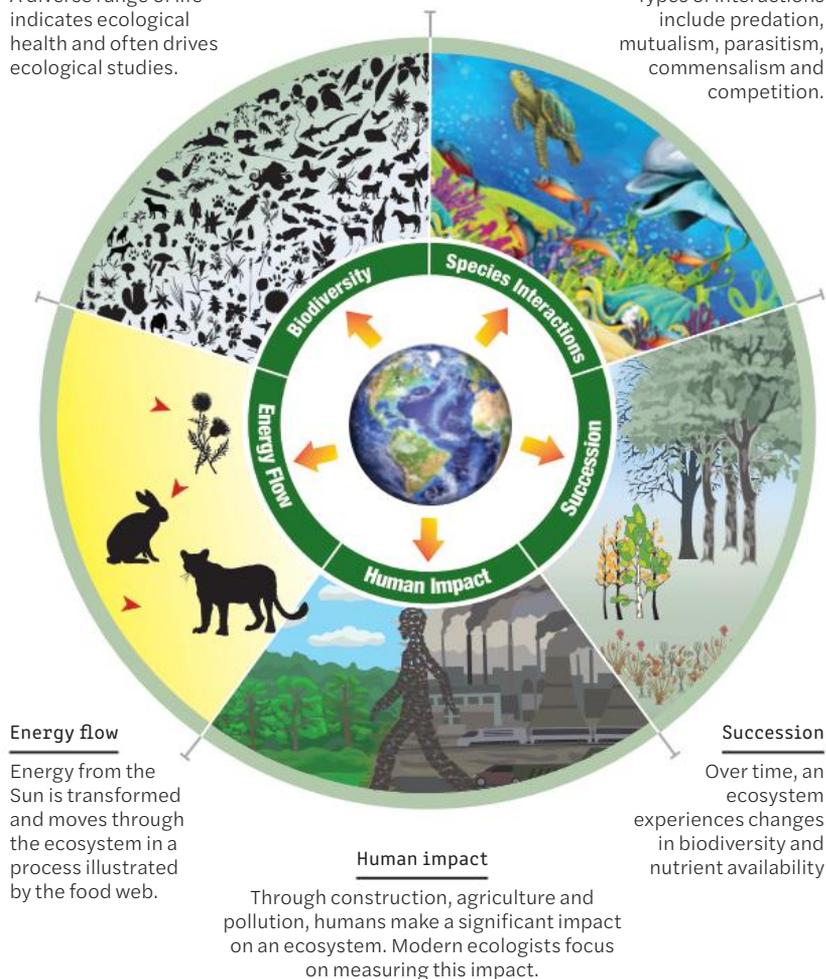
As the human population increases, we need more space for housing, transport and agriculture. Mass deforestation is currently occurring on a global scale. It is estimated that, over the last 30 years, humans have cut down or burned 1.3 million square kilometres of rainforest and replaced it with farmlands.

Biodiversity

A diverse range of life indicates ecological health and often drives ecological studies.
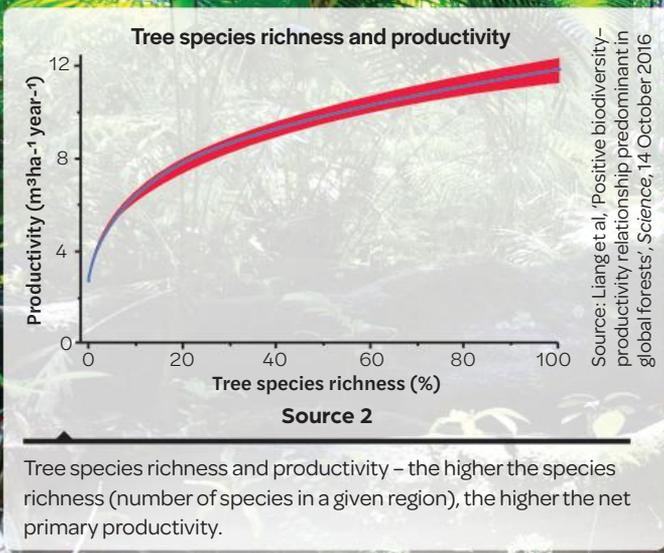
Species interactions

Types of interactions include predation, mutualism, parasitism, commensalism and competition.

Energy flow

Energy from the Sun is transformed and moves through the ecosystem in a process illustrated by the food web.

Human impact

Through construction, agriculture and pollution, humans make a significant impact on an ecosystem. Modern ecologists focus on measuring this impact.

Succession

Over time, an ecosystem experiences changes in biodiversity and nutrient availability
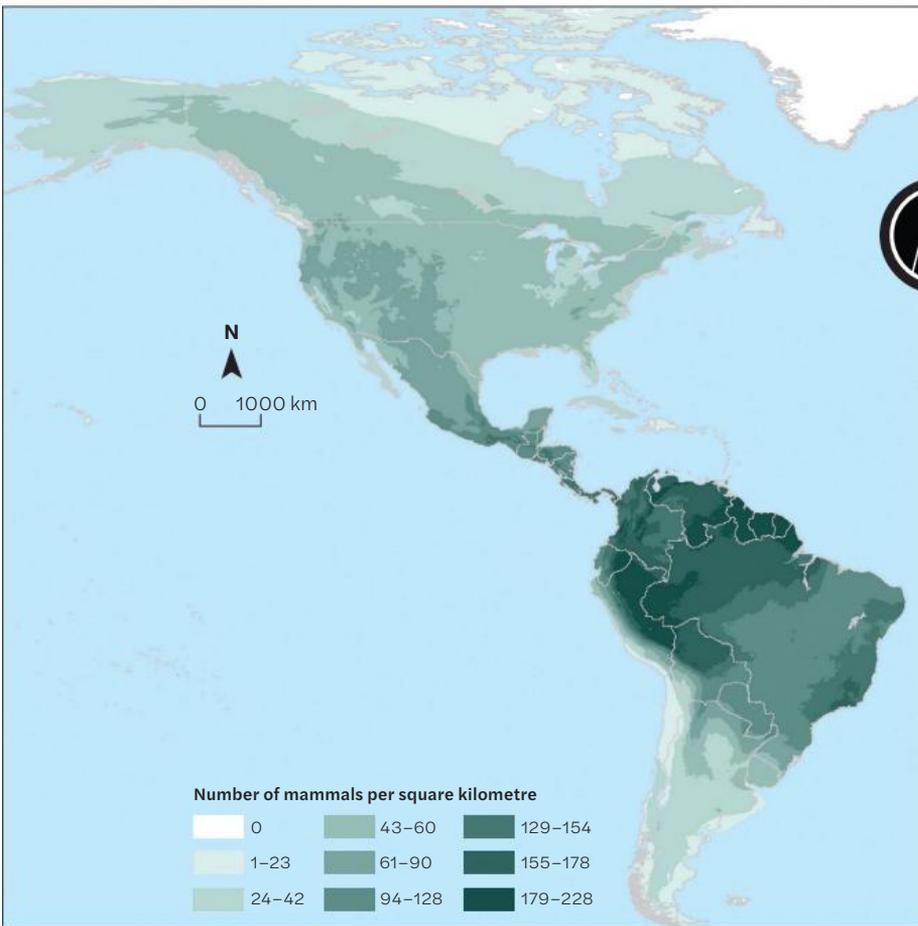
Source 1

Biomes contain strong interconnections between species richness, energy flows, human impacts and biodiversity.

Source: Carolina Biological Supply Company

Tree species richness and productivity

Source 2

Tree species richness and productivity – the higher the species richness (number of species in a given region), the higher the net primary productivity.

Removing primary producers such as trees not only decreases habitat and biomass from the environment but also contributes to our global carbon emissions. As these highly productive biomes are altered, we may see an increase in global temperatures, a reduction in precipitation and a decline in the efficiency of agriculture over time.

Species richness in North and South America

N

0   1000 km

Number of mammals per square kilometre

0	43–60	129–154
1–23	61–90	155–178
24–42	94–128	179–228

Source 3

Source: SEDAC

Species richness (mammals) per square kilometre in North and South America

Learning ladder G1.7

Show what you know

1 Define the term `species richness' using examples from the spread.

2 Discuss why productivity and species richness are important to understand when learning about biomes.

3 Construct a block diagram of a forest biome. Annotate how humans, animals, vegetation, climate and soil type interconnect.

Patterns and interconnections

Step 1: I can provide short explanations for patterns and interconnections

4 Source 3: Provide a brief explanation of what this graph is showing.

Step 2: I can explain patterns and interconnections

5 Source 2: Explain why productivity increases with tree species richness.

Step 3: I can use data to support explanations of patterns and interconnections

6 Source 3: Using PQE, describe the distribution of mammals in North and South America. Using information from this chapter, explain why mammals may occur in these locations.

Step 4: I can use relevant sources to research further reasons for patterns and interconnections

7 Investigate how humans are affecting biomes worldwide. Create an infographic of at least 10 facts and four images to show this.

HOW TO

Block diagrams, page 142

How does productivity vary in North America?

North America is the third largest of the seven continents and its landmass covers 24 230 000 square kilometres, or 16.5 per cent of the available land on Earth. It contains 23 countries including Canada, the USA and Mexico.
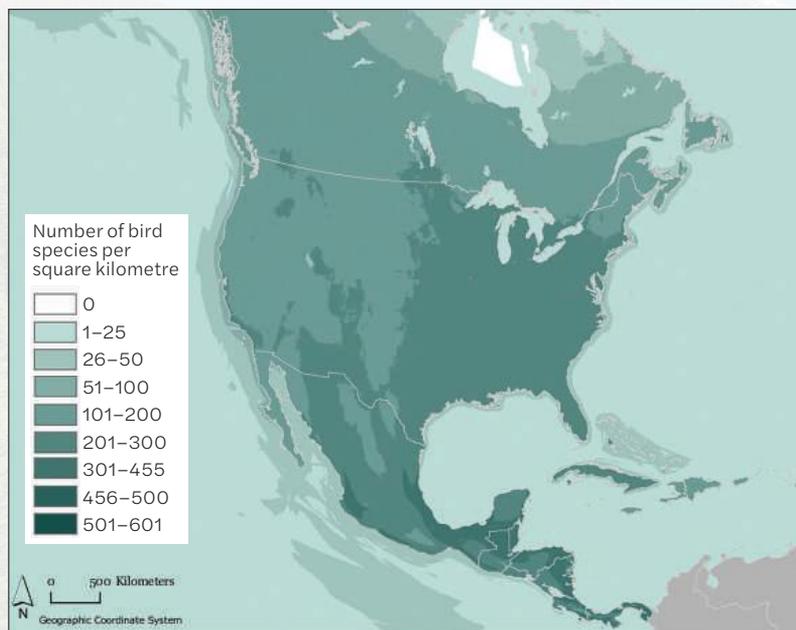
Productivity and biome interconnection

North America is home to a vast range of biomes, because of its large land size, as shown in Source 3. The most northern areas of the continent are contained within the Arctic circle, while the southern most points are tropical and densely forested.

These variations across the continent directly influence the net primary productivity and species richness of different regions. When you compare Sources 1 and 3, you can see that the differences in numbers of breeding bird species around North America is strongly interconnected with biome type, climate zone and net primary productivity. For example, bird species richness increases in regions of tropical and consistent climates.

Bird species richness in North America

Number of bird species per square kilometre

- 0
- 1–25
- 26–50
- 51–100
- 101–200
- 201–300
- 301–455
- 456–500
- 501–601

500 Kilometers

N

Geographic Coordinate System
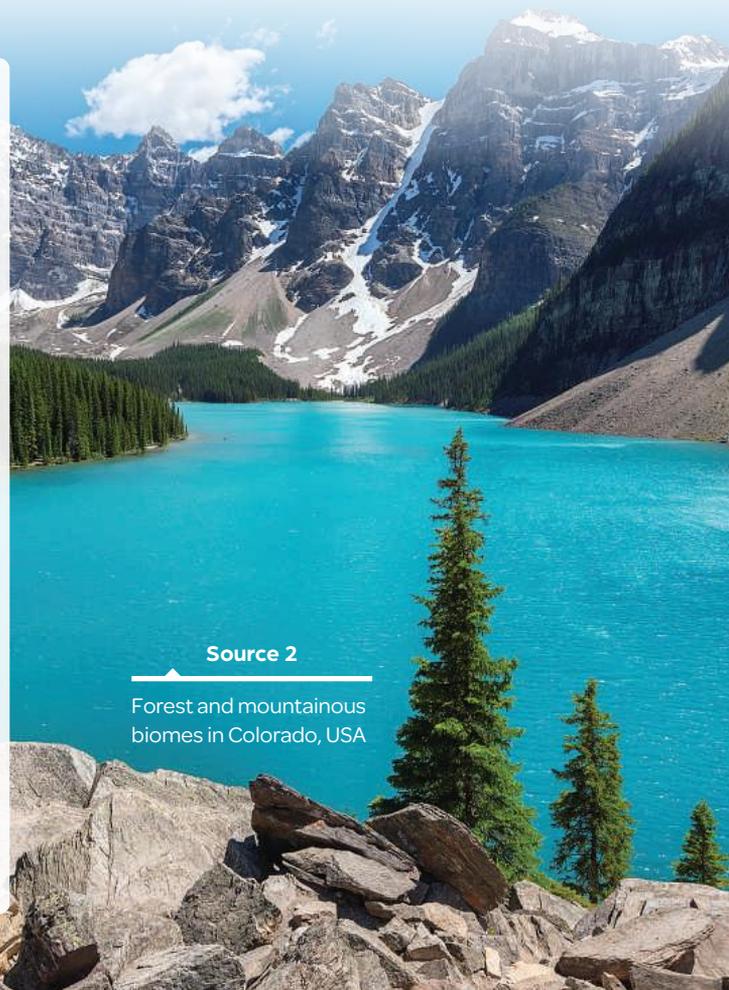
Source 1

Source: SEDAC

This map shows the numbers of breeding bird species across North America. There is a general trend of increasing number of bird species per square kilometre towards the east and south coasts where we observe more tropical biomes.

Source 2

Forest and mountainous biomes in Colorado, USA

Climate zones of North America

CLIMATE ZONE

- Tropical wet (hot and wet all year)
- Tropical wet or dry (hot with distinct wet and dry seasons)
- Humid subtropical (hot or warm, wet summer, mild winter)
- Tropical or mid-latitude semi-arid (hot and dry or cool and dry, usually with a distinct rainy season)
- Tropical or mid-latitude arid (hot and very dry or cool and very dry all year)
- Mediterranean (hot or warm, dry summer, mild wet winter)
- Maritime (warm summer, cool winter, wet all year)
- Continental warm summer (long, hot summer, cold winter)
- Continental cool summer (short, warm summer, cold winter)
- Subpolar (short, cool summer, extremely cold winter)
- Tundra (very short, cool summer, extremely cold winter)
- Mountain (affected by altitude)
- Ice cap (ice and snow, very cold all year)

N

0   500   1000 km

Source 3

The varying climate zones of North America

Source: Matilda Education Australia

Learning ladder G1.8

Show what you know

1   Outline the relative location of North America and find out the absolute location of Atlanta, USA.

2   Compare North America to Australia in terms of its variation in climate and biomes across the landmass.

3   Using Source 3, identify the major biomes in the following locations:
a   Atlanta
b   Churchill
c   Los Angeles.

Communicate data

Step 1: I can list primary and secondary methods useful for my study

4   Identify two methods that would help you collect data on climate zones as pictured in Source 3.

Step 2: I can successfully use data collection methods

5   Using correct techniques, create a field sketch of your local environment. In the annotations, comment on how human actions have changed the natural biome of the region.

Step 3: I can filter collected data

6   Imagine you were conducting the study on breeding birds shown in Source 1. List five points of data you would need to collect in order to understand how breeding birds are affected by primary productivity.

Step 4: I can organise data collected according to relevance for a research question

7   Rank the list of data you suggested in question 6 from most important to least important.

Sketches and annotating, page 140

civics + citizenship

What is global citizenship?

A global citizen is someone who understands that they are part of a wider world and wants to make that world a better place. Global citizenship involves people in many nations taking local action to make our planet fairer, safer, more tolerant and sustainable.

Global citizens

Global citizens are individuals who believe they have a civic responsibility, as human beings, to respect other humans and the planet Earth itself. **Global citizenship** is not a legal status, like Australian citizenship, but represents people who attempt to be **socially responsible** and act to benefit all societies across the world, not just their own. The concept of global citizenship could be summed up by the words of the American political philosopher Thomas Paine, who said in 1792, 'my country is the world, and my religion is to do good'.

Global citizenship education is promoted by the **United Nations (UN)**, an organisation formed in 1945 to maintain international peace and promote co-operation between nations. Global citizenship education aims to empower people to actively promote a more peaceful, tolerant, inclusive and sustainable world.

Source 1

Students at the School Strike for Climate demonstration

Global challenges

Global citizens need to address many important environmental and societal issues around the world, including:

- climate change
- degradation of environments
- gender inequality
- poverty.

To build a more peaceful and **sustainable** world, we all need to change the ways we coexist with the planet and each other. We need to think globally and act locally to shape a more tolerant and sustainable world. Participating in **awareness campaigns** about global issues, writing letters, signing petitions and attending demonstrations are all ways that you can be a responsible global citizen.

School Strike for Climate

The 2019–2020 bushfires once again sparked conversation between the media, parliament and lobby groups around global warming and our use of fossil fuels. School students across the country joined forces to hold a 'school strike' and attend climate change rallies. In Victoria, over 100 000 young people gathered to protest about the need for further action on climate change. Many held signs, with some reading 'One day I will vote, but today I march'.

Chrissy Downes, a Year 10 student from Glen Iris in Melbourne, said she had joined the School Strike for Climate demonstration because the bushfires 'currently sweeping our nation are undoubtedly influenced by the climate crisis'.

'We're doing this protest today as a solidarity sit down to show how much we care about those that are affected by the bushfires that are wreaking havoc across our country,' she said.

This has been noted from firefighters to Indigenous leaders to scientists for years and it's time our policymakers and politicians both on a state, local and federal level give them a voice and listen to them,' she added.

It is important that the awareness raised by events such as the school strike is not lost, and that we continue trying to live more sustainably.

Learning ladder G1.9

Civics and citizenship

Step 1: I can identify topics about society

1 How is global citizenship different to citizenship in a nation?

Step 2: I can describe societal issues

2 Prepare a bulleted list that describes the aims of global citizenship.

Step 3: I can explain issues in society

3 Select one of the global issues listed in this spread, and explain why it is an issue that deserves attention.

Step 4: I can explain different points of view

4 Select one of the global challenges listed in this spread, and explain two different points of view about the issue.

Step 5: I can analyse issues in society

5 What was the purpose of the student climate change rally? What could students do during pandemic conditions to act as global citizens and raise awareness about human-induced climate change?
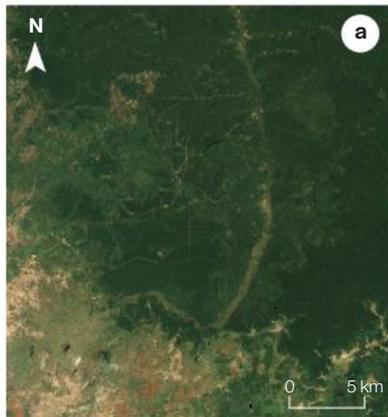
Masterclass

Learning ladder

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

Boreal forests and taiga
Deserts and xeric shrublands
Flooded grasslands & savannas
Mangroves
Mediterranean forest and scrub
Montane grasslands and shrublands
Rock and ice
Temperate forests
Temperate grasslands and shrublands
Tropical/subtropical forests
Tropical/subtropical grasslands and shrublands
Tundra

Scale true at equator
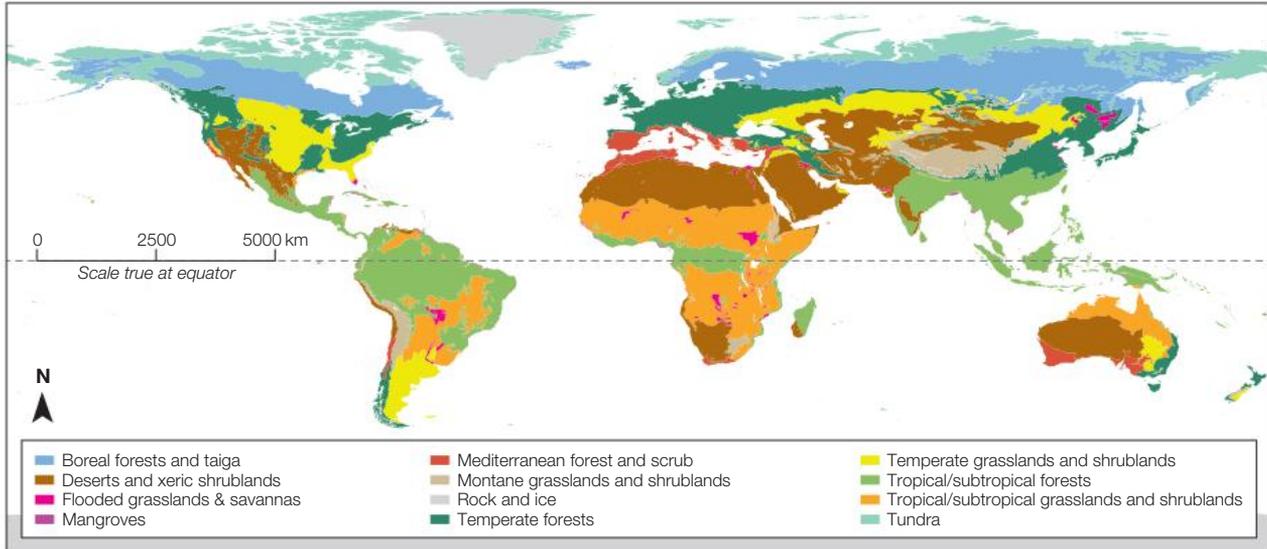
Source: Matilda Education Australia, Ecoregions2017

Source 1

Change over time in Cambodia:
a 2000 and **b** 2015

Source 2

The distribution of biomes on a global scale

Main biomes of the world

Source 3

Change in species richness over time in North America

Historic

Current

Change

Number of species
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14

Species gained
3
2
1

Species lost
1
2
3
4
5
6
7
8
9
10
11
12

Source: NASA

Source: Matilda Education Australia, Ecoregions2017

Climate graph for Brisbane, Australia
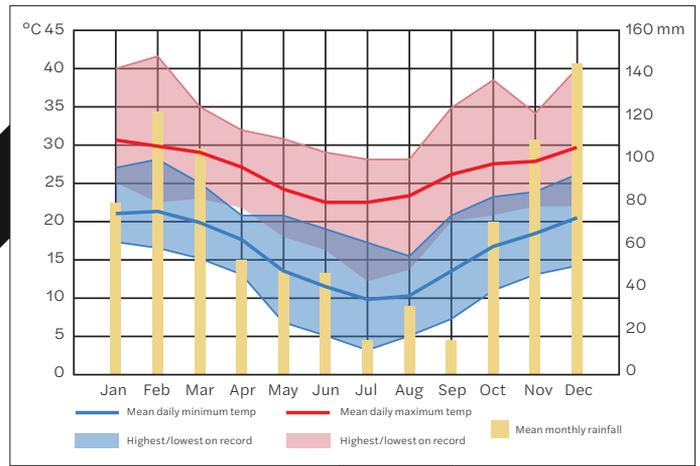
Source: Weatherzone

Step 1

a **I can identify spatial distributions and patterns**

Identify the primary locations of desert biomes in the world.

b **I can provide short explanations for patterns and interconnections**

Provide two explanations for the locations of desert biomes in the world.

c **I can identify that changes occur in the characteristics of places over time**

Refer to Source 4. Comment on how precipitation changes monthly in Brisbane, Australia.

d **I can list primary and secondary methods useful for my study**

Investigate the research question: 'How does climate affect biomes?' Create a list of two primary and two secondary methods you could use to collect data to answer this question.

e **I can interpret different map types using cartographic conventions**

Identify the map type used in Source 3.

Step 2

a **I can use data to quantify spatial distributions and patterns**

Refer to Source 4. Using data, describe how temperature changes monthly in Brisbane, Australia.

b **I can explain patterns and interconnections**

Source 3: Using SHEEPT, suggest the potential causes of changes to species richness in North America over time.

c **I can describe how places have changed over time**

Source 1: Using examples, describe the changes that have occurred in Cambodia over time.

d **I can successfully use data collection methods**

Explore climate data at the Bureau of Meteorology website and collect data that explains why Central Australia is dominated by desert biomes.

e **I can construct paper maps using correct cartographic conventions**

Using this data table and a blank map of Australia, create a choropleth map showing the difference in temperature between states.

7 January 2013	Average maximum
Queensland	33.0°C
NSW	34.5°C
Victoria	34.7°C
Tasmania	27.1°C
South Australia	38.9°C
Western Australia	38.0°C
Northern Territory	37.5°C

Step 3

a **I can describe spatial distributions and patterns**

Source 3: Use PQE to describe the change in species richness in North America over time.

b **I can use data to support explanations of patterns and interconnections**

Using data and examples from this chapter to support your response, explain which of the following biomes would have the highest levels of net primary productivity.

• Forest   • Desert   • Tundra

c **I can explain the causes behind the change over time in a place**

Source 1: Outline three possible causes for the change over time in Cambodia.

d **I can filter collected data**

Investigate the following research question: 'What natural factors determine the types of biomes present in a region?' Select which sources in this spread would provide the most appropriate evidence.

Masterclass

e I can access and use spatial technology platforms such as GIS

Access http://mea.digital/GHV9_G1_1. to explore the world's biomes. Record data on the following topics for five locations:

i climate   ii animal species   iii biomes present.

step 4 Step 4

a I can use data to support exceptions to spatial distributions and patterns

Source 4: Using PQE, describe the climate of Brisbane, quantifying both your pattern and exception.

b I can use relevant sources to research further reasons for patterns and interconnections

Source 4: Which biomes are present in Brisbane? Discuss the interconnection between these biomes and their climate.

c I can make predictions and outline consequences of change over time

Source 1: Suggest five consequences of the change over time in Cambodia, considering environmental, economic and social factors.

d I can organise data collected according to relevance for a research question

Access the Switch Zoo Animal Games at http://mea.digital/GHV9_G1_7. Navigate to the 'Build a biome' game. Build a series of biomes based on your knowledge of their characteristics and climate.

e I can manipulate data using digital and spatial technologies

Access the Our Environment website at http://mea.digital/GHV9_G1_8. Explore the different landscapes and habitats in New Zealand and create summary notes of your observations.

step 5 Step 5

a I can identify multiple spatial distributions and patterns

Research the web to find a climate graph of Melbourne. Compare it with the climate of Brisbane in Source 4 and, using PQE, identify any similarities or differences between the two cities.

b I can interpret causes of patterns and interconnections

Discuss the interconnection between the patterns of species richness in Source 3. What could be the reasons for the change?

c I can interpret data to quantify predictions based on research

Refer to Source 3. Conduct some research and, using quantitative data, predict the future pattern of species richness in North America.

d I can evaluate the success of research methods

Source 1: Evaluate the usefulness of satellite images in determining change over time to Cambodia's natural environment.

e I can draw conclusions from geographical information in digital and spatial technologies

Visit the VRO Agriculture website at http://mea.digital/GHV9_G1_9. Type 'primary production landscapes of Victoria with representative soil profiles' into the search bar. Use the information to discuss how natural factors, such as soil type, can influence biome type and land use in particular regions.

Capstone

How can I understand the natural world?

In this chapter, you have learnt a lot about the natural world. 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.

mea.digital/GHV9_G1

Scan this QR code to find the capstone project online.

A human world

HOW DO **HUMANS** CHANGE THE **ENVIRONMENT?** page **38**

How can I understand our human world?

Humans alter the biomes of the world for many reasons, including transport, tourism and safety. One of the main reasons is for the purposes of food and fibre production. When humans alter a biome to produce food, industrial materials and fibres, these alterations can have significant environmental impacts.

learning ladder

step 5

I can identify multiple spatial distributions and patterns
I can take my PQE one step further to find links or relationships that exist in the human world.

I can interpret causes of patterns and interconnections
I can use multiple sources to find links or relationships that exist in the human world and can explain 'Why?'.

I can interpret data to quantify predictions based on research
I can use external data from research as evidence of the positive and negative impacts of a change I have predicted.

step 4

I can use data to support exceptions to spatial distributions and patterns
I can use data to answer 'Why?' about the exceptions identified in a PQE analysis of the human world.

I can use relevant sources to research further reasons for patterns and interconnections
I can use sources other than this textbook to further research patterns I observe in the human world.

I can make predictions and outline consequences of change over time
I can use my knowledge of natural processes and world regions to make an educated guess of the positive and negative impacts of change in the human world.

step 3

I can describe spatial distributions and patterns
I can describe patterns, quantify them and point out exceptions (PQE) to describe the human world.

I can use data to support explanations of patterns and interconnections
I can use data from a map or graph to explain patterns I observe in the human world.

I can explain the causes behind the change over time in a place
I can use my knowledge of natural processes and world regions to explain why changes may occur over time in the human world.

step 2

I can use data to quantify spatial distributions and patterns
I can read data and use it to measure key trends on a map or graph about the human world.

I can explain patterns and interconnections
I can identify social, historical, economic, environmental, political and technological (SHEEPT) factors to help me explain the human world.

I can describe how places have changed over time
I can use specific examples to describe changes over time in the human world.

step 1

I can identify spatial distributions and patterns
I can find key trends on a map or graph about the human world.

I can provide short explanations for patterns and interconnections
I can write descriptions of patterns and interconnections that I find in the human world.

I can identify that changes occur in the characteristics of places over time
I can read information and answer questions about changes over time in the human world.

| Spatial distributions and patterns | Patterns and interconnections | Changes and implications |

Source 1

A canola field in full bloom in the farmlands of rural Victoria. One isolated patch of gumtrees can be seen in the middle of the plain.

Warm up

Spatial distributions and patterns

1. Refer to Source 1. Describe the type of agriculture that is being undertaken in this region. What other vegetation is present?

Patterns and interconnections

2. What evidence of technology can you see in Source 1?

Changes and implications

3. Describe the biome in Source 1 before it was altered by humans to serve as a farm for food production.
   a. What evidence do you have for this change?
   b. Write down one positive and one negative impact of this change.

Communicate data

4. What type of photograph is shown in Source 1?

Digital and spatial technologies

5. Sketch a map of Source 1 and label any evidence of human alteration of this place.

I can evaluate the success of research methods
On reflection, I can look back and comment on the data collection methods I used and evaluate how successful they were in helping me answer a research question about the human world.

I can draw conclusions from geographical information in digital and spatial technologies
I can interpret and analyse patterns by using different layers and features on spatial technology platforms.

I can organise data collected according to relevance for a research question
I can review the data I have collected in the field and display it using graphs, tables, annotations and captions.

I can manipulate data using digital and spatial technologies
I can work with layers and other features on spatial technology platforms to further explore data and interconnections.

I can filter collected data
I can review my collected data and select the most relevant data to answer a research question about the human world.

I can access and use spatial technology platforms such as GIS
I can use spatial technology platforms to explore data and find patterns.

I can successfully use data collection methods
I can use primary and secondary data collection methods in the field and classroom to investigate the human world.

I can construct paper maps using correct cartographic conventions
I can use a pencil, paper and ruler to construct a map that follows BOLTSS conventions.

I can list primary and secondary methods useful for my study
I can create a checklist of methods to investigate the human world and categorise them as primary or secondary methods.

I can interpret different map types using cartographic conventions
I understand data found in different types of maps and graphs and use the data to answer questions about the human world.

Communicate data

Digital and spatial technologies

How do humans change the environment?

The natural characteristics of biomes can influence the way humans use the land. We also alter the environment to suit our own needs. These changes can have both positive and negative outcomes for a region.

Anthropogenic biomes of the world

N

Urban		
		Dense
		Urban
Wildlands		Barren
		Sparse
		Wild
Forested		Populated
		Remote
Rangelands		Residential
		Populated
		Remote
Croplands		Residential irrigated
		Residential rainfed
		Populated irrigated
		Populated rainfed
		Remote
Villages		Rice
		Irrigated
		Cropped and pastoral
		Pastoral
		Rainfed
		Rainfed mosaic

0   2500   5000 km
Scale true at equator

Water degradation

Aquatic environments are affected by surrounding human activities, including urbanisation and agriculture. When fertilisers and other products containing high levels of nutrients are washed into these natural environments, it causes algal blooms to form. These blooms attract bacteria that feed upon decaying matter. As the number of bacteria grows exponentially, the level of oxygen in the water decreases and this can cause large 'fish kills' within the region. The dead fish, which may have also been feeding on the toxic algae, also pose a risk to other consumers, such as aquatic birds and mammals.

Borneo's environment is being altered by palm oil plantations.

Land degradation

One of the biggest anthropogenic changes occurring in Borneo is **deforestation** to make way for palm oil plantations. Palm oil is a popular and versatile oil that is a component in more than 50 per cent of Australian supermarket products. As more plantations are created, Borneo loses more than 1.3 million hectares of forest a year, and the World Wide Fund for Nature estimates that less than 24 per cent of forest cover remains in 2020. These forests also provide habitat for many species that will become extinct without the food and shelter that the rainforest environment provides.

Source: Erle Ellis, UMBC

Learning ladder G2.1

Show what you know

1   Outline how humans use the land. Classify each use as positive or negative for the environment.

2   Why do humans alter biomes, even though we understand their importance to ecosystems and communities?

3   Source 3: Locate historical and current satellite images of Borneo and discuss how the environment has changed over time because of human influence.

Communicate data

Step 1: I can list primary and secondary methods useful for my study

4   Imagine you plan to investigate the impact of the cotton industry on your local environment. (Remember, impacts can be both beneficial and harmful.) List one primary and two secondary methods for collecting appropriate data.

Step 2: I can successfully use data collection methods

5   Using secondary sources, collect some data that would help address the research topic outlined in question 4.

Step 3: I can filter collected data

6   Using the data you collected in question 5, create a poster showing the impacts of the cotton industry to educate others in your community.

Step 4: I can organise data collected according to relevance for a research question

7   As a class, create a data bank that highlights the impacts the cotton industry might have on your local region.

Industrialisation

Cotton is a versatile crop that can be used for materials and food. Currently, cotton production provides work for more than 7 per cent of people in **less economically developed countries (LEDCs)**. However, cotton requires a lot of water: 20 000 litres are needed for enough cotton to make a t-shirt and a pair of jeans. Of all crops, cotton consumes the largest amount of pesticides (11 per cent of all pesticides globally), which eventually make their way into the natural land and water systems.

HOW TO

Are freshwater biomes our most valuable?

Life depends on water. For humans, water is not only vital to our health, but also crucial for agriculture, sanitation, cooking and recreation. While Earth is known as the 'blue planet', only 2.5 per cent of the water on Earth is fresh. Of that 2.5 per cent, around 1.75 per cent is locked in glaciers and sea ice, so is not accessible to humans. The remaining of fresh water comes from rivers and lakes, springs, purpose–built catchments such as dams and rainwater tanks, as well as bores and wells located underground.
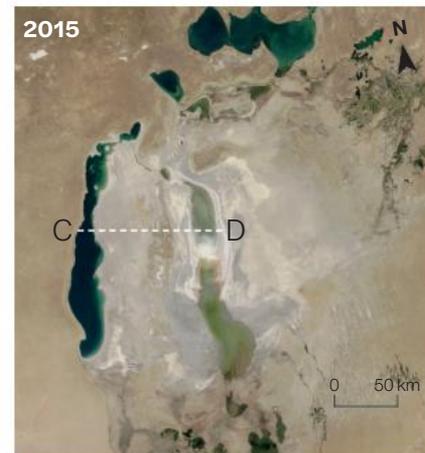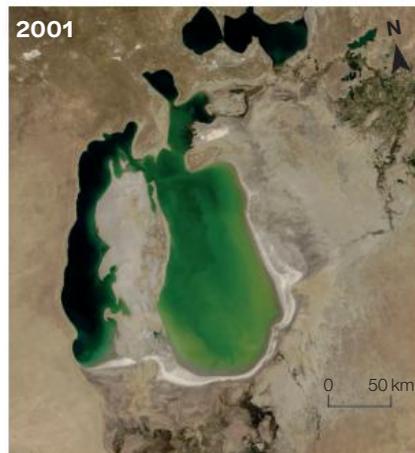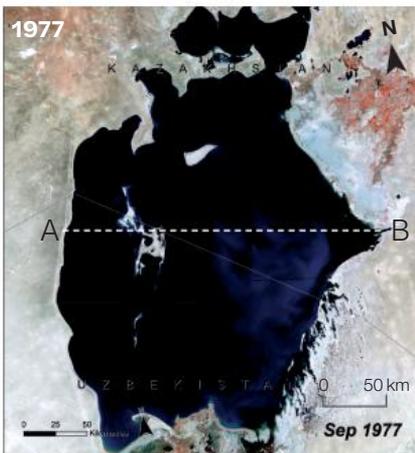
Source 1

The Aral Sea, in Central Asia, was once an expansive freshwater lake, but over time it has almost completely dried up because of drought, overuse and irrigation.

Freshwater biome degradation

Water pollution and degradation is a global issue. As the human population increases, so does our output of pollution and waste, as well as our overall reliance on fresh water sources. Key resources such as the Ganges River or the Aral Sea, which were once large freshwater systems, are now largely degraded, polluted or lost because of human use.

The Ganges River, in India, is a highly sacred, spiritual place. However, because of its many uses – from drinking, washing, cooking and transport, to burial ceremonies and human waste disposal – the river has become highly polluted. This has resulted in many health issues for those living alongside it.

Source 2

The Ganges River in India is an example of a freshwater biome that has become polluted.

Irrigation

In many dry regions, such as Australia, agricultural success relies on **irrigation**. Irrigation diverts water from rivers and lakes to crops, either directly, via channels, or indirectly, through pipelines. While irrigation helps to increase suitable growing conditions, which increases crop yields, it removes water from natural systems and therefore alters local biomes.

The world's freshwater biomes
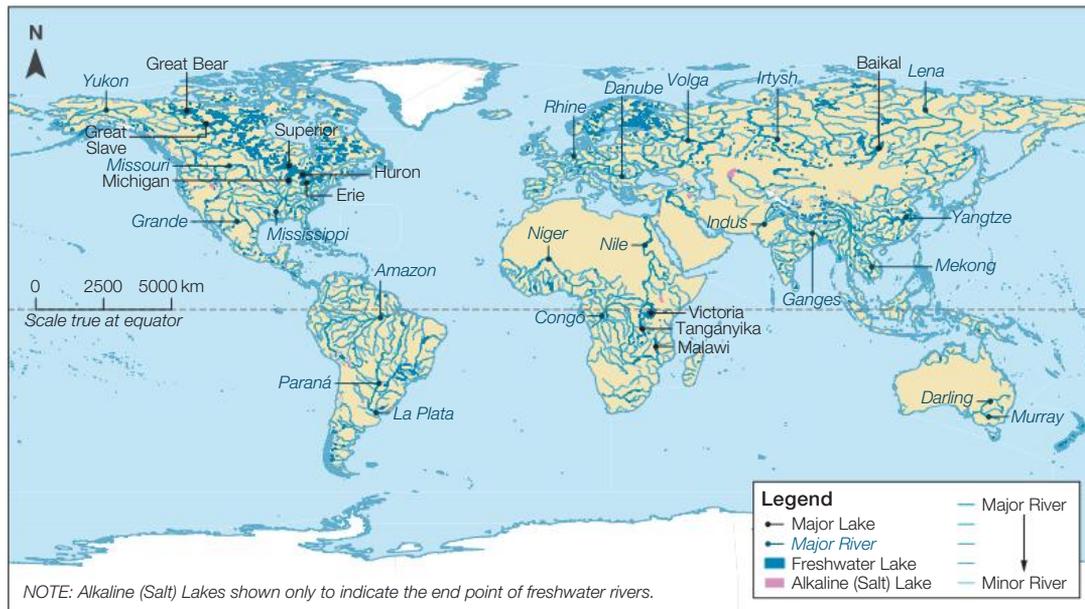
NOTE: Alkaline (Salt) Lakes shown only to indicate the end point of freshwater rivers.

Legend
- Major Lake
- *Major River*
- Freshwater Lake
- Alkaline (Salt) Lake
- Major River
- Minor River

Matilda Education Australia

Learning ladder G2.2

Show what you know

1   List two reasons fresh water is a scarce resource.

2   Outline how water access is interconnected with food crop yields.

3   Define the term 'degradation' using the terms 'pollution' and 'water'.

Patterns and interconnections

Step 1: I can provide short explanations for patterns and interconnections

4   Source 4: Suggest why access to fresh water is not evenly distributed on a global scale.

Step 2: I can explain and patterns and interconnections

5   Source 2: Using the SHEEPT factors, explain why the Ganges River has become so degraded over time.

Step 3: I can use data to support explanations patterns and interconnections

6   Source 1: Using the scale, measure the length of the transect line (from A–B and C–D) and calculate the change in the expanse of the Aral Sea from 1977 to 2015.

Step 4: I can use relevant sources to research further reasons for patterns and interconnections

7   Conduct some research to create a summary table that highlights how much water is used in the production of different crops such as cotton, nuts and wheat. Comment on how irrigation may play an important role in the success of these crops in Australia.

SHEEPT, page 138
Transects, page 149

HOW TO

How does global warming impact productivity?

Often the terms 'climate change' and 'global warming' are used interchangeably. However, these terms can actually refer to different processes on Earth.

Climate change versus global warming
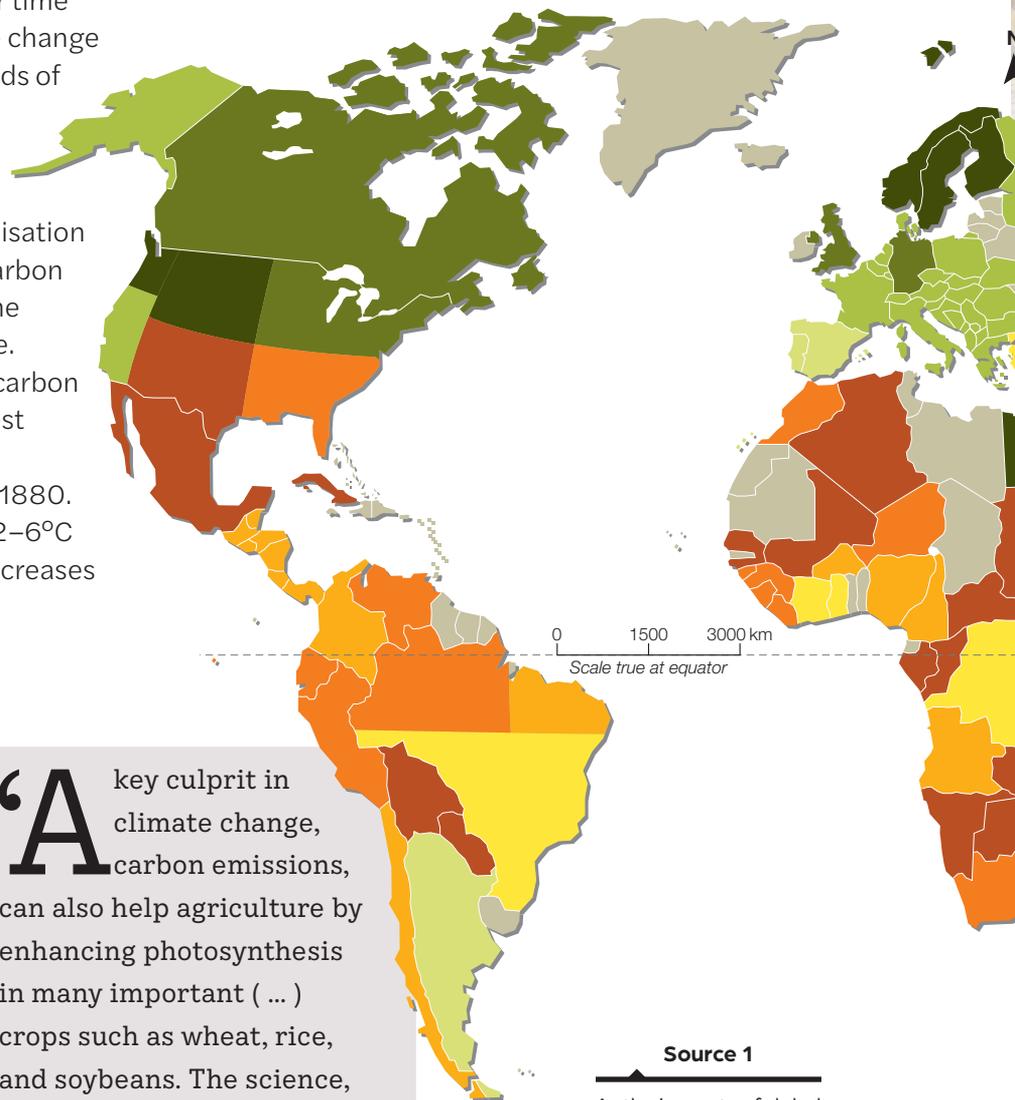
The term **climate change** usually describes the global average temperature fluctuation over time due to a range of natural processes. Climate change has been occurring for hundreds of thousands of years and is responsible for the cycle of very cold glacial periods known as **ice ages**.

Global warming, on the other hand, is a human-induced process by which industrialisation has dramatically increased the amount of carbon dioxide in the atmosphere. This has led to the unnatural, exponential warming of the globe. Recent studies have revealed that levels of carbon dioxide in the atmosphere are at their highest in 400 000 years; this has led to an average global temperature increase of 0.8°C since 1880. Temperatures are predicted to increase by 2–6°C in the next century – 20 times faster than increases in historical records.

Influence of global warming on productivity

The impacts of global warming range from an increase in disastrous climatic events to altered agricultural production and ecosystem structures. Global warming is expected to change productivity on a global scale and this will have flow-on effects on agricultural yields, food security and poverty. Source 1 illustrates how changes to climate may decrease agricultural success in major farming regions throughout the world.

Projected impact of climate change on agricultural yields

0   1500   3000 km
Scale true at equator

'A key culprit in climate change, carbon emissions, can also help agriculture by enhancing photosynthesis in many important (…) crops such as wheat, rice, and soybeans. The science, however, is far from certain on the benefits of carbon fertilisation.'

William R. Cline, *Global Warming and Agriculture, Finance and Development*, 2008.

Source 1

As the impacts of global warming increase, agricultural success is expected to change on a global scale.

Source 3

Drought and other extreme events may lead to less successful crop yields in already dry environments.

Source 2

The climate has naturally fluctuated over hundreds of thousands of years.

Y axis: CO_2 (parts per million)

Current

380

Highest historical CO_2 level — 1950

340

300

260

220

180

400 350 300 250 200 150 100 50 0

Thousands of years before today (0 = 1950)

Source: NASA

Change in agricultural productivity between 2003 and the 2080s

+25 +10 +5 0 −5 −15 −25%   No data

Source: European Environment Agency, 2010
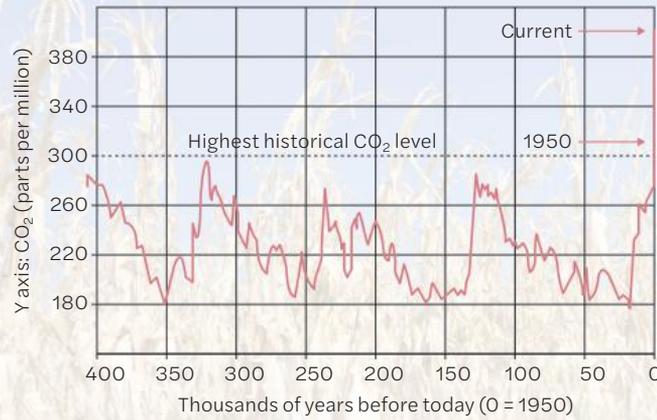
Learning ladder G2.3

Show what you know

1 Outline the difference between the terms 'climate change' and 'global warming'.

2 Why do we use carbon dioxide levels in the atmosphere as a measure of global warming?

3 Source 2: Summarise what is shown in this graph. Outline how it connects to the question, 'How does global warming impact productivity?'

4 Discuss how global warming may further impact fresh water scarcity.

Spatial distributions and patterns

Step 1: I can identify spatial distributions and patterns

5 Source 2: How have carbon dioxide levels in our atmosphere changed over time?

Step 2: I can use data to quantify spatial distributions and patterns
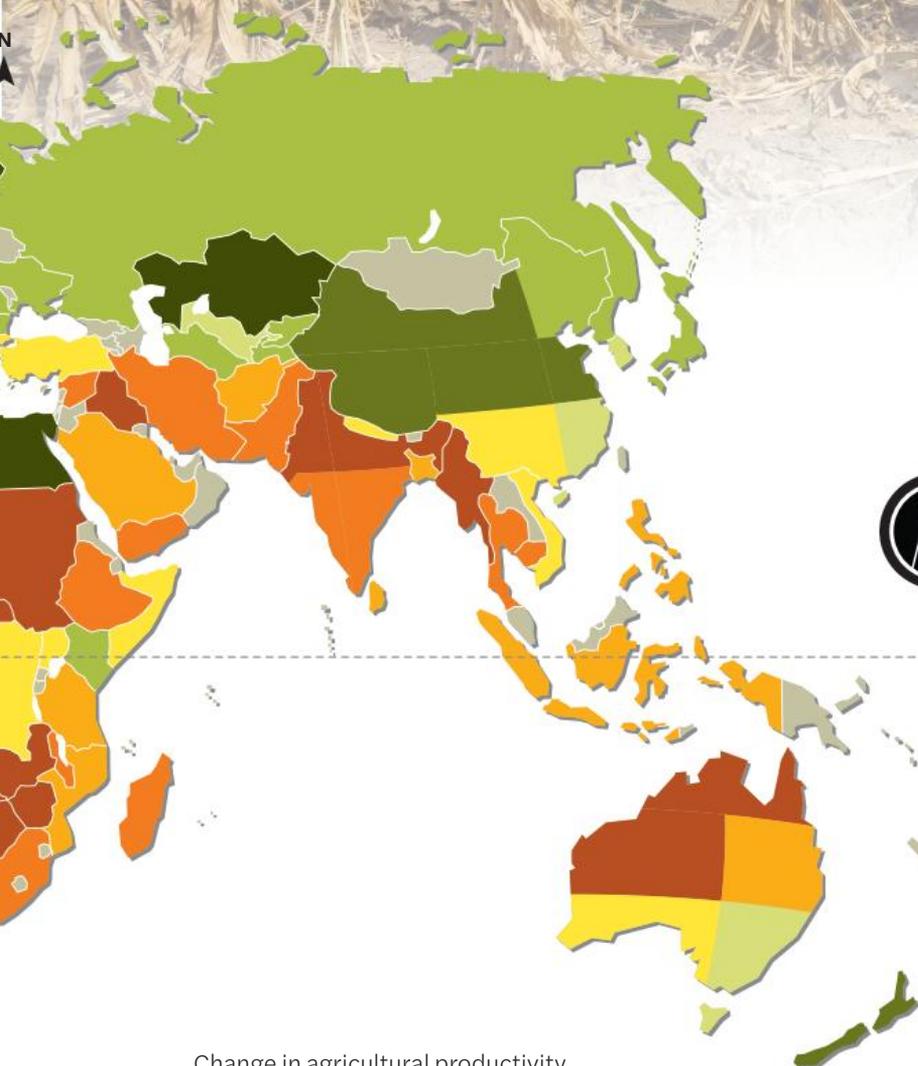
6 Source 2: Identify the predicted change to agricultural productivity rates for South Africa, Canada and Finland.

Step 3: I can describe spatial distributions and patterns

7 Source 1: Outline why some countries do not have data available.

Step 4: I can use data to support exceptions to spatial distributions and patterns

8 Researchers predict a decrease in agricultural productivity in Africa and Australia in the future, while predicting an increase in Canada and Russia. Explain this difference, using references to data from Source 1.

Why do we lack global food security?

As the population of the world grows, so does our need for resources, such as food, water and housing. Since the 1700s, the human population has been increasing rapidly, especially in regions such as Asia and Africa. Improvements in medical knowledge and technology have also increased human life expectancy, so we also require more food per person across a human life span.

What is food security?

According to the World Food Summit (1996), '**Food security** exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'. It is estimated that around one in seven people frequently do not have access to enough food to lead healthy lives. This is known as **food insecurity**.

Food security is not evenly distributed. Regions with higher population densities or rapidly growing populations tend to have lower food security, as there is more competition for available resources. More economically developed nations, such as the USA and Australia, tend to have higher overall food security, but also higher levels of obesity and food wastage. Still, within these richer nations there are marginalised communities that suffer malnutrition, as food security can also vary on a regional and local scale.

Global food security
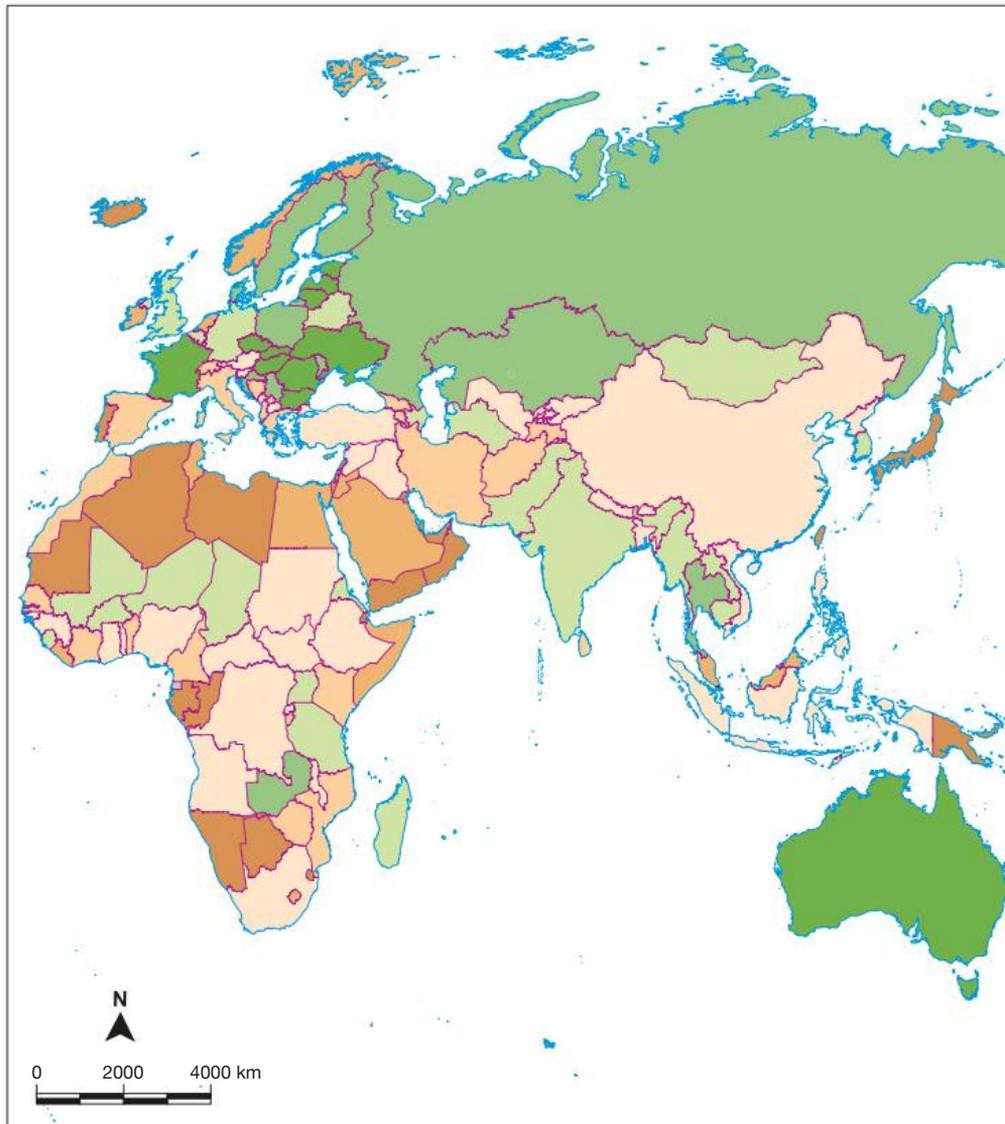
Source 1

Food security is not evenly distributed around the world.

Malthus's basic theory
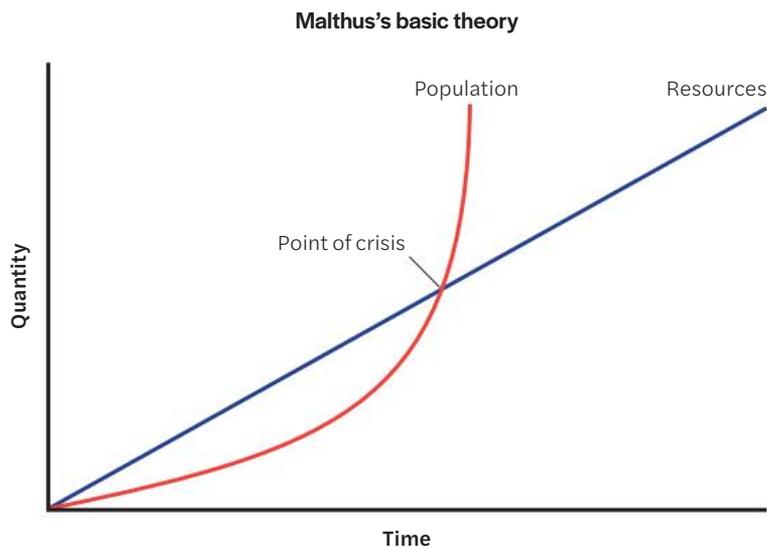
Source 2

Malthus's theory of resource demand and human population growth

Source 3

Malthus developed his 'point of crisis' theory in 1798.

Who was Thomas Malthus?

Thomas Malthus, a professor of history and political economy, published a book in 1798 called *An Essay on the Principle of Population*. This work outlined his theory that the human population grows **exponentially**, while food production can only increase **arithmetically** (Source 2). In other words, as our population continues to grow, there will be a 'point of crisis' where we no longer have enough food to feed all the people in the world.

Many modern scientists now debate this hypothesis, given advancements in technology and farming techniques. However, because of the uneven distribution of wealth and resources, some communities continue to live in poverty. The United Nations estimates that, tragically, more than 25 000 people die from hunger-related causes every day.

FOOD SECURITY

Food insecure
- Imports more than 75%
- Imports 50 to 75%
- Imports 25 to 50%
- Imports 10 to 25%

Food secure
- 0 to 10% of food imported or exported
- Exports 10 to 34%
- Exports more than 34%
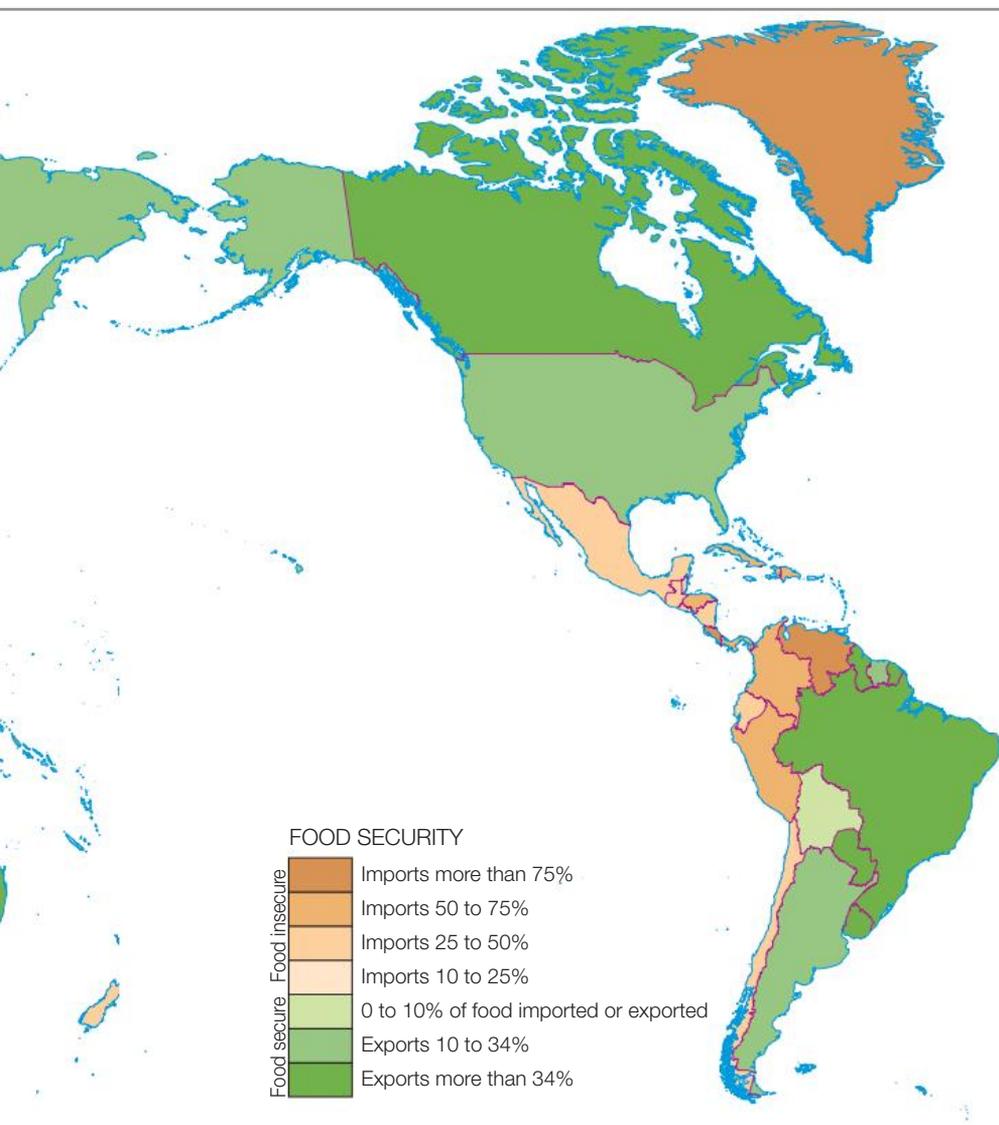
Source: Matilda Education Australia

What about the future?

Recent studies suggest that fertility rates (number of children per woman in a population) are decreasing on a global scale. As a result, even though global population numbers keep rising, they are growing at a much slower pace than previous decades. Researchers predict that by 2100, the human population will plateau at around 11 billion people.

Providing food for these additional people is not as simple as just increasing the amount of farming we do. Food security will depend on how populations use, distribute and price food. **Sustainable** production of resources will also be vital, as global warming will alter our crop yields and cause potentially disastrous climate events such as flooding rains or prolonged droughts.

What causes food insecurity?

Save the Children, Press Release 9 July 2019
Fairfield, Connecticut, USA.

Nearly seven million people, or 61 per cent of the population, face acute food insecurity in South Sudan, the highest number of people ever in the country, warns Save the Children. This is an increase of nearly one million people facing acute food insecurity, based on the IPC classification, since the signing of a revitalized peace deal in September 2018.

Unlike its regional counterparts Ethiopia, Kenya and Somalia, which are facing severe food insecurity due to a worsening drought, South Sudan's food crisis is directly linked to the ongoing conflict, which has dramatically disrupted farming activities and livelihoods, and increased displacement.

The latest food crisis and continued violence is a strong indication that the peace process needs greater national and international support.

'Children in conflict don't only die from bullets', Hansraj said. 'Millions of children suffer starvation, brought on through disruption and destruction resulting from the conflict'.

Save the Children has been working in Southern Sudan since 1989 and the organization remains at the forefront in providing lifesaving humanitarian assistance in health, protection, child rights, nutrition and education for children across ten field sites in South Sudan.

This graph shows population growth in each of the world's regions. While the human population continues to increase over time, the growth rate is slowing.

Source 5

Many populations still suffer from severe food insecurity today. This image shows people lining up to register for food distribution in South Sudan, 2016.

World population by world regions

7 billion
6 billion
5 billion
4 billion
3 billion
2 billion
1 billion
0

1820　1850　1900　1950　2000　2019

Oceania
North America
Europe
Africa
Asia

Source: Our World in Data
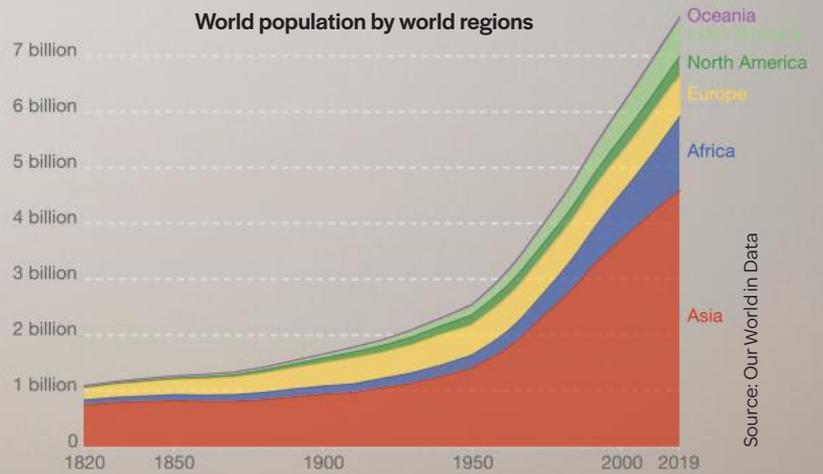
Learning ladder G2.4

Show what you know

1　Define 'food security', using examples of a country with high food security and a country with low food security. Discuss why food security is not evenly distributed in today's world.

2　Comment on the link between world population and food/water security over time.

3　As a pair, discuss whether you think global warming may alter food security on a global scale. List some reasons for your ideas.

4　Source 2: Debate the following statement as a class: 'Malthus' theory is no longer relevant today, given our access to technology and medicines'.

Changes and implications

Step 1: I can identify that changes occur in the characteristics of places over time

5　Visit the Global Food Security Index website at http://mea.digital/GHV9_G2_1. Select one country and record its food security ranking. Why do you think this country is ranked low/high compared to others? (Hint: Consider economic and technological factors.)

Step 2: I can describe how places have changed over time

6　Source 4: Discuss how population has changed over time on a regional scale. Why is that significant when considering food security on a regional scale?

Step 3: I can explain the causes behind the change over time in a place

7　Research a famine event that has occurred over the last 10 years. What were the causes of this event? Could this famine be linked with Malthusian theory; i.e. growing populations?

Step 4: I can make predictions and outline consequences of change over time

8　Refer to http://mea.digital/GHV9_G2_2. Consider the countries that have been ranked highest and lowest for food security (affordability, availability, safety).

a　What factors do the top five countries share that increase their food security ranking?

b　What factors do the bottom five countries share that reduce their food security ranking?

c　Which countries have seen the most change (positive or negative) to their food security ranking over time? Why do you think this is?

d　How could population numbers, economic status and access to technology play a role in determining a country's food security ranking? Does this mean Malthusian theory is still relevant today?

Why is food so scarce in the Sahel drylands?

Although a **dryland** appears to be arid and barren like a desert, it is characterised by a fertile period of 1 to 179 days per year. Drylands account for approximately 40 per cent of Earth's available land. The Sahel is a dryland region that covers land between Senegal and Eritrea. Over 41 per cent of people in Africa live in drylands.

What is desertification?

Desertification is a human-induced process in which the quality and fertility of the land is reduced by overcultivation, deforestation and unsustainable farming practices.

Global warming has increased the rate of desertification in the Sahel drylands. From around 1968, the Sahel experienced a number of extreme drought periods that resulted in a severe loss of croplands and livestock, and disastrous famines leading to over 100 000 deaths. However, as the human population of Africa continues to grow at a rate of around

3.1 per cent, so does people's need for food and income, despite these harsh conditions. Therefore, as farmers increase crops to support their communities, they actively increase the rate of desertification in their region.

Despite a number of local and national humanitarian efforts to reduce the impacts of desertification, around 80 per cent of Sahel is affected by land degradation. If this continues, the region may not be able to grow enough food for local communities, leaving them in danger of severe food insecurity.

Source 1

The Sahel region spans northern Africa.

The Sahel region in northern Africa

Main causes of soil degradation by region in susceptible drylands and other areas

Asia 370.3 million ha — 32.1%, 30.1%, 26.1%, 11.4%, 0.3%

Australia 87.5 million ha — 89.7%, 5.5%, 4.8%

North America 79.5 million ha — 34.8%, 52.1%, 7.7%, 5.4%

Europe 99.4 million ha — 41.5%, 39.1%, 18.4%, 0.9%

South America 79.1 million ha — 33.1%, 40.7%, 14.7%, 11.5%

Africa 319.4 million ha — 57.8%, 5.8%, 19.5%, 16.9%

Total degraded land area: 1035.2 million ha

Legend:
- Overgrazing
- Deforestation
- Agricultural activities
- Overexploitation of vegetation for domestic use
- Bio-industrial activities

Source 2

Source: Adapted from World Atlas of Desertification, 2nd Edition, UNEP, 1997

There are many contributing factors to desertification in different world regions.

Source 3

A forest guard with tree seedlings he has planted beside a row of anti-soil erosion bricks on his field, Bissiga Village, Yako, Burkina Faso.

Learning ladder G2.5

Show what you know

1. Using Google Maps, describe the relative location of the Sahel region and the absolute location of Niger. Would you describe this place as an LEDC? Why?

2. Define the term 'desertification' and consider how this process is linked with crop yields.

3. Using Source 1 on page 44, describe the location of major food insecurity within Africa.

Patterns and interconnections

Step 1: I can provide short explanations for patterns and interconnections

4. Source 2: Explain why overgrazing is a major contributor to desertification in Africa.

Step 2: I can explain patterns and interconnections

5. Use SHEEPT to summarise why the Sahel region is particularly susceptible to food insecurity.

Step 3: I can use data to support explanations of patterns and interconnections

6. Source 2: Using PQE, describe the main causes of soil degradation. Explain why this may make the Sahel more susceptible to desertification.

Step 4: I can use relevant sources to research further reasons for patterns and interconnections

7. Locate two population pyramids 10 years apart for a country within the Sahel region. Discuss how population change may contribute to desertification.

PQE, page 136
SHEEPT, page 138
Population pyramids, page 146

HOW TO

How does the environment influence Australia's productivity?

Australia is a productive nation, with agriculture contributing to 12 per cent of our gross domestic product and providing jobs for at least one in seven individuals.

Over 65 per cent of our produce is exported internationally; however, more than 90 per cent of fresh produce sold in supermarkets is locally grown. In Australia, crops such as grains, sugar and cotton have a gross value of around $9–15 billion annually. Food waste is a huge issue in Australia, with more than 30 per cent of local produce being thrown out.

Agricultural land use in Australia
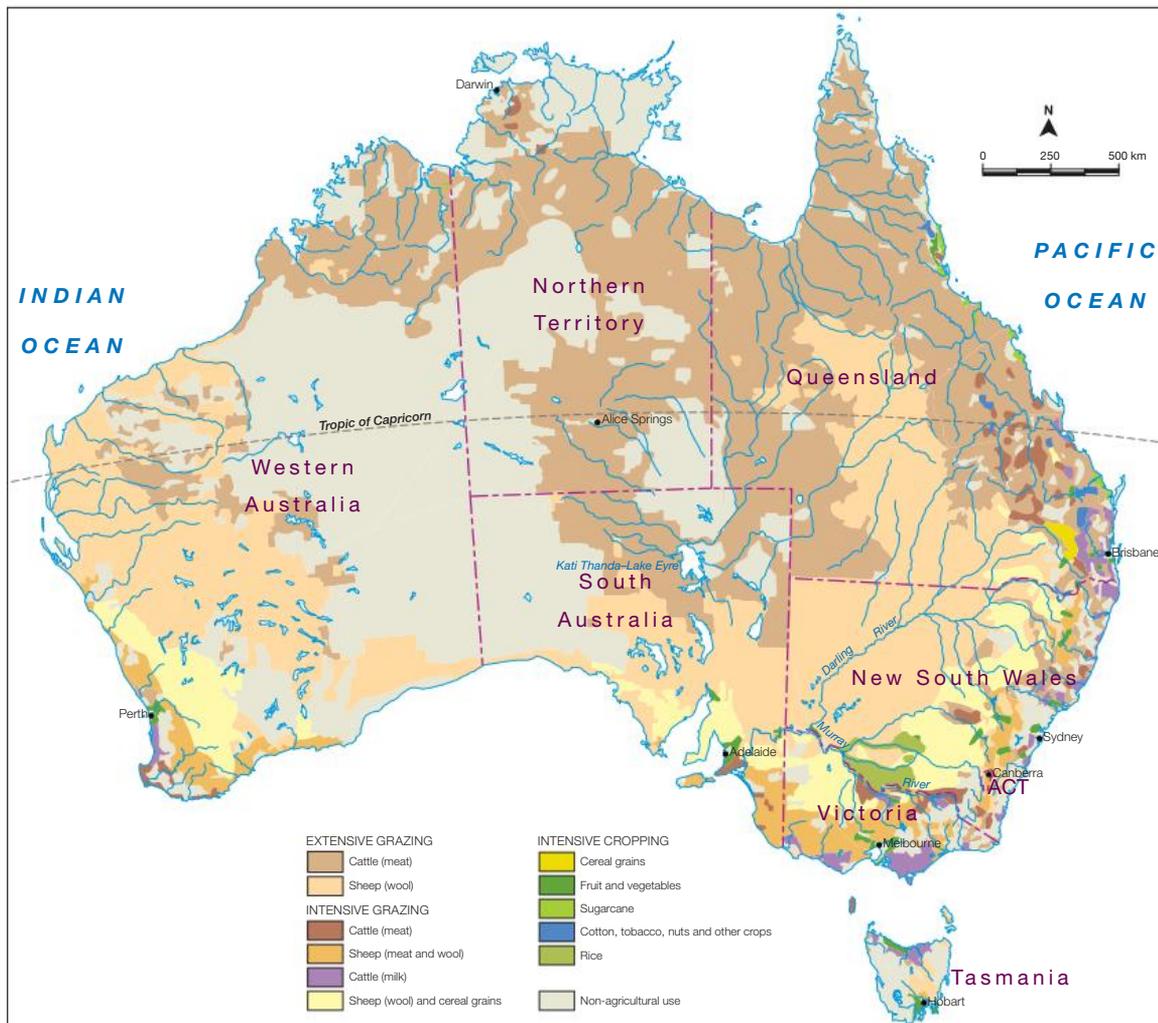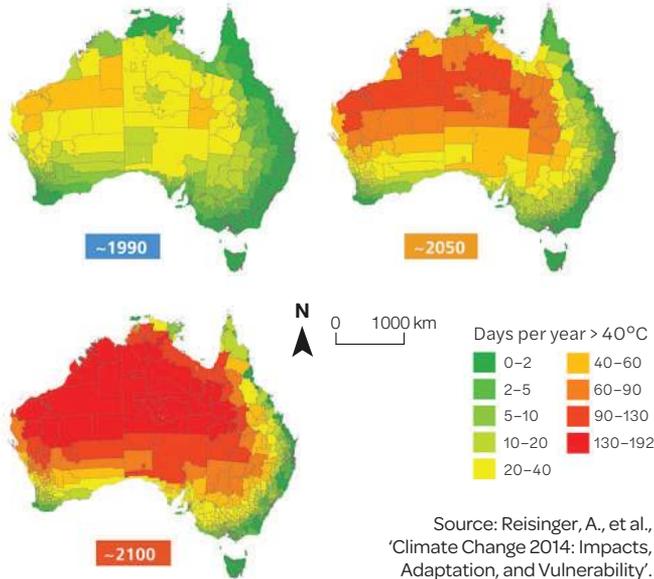
EXTENSIVE GRAZING
- Cattle (meat)
- Sheep (wool)

INTENSIVE GRAZING
- Cattle (meat)
- Sheep (meat and wool)
- Cattle (milk)
- Sheep (wool) and cereal grains

INTENSIVE CROPPING
- Cereal grains
- Fruit and vegetables
- Sugarcane
- Cotton, tobacco, nuts and other crops
- Rice
- Non-agricultural use

Source: Matilda Education Australia

Global warming and food production

As global warming has an impact on our local climate, farmers need to constantly adapt to the changing environment in order to provide for our growing population and sustain our export trade. Farmers have tried to maximise productivity by improving soil health to increase yields from the land, switching to crops that are more drought-friendly and trialling **genetically modified (GM)** crops. Farmers also use spatial technology for surveillance and maintenance of their yield.

N

0   1000 km

Days per year > 40°C

0–2	40–60
2–5	60–90
5–10	90–130
10–20	130–192
20–40	

Source: Reisinger, A., et al., 'Climate Change 2014: Impacts, Adaptation, and Vulnerability'.

Source 2

Global warming is altering our weather and climate patterns, leading to longer and hotter summers.

Major Australian crop and livestock exports (in billions), March 2017

$7.10 — Beef
$6.5 — Wheat
$3.5 — Dairy
$2.6 — Sugar
$2.40 — Wine
$1.20 — Fruit
$0.95 — Nuts
$0.35 — Vegetables

Source: Commonwealth of Australia, Department of Agriculture and Water Resources

Source 3

Beef is Australia's biggest food export.

Learning ladder G2.6

Show what you know

1   The Murray–Darling Basin is sometimes called 'Australia's food bowl'. What do you think 'food bowl' means in this context?

2   Describe the interconnection between agriculture and changing climate. Note two major connections.

3   Discuss why so much Australian agricultural produce is exported.

Digital and spatial technologies

Step 1: I can interpret different map types using cartographic conventions

4   Source 1: Use PQE to describe the distribution of grazing land in Australia.

Step 2: I can construct paper maps using correct cartographic conventions

5   Create an overlay map of Australia. Have one layer illustrate the distribution of natural biomes and a second highlight the main agricultural uses.

Step 3: I can access and use spatial technology platforms such as GIS

6   Access http://mea.digital/GHV9_G2_3, then:
   •   select 'Add Data'
   •   select 'Land Cover and Land Use'
   •   select 'Land Use and Cover'
   •   select 'Land Cover'
   •   select 'Add to the Map' in the top right corner of the data preview map.
   Comment on land cover in Australia. List the top two dominant land covers.

Step 4: I can manipulate data using digital and spatial technologies

7   Explore and add other data to the map you accessed in question 6. Comment on how you think humans have acted to alter biomes in Australia over time.

PQE, page 136
Overlay maps, page 148

HOW TO

How did the First Nations Peoples of Australia manage the land?
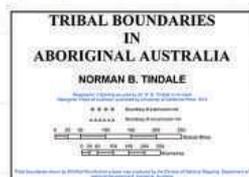
It was once thought that First Nations Peoples of Australia were hunter–gatherers, travelling to collect food rather than managing the land. However, historians are now challenging this idea and now know that First Nations communities practised **seasonal migration** — moving to particular areas for a set time to ensure they did not exhaust their land of plants and animals.

Tribal boundaries in Aboriginal Australia, Norman B. Tindale, 1974
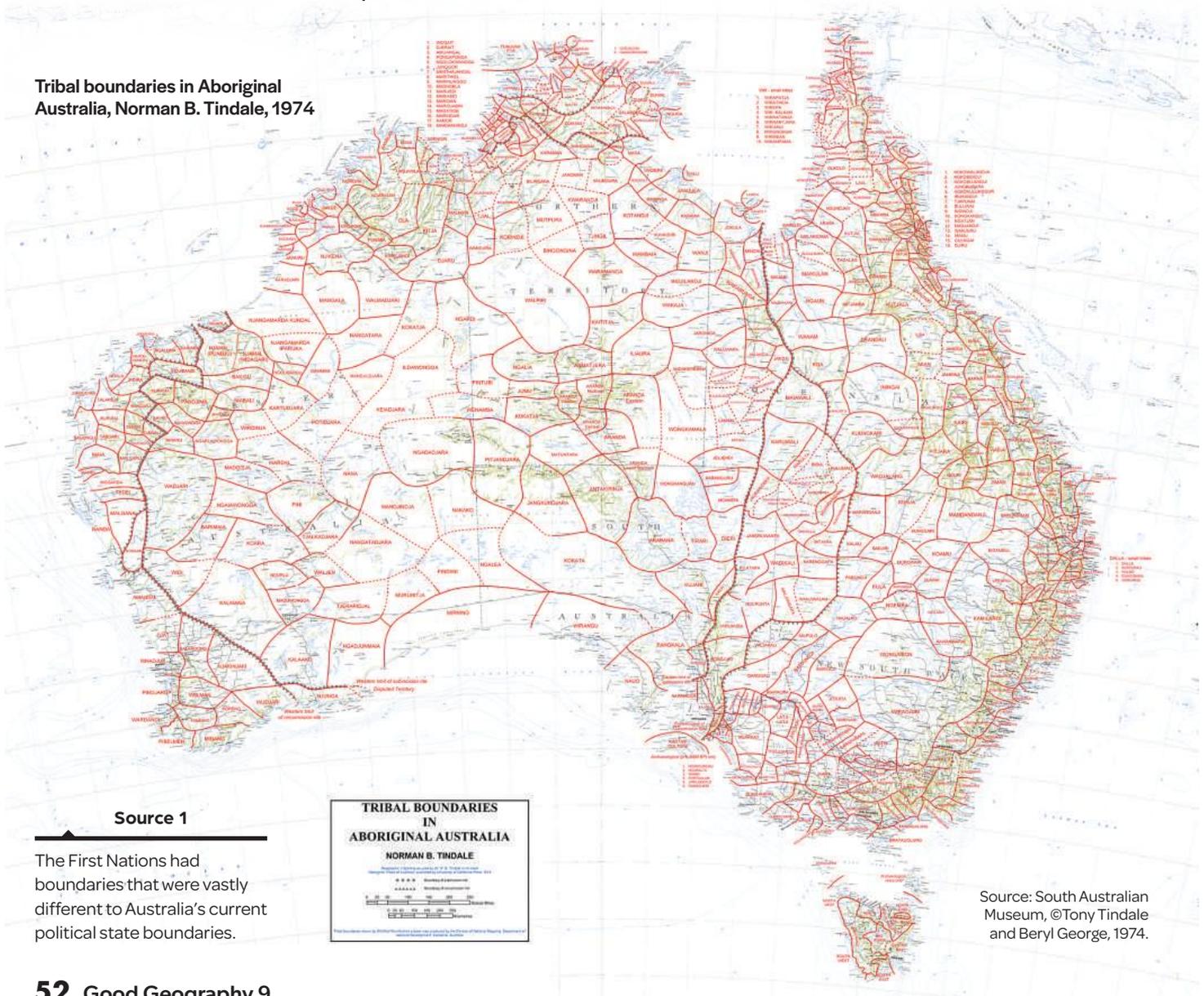
Source 1

The First Nations had boundaries that were vastly different to Australia's current political state boundaries.

Source: South Australian Museum, ©Tony Tindale and Beryl George, 1974.

Australia's first agriculturalists

Using historic journals, drawings and stories, historians have argued that First Nations Peoples engaged in complex agricultural methods that were sustained for thousands of years. There are references to dam building, mass planting and irrigation throughout historical sources, which are in stark contrast to original perceptions. Aboriginal peoples maintained large pastures of murnong (yam daisy) around Melbourne. These crops required deliberate cultivation to ensure the yams were edible. Fire was used to manage the land and to distribute seeds and encourage new growth of vegetation, which in turn attracted grazing animals and allowed easy harvesting. Tools to harvest crops, such as stone knives, have also been discovered.

Food security

The First Nations Peoples of Australia are recorded in historical sources as eating a wide variety of produce, which meant they were able to adapt to changing climates, seasons and weather patterns over time. In contrast, many agricultural farms today are limited to a **monoculture** and rely on the success of a few crop species.

Communities would also move to new locations if drought or other events meant food was scarce in certain locations. Population numbers are said to be have been aligned with food availability, so there were enough resources for everyone.

Learning ladder G2.7

Show what you know

1 Compare First Nations Peoples' approach to agriculture with practices currently used in Australia.

2 Create a photo essay illustrating the comparisons you made in question 1.

Communicate data

Step 1: I can list primary and secondary methods useful for my study

3 Source 1: Is this map a primary or a secondary source of data? Why? How could the data for this map have been collected?

Step 2: I can successfully use data collection methods

4 Collect a series of secondary sources (images, data, written excerpts) online that represent how First Nations Peoples of Australia used, managed and cultivated the land.

Step 3: I can filter collected data

5 Locate secondary data that illustrates First Nations Peoples' agricultural practices. Discuss why historians now conclude that they practised seasonal migration and agriculture.

Step 4: I can organise data collected according to relevance for a research question

6 Imagine you were a geographer assisting historians investigating First Nations' land management. What primary data would be useful for the investigation?
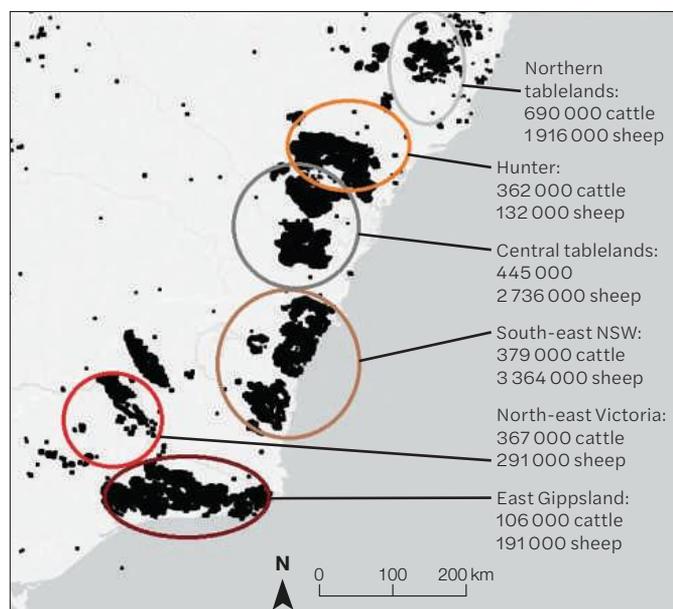
How do bushfires affect what we eat?

Australia is one of the driest continents on Earth; 80 per cent of the country receives less than 600 mm of rain each year. In 2019–20, drier than usual conditions (associated with long–term drought and other climate factors) led to one of the largest bushfire disasters in Australian history.

The 2019–20 bushfires

The fire season began uncharacteristically early, in June 2019, and continued to worsen until January 2020. By February 2020, more than 18 million hectares of land had been burnt, and it was estimated that over one *billion* native animals perished. Many rural communities were devastated, and hundreds of people lost their homes or properties. Tragically, 33 people lost their lives in the fires, including nine fire fighters.

Eastern NSW and eastern Victorian fires and potential livestock impacted

Northern tablelands:
690 000 cattle
1 916 000 sheep

Hunter:
362 000 cattle
132 000 sheep

Central tablelands:
445 000
2 736 000 sheep

South-east NSW:
379 000 cattle
3 364 000 sheep

North-east Victoria:
367 000 cattle
291 000 sheep

East Gippsland:
106 000 cattle
191 000 sheep

N

0   100   200 km

Source 1

The potential impact of the 2019–20 bushfires on livestock production.

Effects on agriculture

The 2019–20 fires had significant impacts on Australia's agricultural sector. More than 14 per cent of the total area burnt in the fires was classified as farmland. Many farms were directly impacted when fires consumed crops and grazing land and it is estimated that 2 per cent of Australia's total cattle and sheep populations were lost. The indirect impacts of the blaze, such as loss of native parklands and the scarcity of fresh water, have had negative effects on other agricultural businesses.

Bushfire damage

New South Wales has suffered the most extensive damage from the ongoing bushfire crisis, with Victoria also seeing widespread impacts (see Source 2).

Recovery efforts

On a local scale, the fires created short-term housing and food security issues. Road closures, loss of infrastructure and smoke haze all made it difficult to distribute food around the country. While some of these issues have been dealt with, others remain.

Nationally, the fires, drought and now the COVID-19 **pandemic** will have long-lasting impacts on our economy. It is more important than ever to 'buy local' to support the industries and communities who, amid the COVID-19 crisis, are still recovering from these fires.

	Conservation	Forests/ plantation	Agriculture	Residential	Total
VIC	428 872	809 689	161 717	16 465	1 416 743
NSW	2 557 544	749 410	558 878	28 581	3 894 412
TAS	18 478	12 505	825	357	32 165
SA	153 010	23 916	98 966	5513	281 404
AUS	3 157 904	1 595 519	820 385	50 915	5 624 723

How Australia's bushfires will affect what you eat

By Bonnie Bayley, ©SBS, 28 Feb 2020

Over in the Snowy Mountains town of Batlow in NSW, Greg Mouat's apple orchard was one of the orchards in the region that were burnt in the fires. 'We have about 14 000 trees, mainly apples and a few cherries, and we lost probably 10–12 per cent of them,' he says.

Oyster farmer Caroline Henry is based at Wonboyn Lake in NSW, an area surrounded by national parks and wilderness. While her oysters weren't directly damaged, 100 per cent of the surrounding catchment was burnt, and the big fear now, ironically, is heavy rain. 'If we get massive rains, it will wash sediment from the fires into the water course, which can lead to algal blooms and issues with the oysters not being able to filter feed,' she says.

Beekeepers are similarly in limbo, including East Gippsland apiarist Ben Murphy. 'We had 450 of our hives in the fire-affected area, and lost a bit over 200 hives, including a lot of our queens,' he says. Murphy's biggest hurdle is that about 75 per cent of the eucalyptus forest sites he leases for his bees were burnt, and could take up to 10 years to regenerate … If bees are disrupted, other industries may be too. 'Almonds, canola, oranges and apples all rely on bees being healthy to pollinate crops,' says Murphy.

The devastation at Ben Murphy's apiary.

Learning ladder G2.8

Show what you know

1 How are climate events such as drought linked to our national productivity?

2 Identify short- and long-term impacts to our overall productivity and crop yields from bushfires.

3 As Earth gets warmer, how might our vulnerability to bushfire and drought events change over time?

Spatial distributions and patterns

Step 1: I can identify spatial distributions and patterns

4 Source 1: What area in Victoria was most badly affected by the 2019–20 bushfires?

Step 2: I can use data to quantify spatial distributions and patterns

5 Source 2: Using appropriate axes, construct a bar graph displaying the amount of agricultural land lost to the fires in four Australian states.

Step 3: I can describe spatial distributions and patterns

6 Source 1: Using PQE, describe the distribution of the livestock harmed by the fires in NSW and Victoria.

Step 4: I can use data to support exceptions to spatial distributions and patterns

7 Source 2: Using data in your response, explain why Tasmania had much less agricultural and residential land damage than the mainland states.

HOW TO

PQE, page 136
Graphing, page 144

economics + business

How do we determine the value of resources?

There are not enough resources in the world to satisfy all our needs and wants, so understanding economics helps to inform our decisions about using scarce or valuable resources.

Resources in the economy

Whether it is a bakery cooking fresh bread, a publisher producing books or a construction company erecting skyscrapers, all businesses need **resources** as inputs to order to produce the **goods and services** that are their outputs. These resources are the **factors of production** used to make or supply the goods or services the business uses to make a **profit**.

There are four factors of production:

1 **Natural resources**: materials drawn from the natural world that are used to produce goods and services. For example, soil, water and sunlight are natural resources harnessed to grow crops such as wheat and rye, which are used to make flour that is then used to bake bread. Humans can't make natural resources, so they tend to be limited. Natural resources can be **renewable**, such as water and sunlight, or **non–renewable**, such as coal, oil or gas.

Source 2

Labour resource: Bakers

2 **Labour resources**: any human input required for making a good or providing a service. Any work performed by a human being, whether physical or intellectual, to produce profits is referred to as **labour** by economists. The labour resources involved in making fresh bread include not just the bakers but also the counter staff and managers, as well as other staff such as technicians or marketers.

Source 1

Natural resource: Wheat

Source 3

Capital resource: Factory and equipment

3 **Capital resources**: human-made resources such as machinery, buildings, equipment and technology used to produce other goods and services. Capital resources used to create and sell bread include flourmills and bakery buildings, ovens and mixers, as well as display counters and cash registers.

A farm producing crops such as soya beans, potatoes, peanuts and cane sugar could produce 96 per cent more protein than the same farm producing beef cattle.

Source 4

Entrepreneurs run the business

4 **Entrepreneurship**: the ability to organise the other factors of production and transform them into a business. Entrepreneurs risk time and money to run a business with the hope of earning a return. Baking entrepreneurs might not make bread themselves but use their business-planning expertise to run a bread-making business.

Scarcity of resources

There are not enough resources to meet all our needs and wants. Economists refer to this situation as **scarcity**, and one part of **economics** is the study of how humans make choices under conditions of scarcity.

Because resources are limited, every time you choose to use them, you must choose to go without other opportunities. Economists use the term **opportunity cost** to describe what is given up in order to obtain something else. For example, a farmer might choose to raise cattle on a farm, but this means they can't grow crops. Forgoing the opportunity to grow crops is the opportunity cost of raising cattle.

Opportunity food loss

Meat production is resource hungry, requiring more land and more water to produce than growing crops. Using scarce agricultural land to grow plant foods, rather than to raise livestock, would create enough food to feed millions of additional people using the same land resources.

Researchers at the Weizmann Institute, in Israel, refer to the opportunity cost of producing meat as 'opportunity food loss'. They compared beef production to producing crops, such as soya beans, potatoes, peanuts and cane sugar, that deliver the same nutrition as meat. They found that using agricultural land for beef production results in an opportunity food loss of 96 per cent per unit of land. In other words, a farm producing 100 grams of protein from plant-based crops would only yield 4 grams from beef.

Learning ladder G2.9

Economics and business

Step 1: I can recognise economic information

1 What different resources are required to make a product or service?

Step 2: I can describe economic issues

2 What is scarcity and why is it important in the study of economics?

Step 3: I can explain issues in economics

3 Use a personal example to explain the concept of opportunity cost.

Step 4: I can integrate different economic topics

4 Why are entrepreneurs important to the production of goods and services?

Step 5: I can evaluate alternatives

5 Explain why all beef producers do not simply change to plant-based protein crops.

thinking locally

How can we plan for a sustainable future?

Over time, the state of Victoria has seen a rapid growth in its population, which increased 1.95 per cent in 2018. It has the second–highest **population density** in Australia.
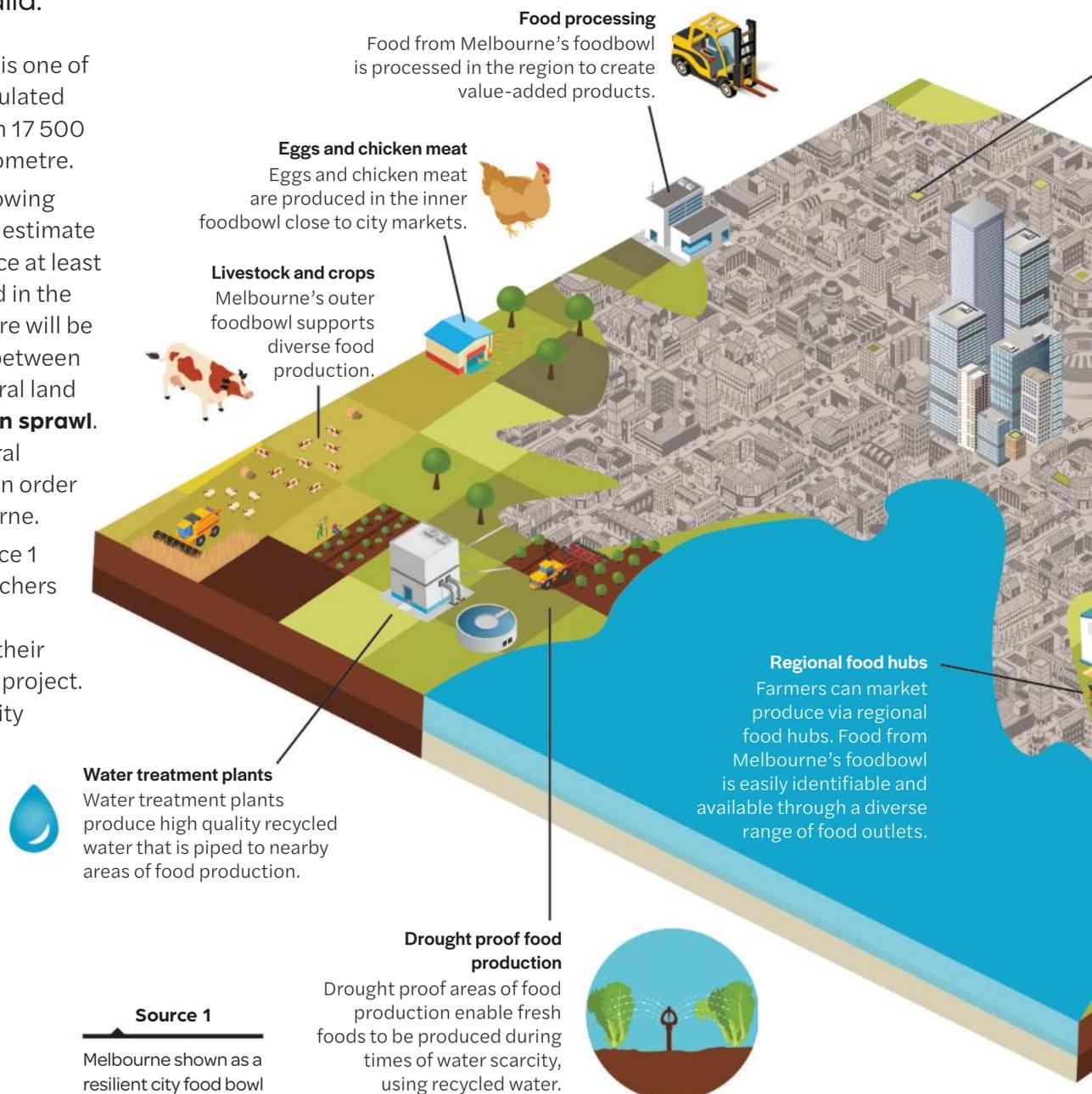
Inner-city Melbourne is one of the most densely populated areas in Australia, with 17 500 people per square kilometre.

To support our growing population, scientists estimate we will need to produce at least 60 per cent more food in the future. As a result, there will be a significant conflict between the need for agricultural land and the growing **urban sprawl**. Sustainable agricultural practices will be vital in order to provide for Melbourne.

The image in Source 1 was created by researchers at the University of Melbourne as part of their Foodprint Melbourne project. It shows a proposed city foodbowl plan to help Melbourne create a sustainable food future.

Resilient city foodbowl
A vision for Melbourne

Food processing
Food from Melbourne's foodbowl is processed in the region to create value-added products.

Eggs and chicken meat
Eggs and chicken meat are produced in the inner foodbowl close to city markets.

Livestock and crops
Melbourne's outer foodbowl supports diverse food production.

Regional food hubs
Farmers can market produce via regional food hubs. Food from Melbourne's foodbowl is easily identifiable and available through a diverse range of food outlets.

Water treatment plants
Water treatment plants produce high quality recycled water that is piped to nearby areas of food production.

Drought proof food production
Drought proof areas of food production enable fresh foods to be produced during times of water scarcity, using recycled water.

Source 1

Melbourne shown as a resilient city food bowl

Food growing in communities

Communities grow some of their own food, increasing access to healthy foods.

Food waste becomes fertiliser

Organic and food waste is converted to fertilisers and animal feed for use on farms.

New farmers can access land

Farmland is easily accessed by new and young farmers for diverse production systems.
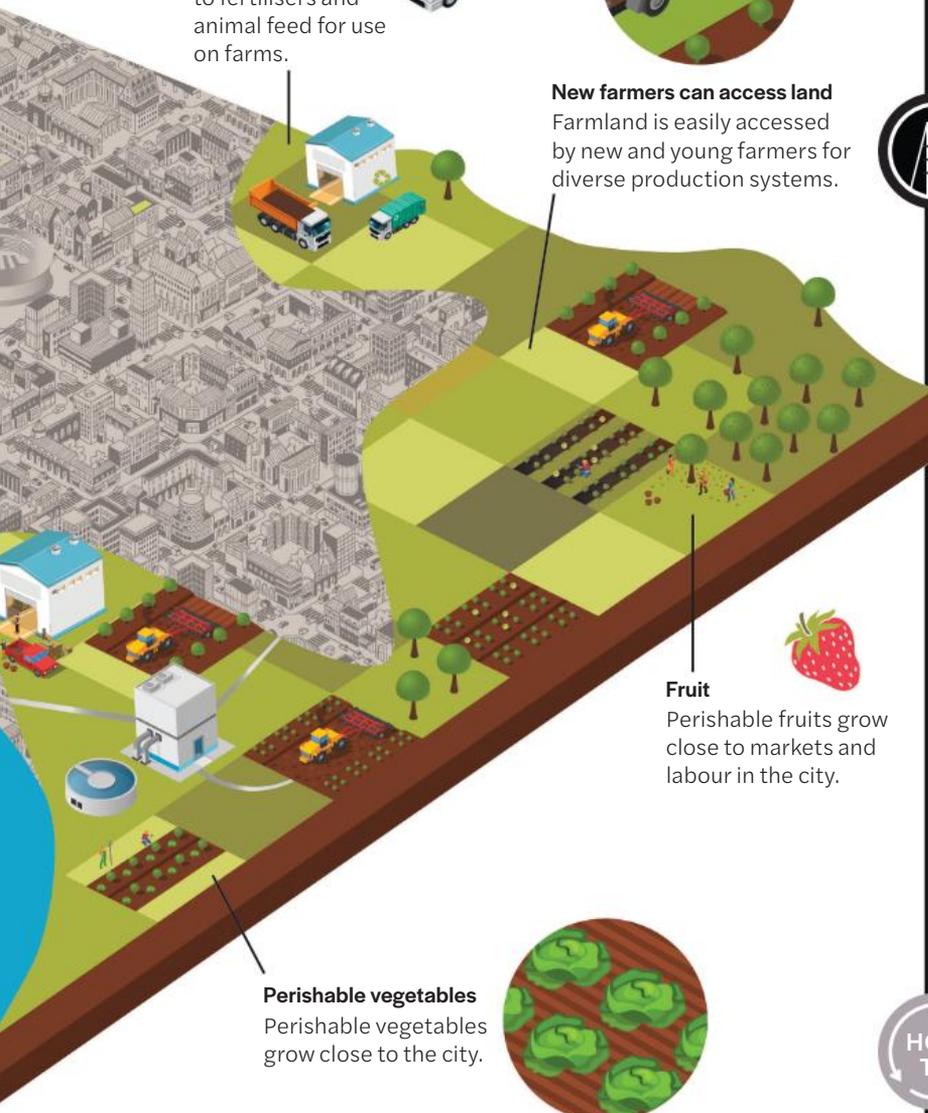
Fruit

Perishable fruits grow close to markets and labour in the city.

Perishable vegetables

Perishable vegetables grow close to the city.
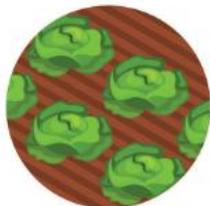
Learning ladder G2.10

Show what you know

1   Define 'urban sprawl' and draw a diagram that visually shows this process.

2   How can we link the concept of urban sprawl with human-altered biomes?

3   Discuss how land might need to be used in the future to maintain our demand for both quality housing and food production.

Changes and implications

Step 1: I can identify that changes occur in the characteristics of places over time

4   Outline how the 'Resilient city foodbowl' vision will help change Melbourne and make it more sustainable.

Step 2: I can describe how places have changed over time

5   Research some historical photos of Melbourne's Central Business District (CBD). How has this place changed over time? What factors do you think led to this change? (Hint: Consider SHEEPT factors.)

Step 3: I can explain the causes behind the change over time in a place

6   Consider the suburb of Officer in Victoria. Using satellite images and time-lapse footage you find on the internet, discuss why this region has changed so significantly.

Step 4: I can make predictions and outline consequences of change over time

7   Using your response from question 6, discuss as a class any predictions you have regarding future land use within suburbs such as Officer.

HOW TO
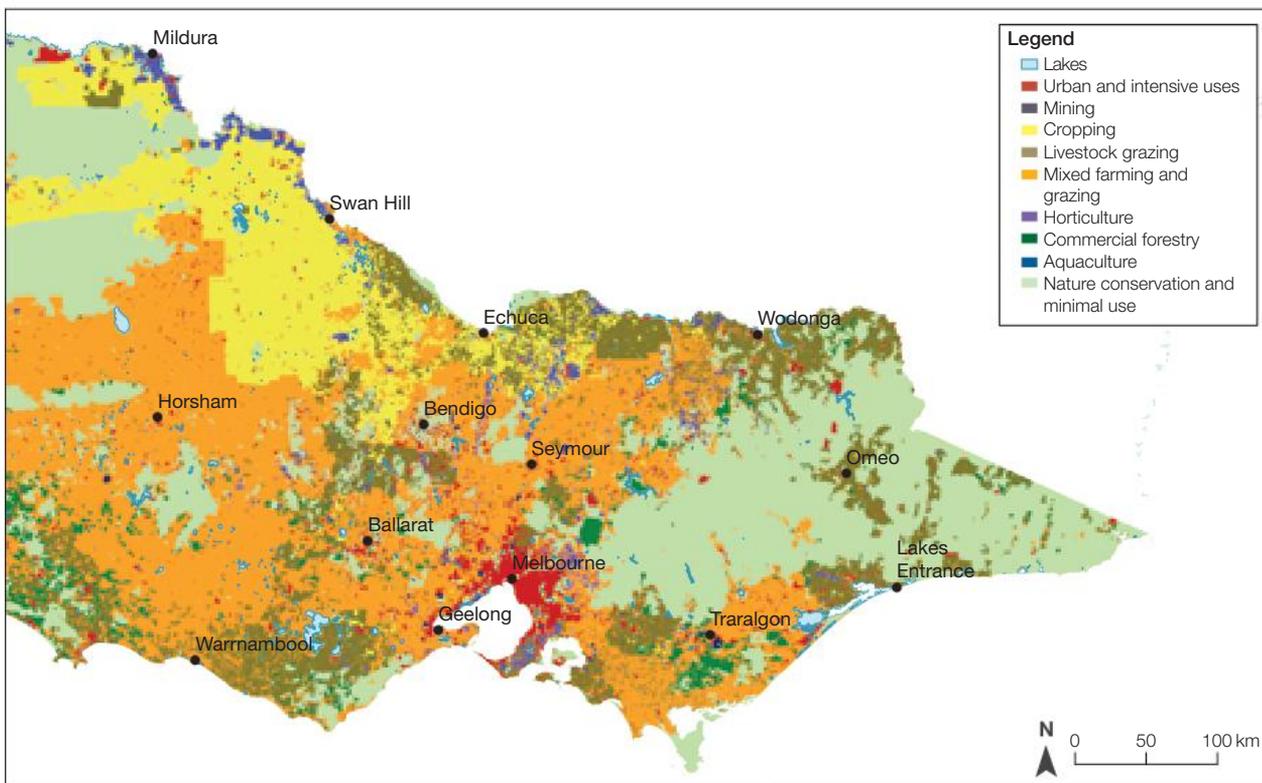
SHEEPT, page 138
Satellite images, page 147

How can we use spatial technology to monitor productivity?

The **Global Positioning System (GPS)**, Google Maps and satellite imagery are all examples of spatial technologies. **Spatial technology** allows geographers and everyday users to visualise patterns on a variety of scales.

Land use and land cover in Victoria, Australia

Legend
- Lakes
- Urban and intensive uses
- Mining
- Cropping
- Livestock grazing
- Mixed farming and grazing
- Horticulture
- Commercial forestry
- Aquaculture
- Nature conservation and minimal use

Source: Matilda Education Australia

Source 1

Victoria is largely used for cropping and modified pastures.
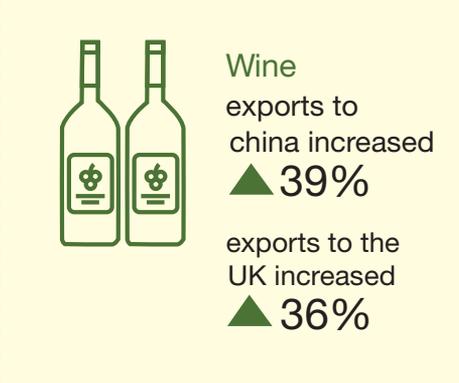
How can technologies improve food security?

Victoria produces more than $14 billion of agricultural produce and the agriculture sector employs over 87 564 people. As an occupation, farming relies heavily on spatial technology and a detailed understanding of both natural and human geography. To produce successful yields, farmers must understand how to best use their land; be able to adapt to sudden changes in local climate; predict future trade and demand fluctuations; and maintain the fertility, viability and productivity of their land.

Victorian food and fibre export performance 2017–18

Victorian food and fibre exports

$14.1 billion

▲ $1.4b (11%)

27% of national food and fibre exports

Food

$10.2 billion

▲ $1.2b (13%)

26% of national food exports

Fibre products

$3.9 billion

▲ $196m (5%)

31% of national fibre exports

Meat – Victoria´s largest value export

$3.3 billion

▲ $910m **or** 37%

on the previous year

USA highest value market for meat exports

$798 million

▲ $175m 28%

on the previous year

China highest value market for wool exports

$1.5 billion

▲ $175m **or** 13%

on the previous year

Japan highest value market for dairy exports

$442 million

▲ $91m **or** 26%

on the previous year

Sheepmeat ▲ 41%

Beef ▲ 46%

Wine exports to china increased ▲ 39%

exports to the UK increased ▲ 36%

Wool value $2.1b ▲ 18%

Dairy $1.9b ▲ 9%

Source 2

Source: State Government of Victoria

Victoria's most valuable export is food, particularly meat.

Spatial technology in action

As our population continues to grow, and the impacts of global warming such as extreme drought increase, it is becoming increasingly important for people working in the agricultural industry to ensure that they use the land productively and efficiently.

How spatial technology helps farming
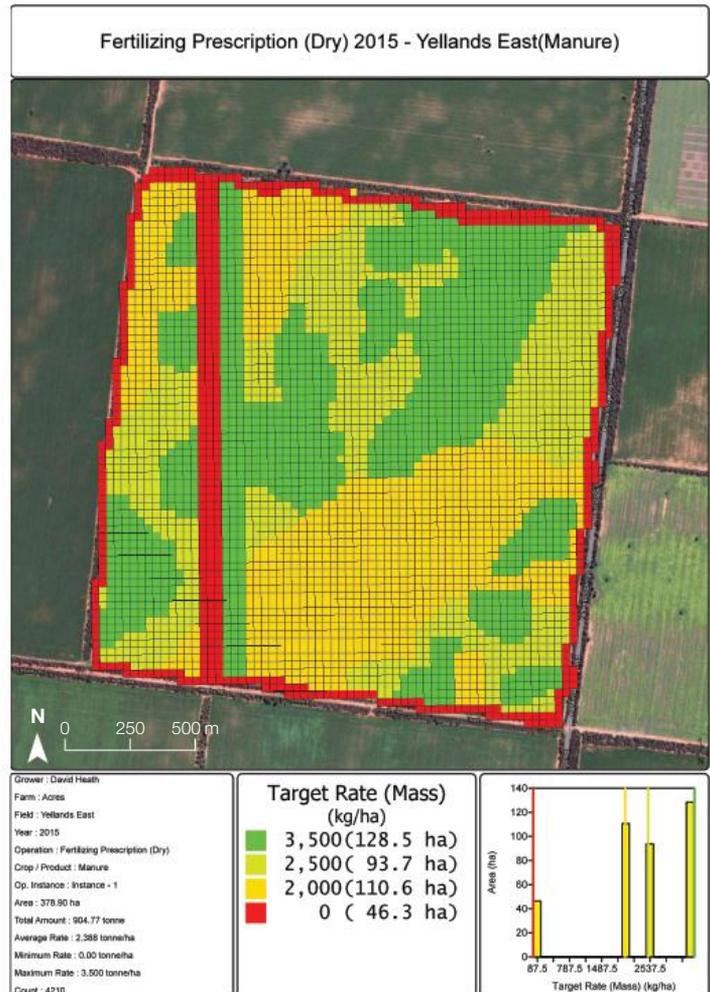
David owns an 8000-acre property north of Griffith in New South Wales. He primarily farms wheat, barley, canola and legumes, such as chickpeas and lupins. David relies solely on natural rainfall to water his crops; therefore, he needs to pay close attention to the local climate and any changes in rainfall and weather patterns. In order to ensure successful yields, David plants crops that he knows are better adapted to drier climates. He also employs GPS and other mapping systems to manage soil quality, chemical use and rotation of crops.

The machinery used in this industry is highly sophisticated. David's tractors operate with a GPS tracker that has a 2-centimetre accuracy steering system to ensure minimal overlap when planting, which reduces fuel and fertiliser waste. Harvesters are also fitted with GPS tracking and yield monitors so maps can later be produced to understand which areas on the property are most productive and which may require soil testing or more fertilisers.

Using technologies such as these can help farmers like David to use the land more sustainably and allow them to monitor and increase the productivity of their farmland over time.

Source 3

Mapping outputs from David's farm. These allow him to assess and monitor the land, and increase its fertility and the viability of his crops.

Fertilizing Prescription (Dry) 2015 - Yellands West(Manure)

Grower : David Heath
Farm : Acres
Field : Yellands West
Year : 2015
Operation : Fertilizing Prescription (Dry)
Crop / Product : Manure
Op. Instance : Instance - 1
Area : 170.37 ha
Total Amount : 400.00 tonne
Average Rate : 2.348 tonne/ha
Minimum Rate : 0.00 tonne/ha
Maximum Rate : 3.500 tonne/ha
Count : 1893

Target Rate (Mass) (kg/ha)
- 3,500 (45.65 ha)
- 2,500 (52.22 ha)
- 2,000 (54.92 ha)
- 0 (17.65 ha)

Fertilizing Prescription (Dry) 2015 - Yellands East(Manure)

Grower : David Heath
Farm : Acres
Field : Yellands East
Year : 2015
Operation : Fertilizing Prescription (Dry)
Crop / Product : Manure
Op. Instance : Instance - 1
Area : 378.90 ha
Total Amount : 904.77 tonne
Average Rate : 2.388 tonne/ha
Minimum Rate : 0.00 tonne/ha
Maximum Rate : 3.500 tonne/ha
Count : 4210

Target Rate (Mass) (kg/ha)
- 3,500 (128.5 ha)
- 2,500 (93.7 ha)
- 2,000 (110.6 ha)
- 0 (46.3 ha)

Precision farming involves using GPS and other mapping systems to manage farmland and more accurately use resources such as fertilisers.

Learning ladder G2.11

Show what you know

1   Imagine you were teaching a Year 7 class about spatial technology. Write a short summary outlining what it is and how it can be used, and provide two different examples of spatial technologies used today.

2   How can spatial technology be used to monitor food security?

3   Visit the Farming and Food Production page of the CSIRO website at http://mea.digital/GHV9_G2_5. According to CSIRO, how can we better prepare for a more food-secure future?

Digital and spatial technologies

Step 1: I can interpret different map types using cartographic conventions

4   Source 1: State the primary land use of Melbourne.

Step 2: I can construct paper maps using correct cartographic conventions

5   Using correct techniques, draw a sketch map of your local region and highlight any areas that are used for productivity and food production. If there are no areas of food production, consider why this is the case.

Step 3: I can access and use spatial technology platforms such as GIS

6   Describe how spatial technology can be used to map land use around Australia. How is this helpful in determining future food security?

Step 4: I can manipulate data using digital and spatial technologies

7   Source 3: Summarise how maps such as these could be manipulated to assist farmers in maximising their crop production.

BOLTSS, page 132

HOW TO
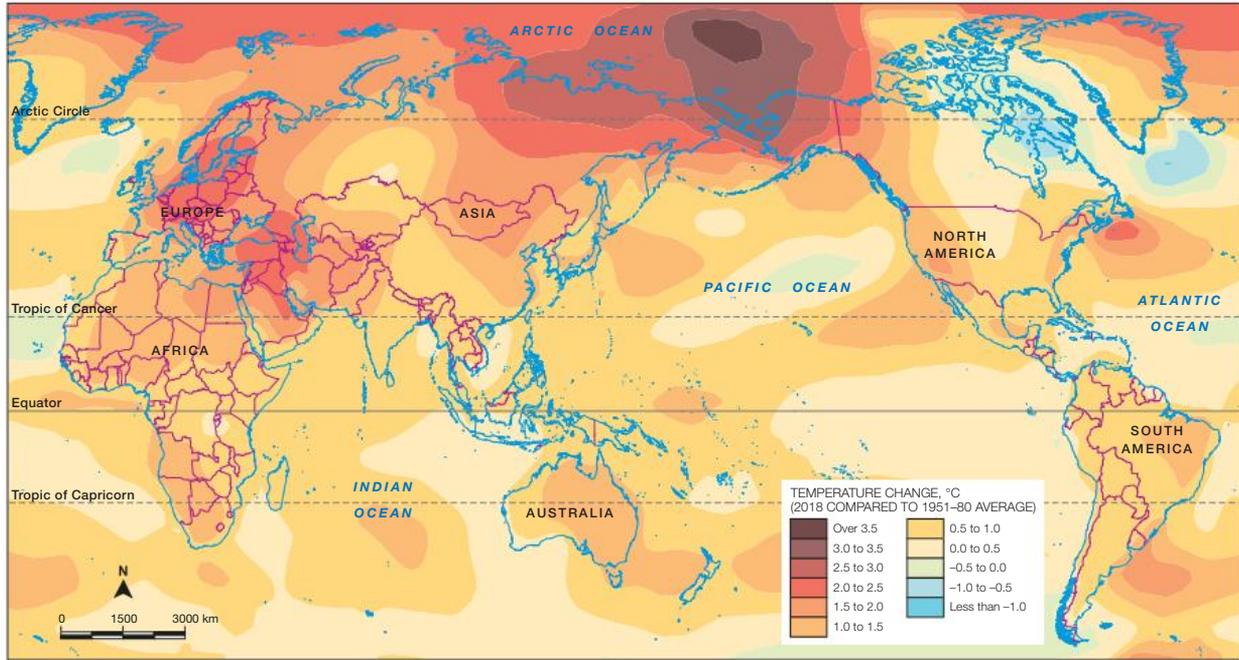
Masterclass

Learning ladder

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

Global temperature change 2018 compared to the 1951–1980 average

TEMPERATURE CHANGE, °C
(2018 COMPARED TO 1951–80 AVERAGE)

Over 3.5	0.5 to 1.0
3.0 to 3.5	0.0 to 0.5
2.5 to 3.0	−0.5 to 0.0
2.0 to 2.5	−1.0 to −0.5
1.5 to 2.0	Less than −1.0
1.0 to 1.5	
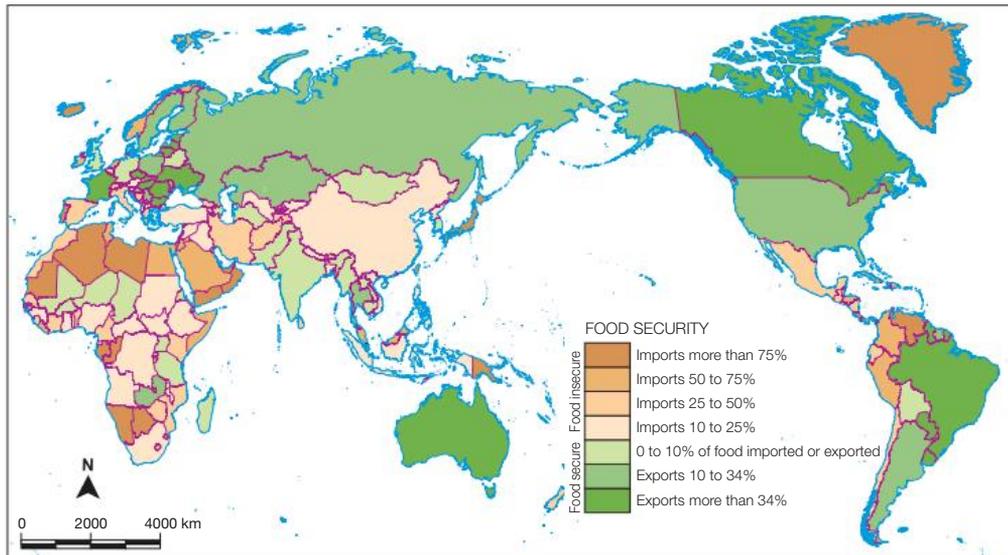
Source: Matilda Education Australia

Source 1

Increased greenhouse emissions are leading to global temperature increases.

Global distribution of food security

Source 3

Food security is not evenly distributed around the world.

FOOD SECURITY

Food insecure
- Imports more than 75%
- Imports 50 to 75%
- Imports 25 to 50%
- Imports 10 to 25%

- 0 to 10% of food imported or exported

Food secure
- Exports 10 to 34%
- Exports more than 34%

Source: Matilda Education Australia

World population growth, 1750–2100

While population continues to rise, our overall growth rate is declining.

- Annual growth of the world population
- World population

2.1%

11.2 Billion
10.8 Billion
10.2 Billion
9.2 Billion
7.4 Billion
4.4 Billion
3 Billion
1.65 Billion
0.9 Billion
0.1%

1760 1780 1800 1820 1840 1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100

2015 — Projection —→
(UN Medium Fertility Variant)

Source: Our World in Data

Step 1

a I can identify spatial distributions and patterns

Source 1: Identify two countries that are at risk of a 0.15°C temperature change.

b I can provide short explanations for patterns and interconnections

Explain why Australia's agricultural industry is dominated by livestock grazing and grain crops.

c I can identify that changes occur in the characteristics of places over time

Identify environmental changes that occurred in order to build your school. What effects may this have had on the surrounding region?

d I can list primary and secondary methods useful for my study

Source 3: List the primary and secondary data needed to create this map.

e I can interpret different map types using cartographic conventions

Describe how topographic maps would be helpful in planning for environmental change.

Step 2

a I can use data to quantify spatial distributions and patterns

Source 3: Using data, describe the distribution of food security in Africa compared with North America.

b I can explain patterns and interconnections

Source 3: Using SHEEPT, explain the distribution of food insecurity on a global scale.

c I can describe how places have changed over time

Describe how your town, suburb or city has changed over time, using examples as evidence in your response.

d I can successfully use data collection methods

Use Google Earth to locate your local region. Collect data on the type of biomes in your region and how humans have used or changed them over time.

e I can construct paper maps using correct cartographic conventions

Locate population counts for the seven major continents. On a blank world map, illustrate the distribution of the human population in a regional context.

Step 3

a I can describe spatial distributions and patterns

Source 1: Describe (PQE) the expected temperature change on a global scale.

b I can use data to support explanations of patterns and interconnections

Conduct research to estimate the percentage of Australia that is used for cattle and sheep grazing.

c I can explain the causes behind the change over time in a place

Source 1: Provide a brief explanation about why temperature is expected to change on a global scale in the future.

d I can filter collected data

'Malthus' theory is still relevant today because of the uneven distribution of food security.' Discuss with reference to data collected from research.

e I can access and use spatial technology platforms such as GIS

Comment on how spatial technology can be used to monitor and assess agricultural production.

Masterclass

Step 4

a I can use data to support exceptions to spatial distributions and patterns

Source 3: Using examples and data from the chapter and external research, explain why there is uneven food security on a global scale.

b I can use relevant sources to research further reasons for patterns and interconnections

Source 2: Using research, explain why world population growth continues to increase while population growth is declining.

c I can make predictions and outline consequences of change over time

Source 2: Based on current projections, predict how world population might change in the next century.

d I can organise data collected according to relevance for a research question

'Biomes would not change if humans did not alter them.' Discuss whether you agree with this statement, using evidence from the chapter to justify your response.

e I can manipulate data using digital and spatial technologies

Visit the National Museum Australia Encounters website to find an interactive map at http://mea.digital/GHV9_G2_6. Explore the different Aboriginal and Torres Strait Islander areas and comment on any links made to agriculture or environmental management.

Step 5

a I can identify multiple spatial distributions and patterns

Refer to Sources 1 and 3. Using PQE, identify any interconnections between expected temperature changes and food security patterns on a global scale.

b I can interpret causes of patterns and interconnections

Predict how Australia's agricultural land use may change over time due to global warming. Discuss the interconnection between these processes.

c I can interpret data to quantify predictions based on research

Access http://mea.digital/GHV9_G2_7.

Select one country. Using the data provided, comment on how affordability, availability and safety affects food security in that place.

d I can evaluate the success of research methods

You are asked to make a speech at assembly regarding the impacts of global warming on the world's biomes. You use a basic internet search to gain some data from blogs and forums. Consider the reliability of the data you have collected. Create a list of more reliable sources of information, and then collect three statistics to use in your speech.

e I can draw conclusions from geographical information in digital and spatial technologies

Visit the Geoscience Australia website at http://mea.digital/GHV9_G2_8. Navigate to Data & Publications. Click on Interactive Maps. Find the surface hydrology map in the water section. Comment on the distribution of waterways in Australia.

Capstone

How can I understand a human world?

In this chapter, you have learnt a lot about the human world. 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.

mea.digital/GHV9_G2

Scan this QR code to find the capstone project online.

Perceptions
and
places

G3

WHAT ARE PEOPLE'S PERCEPTIONS OF PLACE?

How can I understand perceptions and places?

All of us are connected to places. Your home, your school, the place you like to sit at lunch, your favourite holiday location — the concept of 'place' is evident in all of our lives. The *geography of interconnections* focuses on investigating how people are connected to places throughout the world in a wide variety of ways, and how these connections can change places.

learning ladder

step 5

I can identify multiple spatial distributions and patterns
I can take my PQE one step further to find links or relationships that exist in places.

I can interpret causes of patterns and interconnections
I can use multiple sources to find links or relationships that exist in places and can explain 'Why?'.

I can interpret data to quantify predictions based on research
I can use external data from research as evidence of the positive and negative impacts of a change I have predicted.

step 4

I can use data to support exceptions to spatial distributions and patterns
I can use data to answer 'Why?' about the exceptions identified in a PQE analysis of places.

I can use relevant sources to research further reasons for patterns and interconnections
I can use sources other than this textbook to further research patterns I observe in places.

I can make predictions and outline consequences of change over time
I can use my knowledge of natural processes and world regions to make an educated guess about the positive and negative impacts of change in a place.

step 3

I can describe spatial distributions and patterns
I can describe patterns, quantify them and point out exceptions (PQE) to describe places.

I can use data to support explanations of patterns and interconnections
I can use data from a map or graph to explain patterns I observe in places.

I can explain the causes behind the change over time in a place
I can use my knowledge of natural processes and world regions to explain why changes may occur over time in a place.

step 2

I can use data to quantify spatial distributions and patterns
I can read data and use it to measure key trends on a map or graph about places.

I can explain patterns and interconnections
I can identify social, historical, economic, environmental, political and technological (SHEEPT) factors to help me explain perceptions of places.

I can describe how places have changed over time
I can use specific examples to describe changes over time in places.

step 1

I can identify spatial distributions and patterns
I can find key trends on a map or graph about places.

I can provide short explanations for patterns and interconnections
I can write descriptions of patterns and interconnections that I find in places.

I can identify that changes occur in the characteristics of places over time
I can read information and answer questions about changes over time in places.

| Spatial distributions and patterns | Patterns and interconnections | Changes and implications |

Source 1

People take risks sitting anywhere they can on an overcrowded train in Dhaka, Bangladesh. They are travelling home for the religious festival of Eid-ul Adha.

I can evaluate the success of research methods
On reflection, I can look back and comment on the data collection methods I used and evaluate how successful they were in helping me answer a research question about a place.

I can draw conclusions from geographical information in digital and spatial technologies
I can interpret and analyse patterns by using different layers and features on spatial technology platforms.

I can organise data collected according to relevance for a research question
I can review the data I have collected in the field and display it using graphs, tables, annotations and captions.

I can manipulate data using digital and spatial technologies
I can work with layers and other features on spatial technology platforms to further explore data and interconnections.

I can filter collected data
I can review my collected data and select the most relevant data to answer a research question about a place.

I can access and use spatial technology platforms such as GIS
I can use spatial technology platforms to explore data and find patterns.

I can successfully use data collection methods
I can use primary and secondary data collection methods in the field and classroom to investigate places.

I can construct paper maps using correct cartographic conventions
I can use a pencil, paper and ruler to construct a map that follows BOLTSS conventions.

I can list primary and secondary methods useful for my study
I can create a checklist of methods to investigate a place and categorise them as primary or secondary methods.

I can interpret different map types using cartographic conventions
I understand data found in different types of maps and graphs and use the data to answer questions about a place.

Communicate data

Digital and spatial technologies

Spatial distributions and patterns

1   Compare the community's use of public transport in the place in Source 1 with how people use public transport in Victoria.

Patterns and interconnections

2   Which region of the world the photo in Source 1 was taken in.

Changes and implications

3   Discuss with a partner how the world's growing population may affect how connected people feel to places.

Communicate data

4   Consider your journey to school. What locations along this route do you feel connected to? Why?

Digital and spatial technologies

5   Create a sketch map of the locations outlined in Question 4.

HOW TO   Sketches and annotating, page 140

How can we describe place?

Place can refer to any area that has defining characteristics and has meaning to people. A meaningful place for you could be as simple as your 'place' at the dinner table, or as complex as an Indigenous Australian person's **connection to Country**. Place can be described by its geographical characteristics, which can be either human or natural.

Source 1

A number plate identifies which place cars have come from as they drive around Australia.

Natural characteristics

Natural characteristics are those that exist largely without human intervention. They may include location, vegetation, animal life, climate, seasonal variations or proximity to landforms.

Human characteristics

The human characteristics of a place may involve social, historical, economic, environmental, political and technological (SHEEPT) factors. For example, a place may have a dominant culture, religion or language (social factors); it may have been affected by war (historical factor); or there may have been an economic boom (economic factor). Places can also be described by their access to technologies and infrastructure, such as schools, hospitals, roads, shops or parklands.

Source 2

First Nations rock art in Kakadu National Park, Northern Territory. This shows an interaction between natural and historical human characteristics.

Location

Places can also be described by their location. A place may be rural or urban, industrial or coastal. A place's location will often determine what we do there – coastal regions are often associated with holidays, recreational activities, fishing or even trade, while city locations are associated with office work, public service, tourism and entertainment.

The natural and human characteristics of places change over time. This may be on a small scale, such as seasonal changes in snowfall at Mount Buller, or large-scale changes in response to population growth and **urban sprawl**. How would you describe your local place? Has it is changed over time?

Source 3

People often describe where they live as either rural or urban.

Learning ladder G3.1

Show what you know

1   Outline the natural and human characteristics of your local region.

2   Compare the terms 'place' and 'space' using examples.

3   Draw a field sketch of your local area, annotating the natural and human characteristics outlined in question 1.

Changes and implications

Step 1: I can identify that changes occur in the characteristics of places over time

4   Create a photo essay of your local region, highlighting changes that have occurred over time.

Step 2: I can describe how places have changed over time

5   Annotate the photo essay from question 4 to show significant impacts to the natural and human characteristics of the area.

Step 3: I can explain the causes behind the change over time in a place

6   Consider the changes you identified in question 4 and 5. Using SHEEPT, explain why these changes may have occurred over time.

Step 4: I can make predictions and outline consequences of change over time

7   Access: http://mea.digital/GHV9_G3_1 and search for your local government area. Using the data displayed, consider how these factors may lead to changes in your region over time. For example, if your area has a growing young population, will more schools be needed?

HOW TO

SHEEPT, page 138
Sketches and annotating, page 140
Photo essays, page 143

What are people's perceptions of place?

A key part of understanding the concept of place is to consider the human connection to a place and the significance of that area. When we have an emotional or spiritual connection to an area, we often say that it has a 'sense of place' for us.

What influences people's perceptions of place?

Each person will have a different opinion about, or attachment to, a place. Your perceptions of a place develop over time and depend on many factors, such as your gender, family history or even tolerance levels. If you don't like loud noises or large groups of people, you may not like major cities. On the other hand, people who grew up in a city might find the busyness, lights and street noise comforting, but struggle with the quiet of rural areas.

Sometimes our perceptions are based on personal experience, such as our connection to home. At other times, our perceptions are influenced by hearing stories from other people. Suburbs or cities can develop negative reputations over time if they are portrayed in the media as areas with high levels of crime and violence.

Why do we connect to different places?

Your connection to a place may make up part of your identity. You may feel most at home in a particular area and have a strong sense of belonging, comfort and cultural connection to that place. Over time, you may develop an attachment to many different places as your needs, wants and desires change.

When communities undergo trauma or disaster, their strong sense of place is often illustrated by their ability to work together to rebuild, support neighbours, provide relief to nearby townships or form groups to aid in the recovery. More than 10 years after the devastating Black Saturday Bushfires of 2009, the people of Kinglake are still working together to support those affected, and to develop strategies to avoid disasters like that in the future.

Source 1

A sign made by locals after the devastating 2009 Black Saturday fires killed 173 people.

Source 2

Religion connects people to place and to other people.

Source 3

Sporting teams and other group activities bond people to a particular community and place.
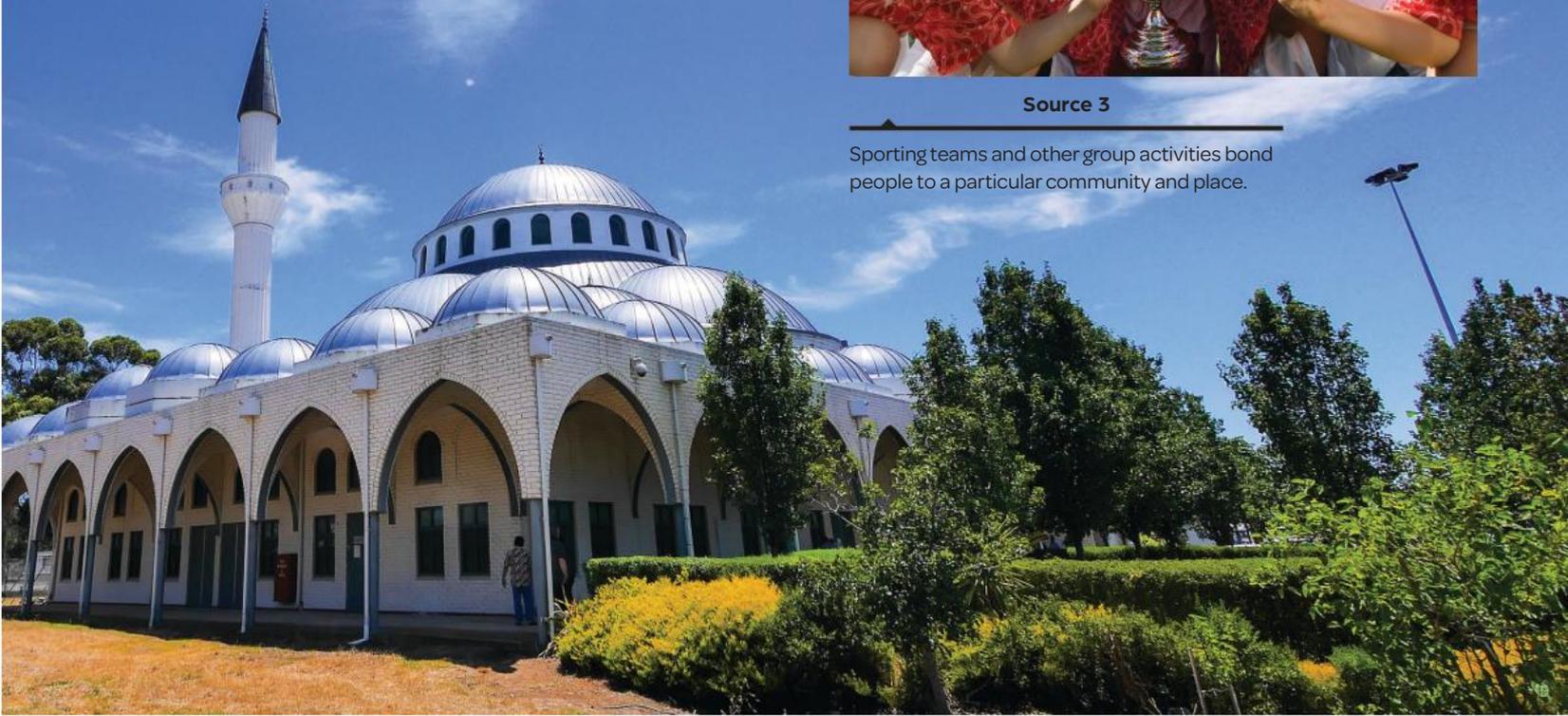
Learning ladder G3.2

Show what you know

1   Define the term 'sense of place'.

2   Explain how your sense of place can change over time or between regions.

3   Sources 1–3: Create an illustration or mind map that encompasses all of the factors that build your sense of place.

Communicate data

Step 1: I can list primary and secondary methods useful for my study

4   Create a survey to determine which factors are important for creating a sense of place in your class. Include five or more questions.

Step 2: I can successfully use data collection methods

5   Carry out the survey you created in question 4 and discuss your results as a class.

Step 3: I can filter collected data

6   Use the data from your survey to create a summary table or graph that shows the results of your data collection. Is there one factor that your class links more often to 'sense of place' than others? Why do you think this is?

Step 4: I can organise data collected according to relevance for a research question

7   Using your mind map from question 3, and a suitable colour legend, classify the different factors that build your 'sense of place' into the following categories:
   - social
   - religion
   - education
   - relationships.
Is there one factor that is dominant when building your sense of place? Compare this with the ideas raised in question 6.
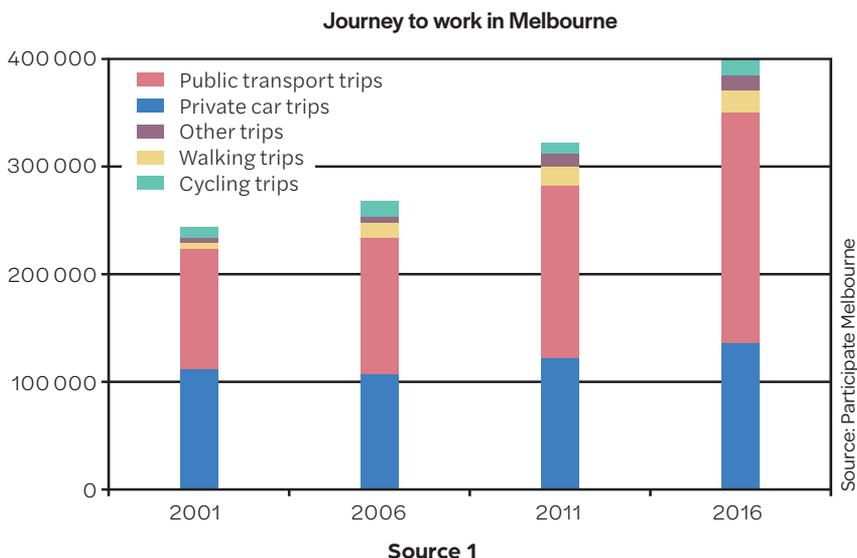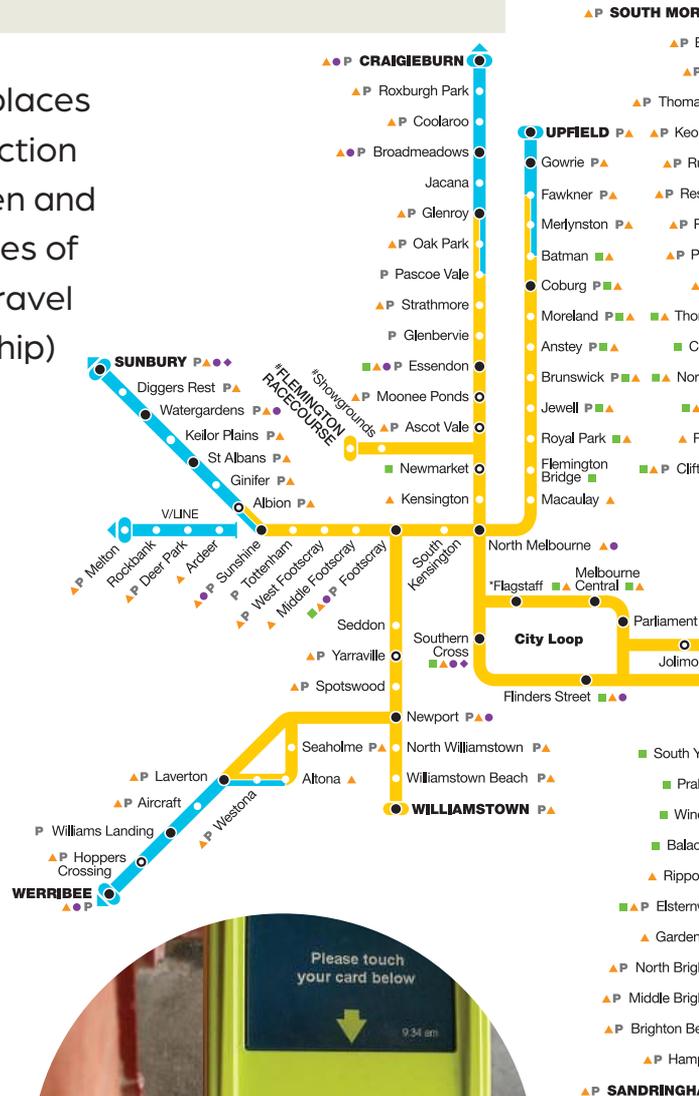
How are different places physically connected?

All places are interconnected. When we discuss how places are connected, we usually think about physical connection such as the roads, transport and trade routes between and within regions. There is an estimated 874 500 kilometres of road in Australia, and around 55 per cent of surface travel (the movement of people or goods by road, train or ship) between places occurs in our capital cities.

Local transport networks

For many people living in cities, public transport is the main way they move between places. As petrol prices and the costs of running private vehicles increase, public transport provides a more sustainable and economic solution for local travel needs. Public transport routes and networks are constantly being upgraded as more advanced technologies emerge and new communities are formed in the outer suburbs of cities.

In Melbourne, the use of trains to get to work has risen by 27 per cent since 2011, which is comparable to an additional 57 trains' worth of passengers.

Journey to work in Melbourne

Legend:
- Public transport trips
- Private car trips
- Other trips
- Walking trips
- Cycling trips

Source: Participate Melbourne

Source 1

The number of people that journey to work in Melbourne using a range of transport options

Source 2

Myki is the ticketing system for public transport in Victoria.

Information

*Flagstaff Station is closed on weekends and public holidays.

#Line to Showgrounds and Flemington Racecourse is only open for special events.

© Public Transport Victoria 2013

Ticketing zones

Zone 1 | Zone 2 | Connecting tram | Connecting bus | Connecting V/Line train | Connecting V/Line coach | Premium Station | Host Station | Parking

Source 3

Melbourne's train network

RANG
Epping
Lalor
...astown
...n Park
Ruthven
...servoir
Regent
Preston
Bell
...ornbury
Croxton
...rthcote
Merri
Rushall
...fton Hill
Victoria Park
Collingwood
North Richmond
West Richmond

HURSTBRIDGE P
Wattle Glen P
Diamond Creek PA
Eltham PA
Montmorency PA
Greensborough PA
Watsonia PA
Macleod PA
Rosanna PA
Heidelberg PA
Eaglemont
Ivanhoe PA
Darebin PA
Alphington PA
Fairfield PA
Dennis PA
Westgarth P A

Richmond | East Richmond P | Burnley | Hawthorn P | Glenferrie P | Auburn | Camberwell P | East Camberwell P | Canterbury P | Chatham P | Surrey Hills PA | Mont Albert PA | Box Hill PA | Laburnum PA | Blackburn PA | Nunawading PA | Mitcham PA | Heatherdale PA | Ringwood PA

LILYDALE PA
Mooroolbark PA
Croydon PA
Ringwood East PA

Heyington
Kooyong P
Tooronga P
Gardiner P
Glen Iris PA
Toorak
Armadale PA
Malvern
Caulfield PA

Riversdale PA
Willison
Hartwell P
Burwood P
Ashburton PA
ALAMEIN

Heathmont
Bayswater
Boronia
Ferntree Gully
Upper Ferntree Gully
Upwey
Tecoma
BELGRAVE

Glenhuntly
Ormond
McKinnon
Bentleigh
Patterson
Moorabbin
Highett
Cheltenham
Mentone
Parkdale
Mordialloc
Aspendale
Edithvale
Chelsea
Bonbeach
Carrum
Seaford
Kananook
FRANKSTON

East Malvern PA
Holmesglen PA
Jordanville PA
Mount Waverley PA
Syndal PA
GLEN WAVERLEY PA

Hughesdale PA
Oakleigh PA
Huntingdale PA
Clayton PA
Westall PA
Springvale PA
Sandown Park P
Noble Park PA
Yarraman PA
Dandenong PA
Hallam PA
Narre Warren PA
Berwick PA
Beaconsfield PA
Officer P
Cardinia Road PA
PAKENHAM PA

Lynbrook P
Merinda Park P
CRANBOURNE

Carnegie PA
Murrumbeena PA

Leawarra | Baxter PA | Somerville PA | Tyabb PA | Hastings PA | Bittern PA | Morradoo PA | Crib Point PA | **STONY POINT P**

DIESEL SERVICE

NORTH

MAP NOT TO SCALE
Effective 28 April 2013

Source: © Head, Transport for Victoria 2020

Learning ladder G3.3

Show what you know

1   List five ways that people are physically connected to their surrounding region.

2   Create a photo essay of how your local community is interconnected with the surrounding region.

3   Consider how you are 'physically connected' to your place. Create a list of ways you move around your region – do you ride to school or catch a train to the city?

Digital and spatial technologies

Step 1: I can interpret different map types using cartographic conventions

4   Access the map of Australia's roads here: http://mea.digital/GHV9_G3_2. How does transport connect people to regions? Discuss the following ideas:
   a   How does trade connect cities and towns?
   b   How do public transport routes allow people to move within and between places?
   c   Where are most of the transport networks located? Why is this?
   d   How could transport networks be improved to allow better connections?

Step 2: I can construct paper maps using correct cartographic conventions

5   Locate a blank map of your local area. Annotate the transport networks that allow connection between you and other places.

Step 3: I can access and use spatial technology platforms such as GIS

6   Access Google Maps. Consider how this technology allows us to feel physically connected to 'place'. How does it help us to more easily move around a 'space'?

Step 4: I can manipulate data using digital and spatial technologies

7   Locate your house on Google Maps. Identify any major roads, highways or freeways nearby. Using the scale, calculate how far they are in kilometres from your house. Discuss how these kinds of roads provide greater physical connection to other places than smaller suburban roads.

HOW TO

Photo essays, page 143

Are Melbourne buses getting better?

Bus lobby pitches to solve Melbourne's transport problems a 'hell of a lot sooner than rail'

By James Oaten and Ben Knight, 25 Oct 2018

Like a lot of Melburnians, Amanda Ralph hates getting the bus to and from work.

It's usually packed, and often late. Sometimes it doesn't even turn up at all. 'We call them ghost buses,' Ms Ralph said. 'They just don't turn up. There's nothing on the PTV app. There's nothing on the Transdev [website] or Twitter account. So, you have no idea.'

But like the two-thirds of Melburnians who don't live near a train or tram stop, Ms Ralph has few alternatives to get from her home in Balwyn North to her job in the city. So, she puts up with the bus – and the long, uncomfortable ride …

Commuters bypass the bus

As Melbourne continues to grow, buses have arguably never been more important to the city's public transport network – servicing new suburbs, and spanning the gaps between the train and tram lines. Yet this year, Infrastructure Victoria found that nearly half of Melbourne's bus network is underperforming. 'Forty per cent of the bus services that we operate aren't getting enough passengers to really justify their existence,' said John Stone, a lecturer in transport planning at Melbourne University.

Melbourne buses compare poorly to Brisbane and Sydney networks. A 2009 study found Sydney buses carry twice as many passengers per kilometre than Melbourne buses. Melbourne buses carry a fraction of the passengers who catch trains and trams, even though the bus network covers more of the city … The main complaint, however, is how infrequently buses run, said Chris De Gruyter from RMIT University's Centre for Urban Research.

'Melbourne has over 300 bus routes. But the majority of these only run every 30 to 40 minutes, and some only run once an hour. We need higher frequency services that people will want to use, rather than have to use because it's their only option.'

Yet for many people in Melbourne, buses are the only option for public transport – especially in the outer growth suburbs, where residents may be waiting decades for a train or tram link. So, it should hardly be surprising that many choose not to spend their time stuck in traffic while standing in the aisle of a bus, and decide to sit in their car instead – adding to congestion …

Bus Association Victoria argues it could fix the frequency problem for $300 million a year – providing services every 15 minutes from 5.30 am to 10.30 pm on weekdays … 'People these days don't want to travel when the timetable says they must,' said Dr Lowe.

'They want to travel when it suits them. And if there's a bus every 15 minutes they don't need a timetable; they just know it's going to show up.'

Melbourne's SmartBus network map

SmartBus routes:
- 703 Middle Brighton to Blackburn
- 900 Rowville to Caulfield
- 901 Frankston to Melbourne Airport
- 902 Chelsea to Airport West
- 903 Altona to Mordialloc
- 905 City to The Pines Shopping Centre
- 906 City to Warrandyte
- 907 City to Mitcham
- 908 City to The Pines Shopping Centre

● Connecting train

NORTH
MAP NOT TO SCALE
Effective October 2019
© Public Transport Victoria 2018

Source 1

Melbourne's buses are an important part of the public transport network.

Source: © Head, Transport for Victoria 2020

Learning ladder G3.4

Show what you know

1 What are the main issues with Melbourne's public transport system?

2 How do transport systems need to adapt to meet the needs of the growing population?

3 With a partner, create a list of 3–4 recommendations for the government about how to improve the local interconnection between places through transport.

Patterns and interconnections

Step 1: I can provide short explanations for patterns and interconnections

4 Source 1: Explain the apparent scattered pattern of bus networks in Melbourne. What suburbs do they miss?

Step 2: I can explain patterns and interconnections

5 Using SHEEPT, explain why public transport is important to connect people and places.

Step 3: I can use data to support explanations of patterns and interconnections

6 Consider the situation when more people choose to drive to work than to take public transport. What issues does this create for road networks and the environment? Use at least one point of data from personal research to support your response.

Step 4: I can use relevant sources to research further reasons for patterns and interconnections

7 Access http://mea.digital/GHV9_G3_3, page 3. Review the list of reasons why we rank poorly when it comes to tackling transport emissions. List three things that could help Australia's transport to become more sustainable. You may want to conduct some research on the higher-ranked countries for ideas.

SHEEPT, page 138

HOW TO

How are we virtually connected to place?

Places are not only connected via physical roads, public transport networks and landscapes, but also via virtual pathways, such as social media, internet platforms and other technologies.

Everyday virtual connections

Over time, improvements in technology have altered the way we communicate and connect with places. Social media and photo-sharing applications allow people to travel virtually and develop perceptions about places without physically visiting them. Access to mobile devices, such as phones, tablets and laptops, means that we can connect to any place at any time. These new technologies have allowed for advancements in trade, the launch of online shopping and instant answers to questions about our world.

During the COVID-19 pandemic, international travel became virtually impossible and domestic travel was severely limited. Victorians in particular experienced lockdowns that left us unable to leave our homes.

Suddenly, virtual reality was more important than ever to connect to extended family, friends and places. For many people who live alone, social connection became entirely virtual; for others, live-streamed events such as Phillip Island's Penguin Parade replaced school holiday trips or weekend getaways.

Source 1

Technology has improved our virtual connection to the world.

Source 2

An output from Snap Map – this feature within the application Snapchat allows users to see where their friends are. While you can tag your location on other social media apps, Snap Map turns sharing your location into a visual experience.

Source 3

GPS tracking allows us to watch our food being delivered in real time. It can be used to track our fitness and help us find our way.
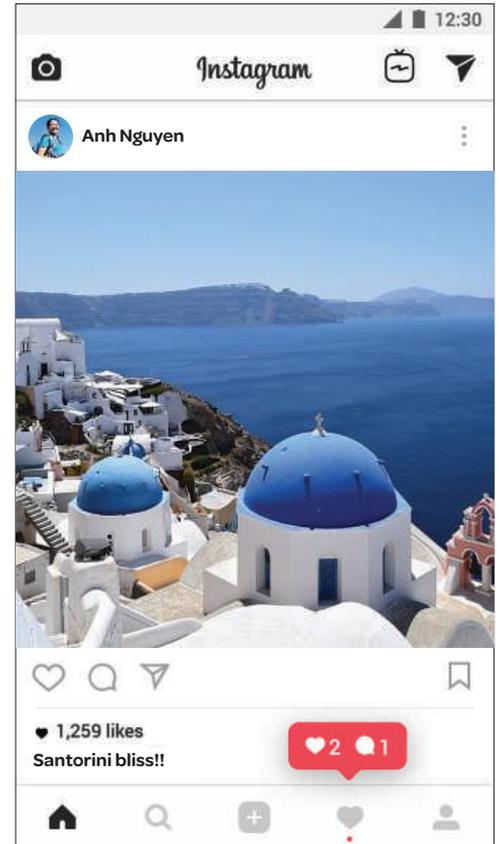
Source 4

Social media, such as Instagram, connects us to places we may have never visited.

Learning ladder G3.5

Show what you know

1   How could virtual connection change people's sense of place?

2   Can you be truly connected to a place through technology, or do you need physical access to feel a true connection?

3   Break into two groups and debate the following topic: 'Virtual connection to a place is better than physical connection'.

Communicate data

Step 1: I can list primary and secondary methods useful for my study

4   Consider the following research question: 'Which smartphone app do students use the most to connect to their school environment?' List two primary methods you would use to collect data to answer this question.

Step 2: I can successfully use data collection methods

5   List the apps you use that allow you to connect to other places virtually. As a class, discuss what apps you use and why you use them.

Step 3: I can filter collected data

6   Create a summary table that identifies each of your apps and provide a 1–2 sentence explanation for how each helps you connect to place. (You may wish to record some of the ideas raised in your class discussion from question 5.)

Step 4: I can organise data collected according to relevance for a research question

7   Tally the number of different apps identified in question 5 for everyone in your class. Graph your results.

How is technology reducing temporal scale?

As technology has improved, our ability to connect with people and places on the other side of the world has become easier and almost instantaneous. You can now video chat with a family member in Australia when travelling overseas. You can buy the latest fashion online from a shop in the USA and have it land on your doorstep within a week or two. Our ability to connect virtually to place has shortened the **temporal distance** between locations. What once may have taken weeks or even months may now take less than a second.

Temporal scale

In Geography we refer to two main types of scale: spatial scale and temporal scale. Spatial scale refers to the physical size or distribution of a phenomena or process. For example, an urban block is smaller than an agricultural property in spatial scale. Temporal scale is the measurement of time, such as a period of 20 years.
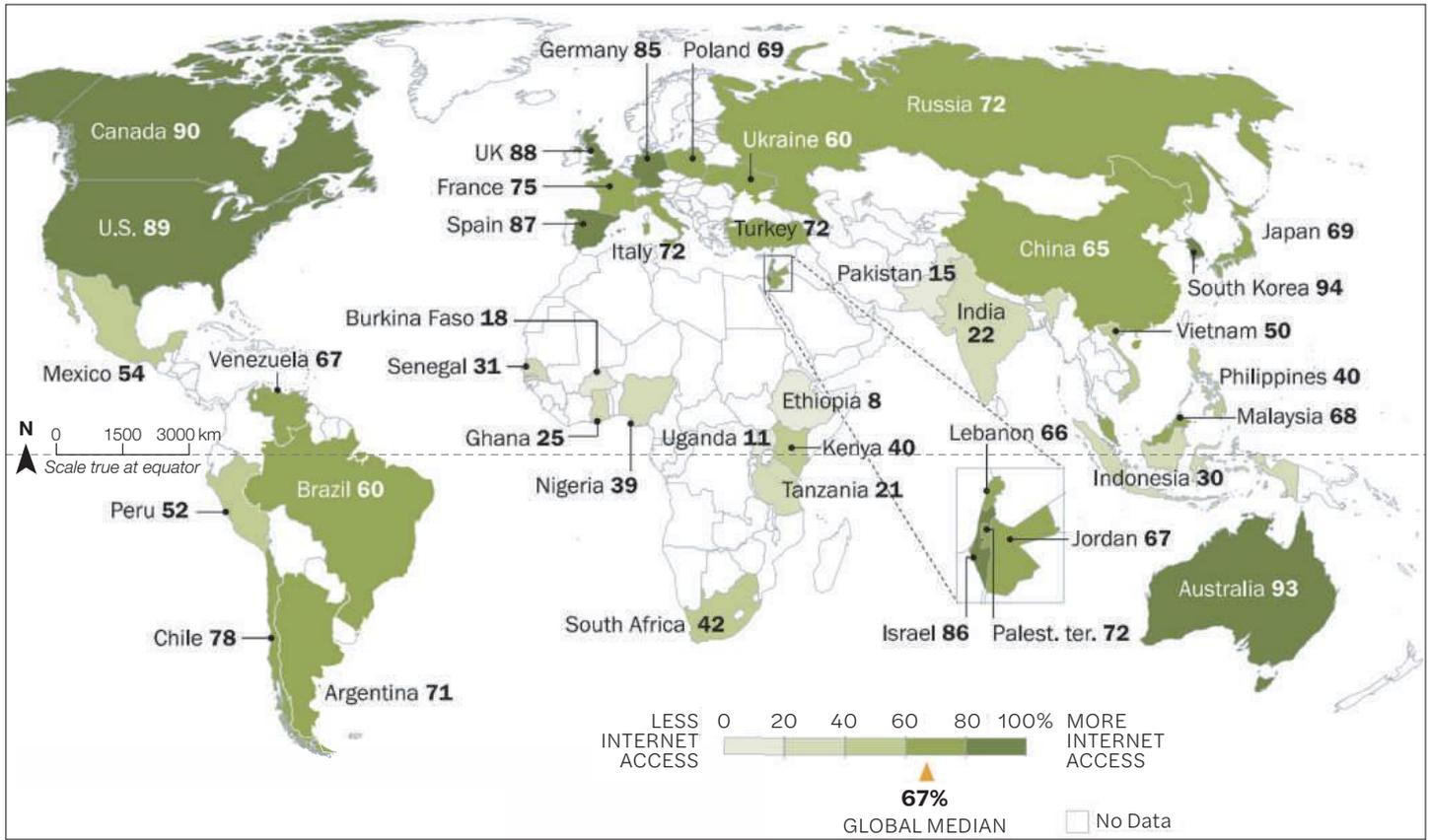
Source 1

Applications allow us to shop from anywhere in the world.

Percentage of adults who use the internet at least occasionally or report owning a smartphone , worldwide 2015

Canada 90
U.S. 89
Mexico 54
Venezuela 67
Peru 52
Brazil 60
Chile 78
Argentina 71

Germany 85   Poland 69
UK 88
France 75
Spain 87
Italy 72
Russia 72
Ukraine 60
Turkey 72
Burkina Faso 18
Senegal 31
Ghana 25
Nigeria 39
Ethiopia 8
Uganda 11
Kenya 40
Tanzania 21
South Africa 42
Pakistan 15
India 22
China 65
Japan 69
South Korea 94
Vietnam 50
Philippines 40
Malaysia 68
Indonesia 30
Lebanon 66
Jordan 67
Israel 86   Palest. ter. 72
Australia 93

N
0   1500   3000 km
Scale true at equator

LESS INTERNET ACCESS   0   20   40   60   80   100%   MORE INTERNET ACCESS

67%
GLOBAL MEDIAN   No Data

Source 2

Source: Spring 2015 Global Attitudes Survey, Pew Research Center, 2015

This map shows access to the internet on a global scale. In most parts of the world, more than two-thirds of people use the internet. However, fewer peope have access in Africa and South Asia.

Temporal and spatial scale are inherently linked. For example, urban blocks in the suburb of Officer in Victoria have become smaller over the past 10 years to allow for high-density urban development.

Reducing the urban—rural divide

The reduction in temporal distance through technology has meant that people in rural or marginalised communities now have better access to resources enjoyed by residents in more urbanised regions. Historically, rural communities were isolated and often lacked access to higher education opportunities or a range of medical professionals. Thanks to the growth of online education, telehealth and video conferencing, these communities are now able to access these services from their own homes.

Internet access is not evenly distributed
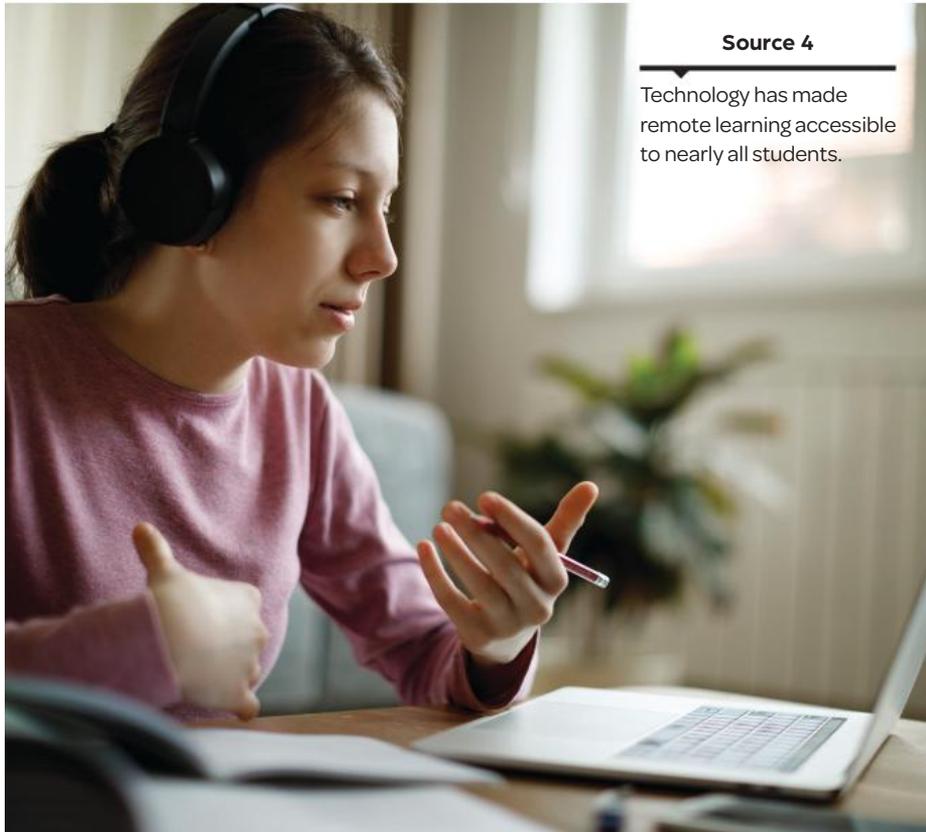
Despite the range of benefits brought about by technology, access to technology is not evenly distributed on a global scale. It is estimated that 94 per cent of youth have access to the internet in **more economically developed countries (MEDC)** compared with 30–67 per cent in **less economically developed countries (LEDC)**. Many countries monitor internet use and restrict access to social media platforms. People in LEDC may not have the financial capacity to purchase devices, or maintain an internet presence, and therefore are less able to access global opportunities to connect to places, people, services and resources. However, while differences are clear, LEDCs are catching up and their access to technology is improving.

Levels of internet censorship, 2019

Source 3

Some countries block or limit access to the internet, including social media sites.

Map: Levels of internet censorship, 2019

Internet Freedom
- No data
- Not Free
- Partly Free
- Free

0   2500   5000 km
Scale true at equator
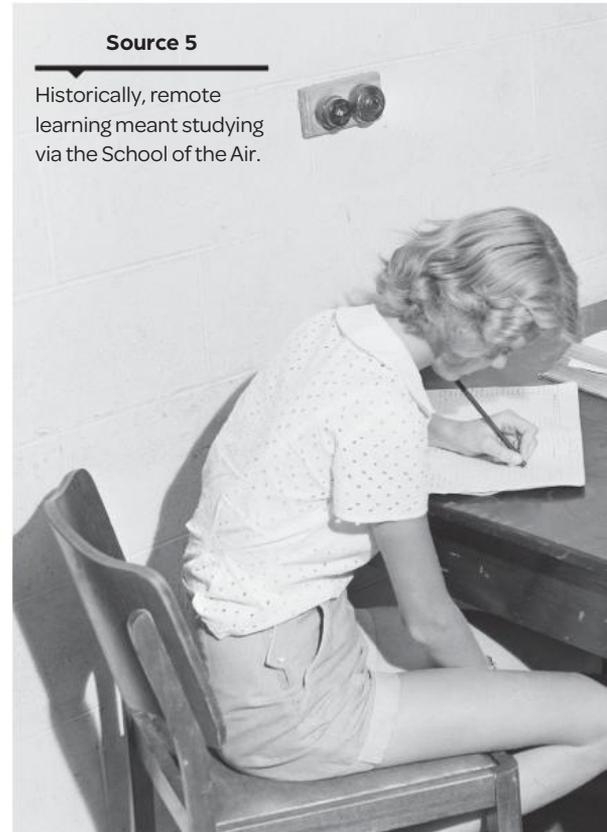
Source: Matilda Education Australia, data from Freedom House

Source 4

Technology has made remote learning accessible to nearly all students.

Source 5

Historically, remote learning meant studying via the School of the Air.

Remote learning

Not only does virtual connection increase our ability to interact with other places and people, it also allows us to access education. Fifty years ago, if you lived in a remote rural community, going to school or university required you either to board at the institution or to travel long distances every day. For some students, the only way they could get their education was via the 'School of the Air'. This remote learning school provided young people with access to teachers and resources by using CB radio connections and broadcasts.

In the present day, remote learning via technology and virtual spaces has developed dramatically, meaning students can complete their VCE online and attend university lectures and seminars virtually.

During the recent COVID-19 crisis, remote learning became vital to help young Australians continue their learning. Victorian school students, in particular, needed to be highly adaptable and to access learning via online platforms for much of the year. Some students reported that online learning fostered independent learning, while allowing them to stay home and learn in their own environment. Others reported that virtual connection for schooling did not allow for the same level of discussion, interaction, class involvement and teacher communication as traditional face-to-face learning. In addition, while remote learning meant that lessons could still take place, school events such as sport days, dances and performances could not, reinforcing that school is more than just what happens in the classroom.

Learning ladder G3.6

Show what you know

1   Compare spatial scale and temporal scale.

2   Explain how virtual connection has narrowed the divide between urban and rural regions.

3   Visit the ICT Development Index 2017 at http://mea.digital/GHV9_G3_4. Using a blank world map, indicate the location of the 10 countries that are the most ICT developed and the 10 countries that are the least ICT developed.

Spatial distributions and patterns

Step 1: I can identify spatial distributions and patterns

4   Source 2: Identify the world region with the highest percentage of adults who use the internet at least occasionally or report owning a smartphone in 2015.

Step 2: I can use data to quantify spatial distributions and patterns

5   Using the map you created in question 3, comment on the distribution of ICT development, using data from the website to support your response.

Step 3: I can describe spatial distributions and patterns

6   Source 3: Locate three countries that censor the internet. Discuss why the governments of these countries may block access for their citizens.

Step 4: I can use data to support exceptions to spatial distributions and patterns

7   Source 2 and 3: Consider why some countries within Africa have greater access to the internet than others. Use data in your response. Consider SHEEPT factors to help expand your ideas.

HOW TO

SHEEPT, page 138

How has COVID–19 affected our reliance on technology?

COVID–19 dominated conversation, news, social media and communities in 2020. National, regional and local restrictions and lockdowns meant that we relied on technology to create a sense of belonging and place like never before.

What is COVID–19?

Caused by a novel (new) coronavirus, 'severe acute respiratory syndrome coronavirus 2' (SARS-CoV-2) is a **viral** infection that causes the disease called 'COVID-19'. COVID-19 affects an infected person's blood vessels and respiratory system, causing symptoms such as fever, lethargy and difficulty breathing, as well as complications such as pneumonia. Researchers described the virus as 'novel' because they had not previously seen it in humans. Medical researchers are still working to understand the disease's full spectrum of symptoms, as well as to create effective treatments or a vaccine.

COVID-19 was first identified in Wuhan, China, with the first known human case recorded on 1 December 2019. From there, the disease was able to spread quickly. On 11 March 2020, the World Health Organisation announced the spread of the virus had reached **pandemic** status.

Responding to the pandemic

To reduce **community transmission**, and ensure the health system could cope with increasing numbers of sick people, Australia (and particularly Victoria) underwent a series of lockdown stages. These ranged from social distancing by standing at least 1.5 metres from others while in the community, to self-quarantining by isolating oneself in the home.

YES WE CAN DEFEAT

COVID-19 ☒

WASH OR SANITISE HANDS

PRACTISE GENERAL HYGIENE

USE A TISSUE WHEN COUGH/SNEEZE

AVOID TOUCHING EYES, NOSE AND MOUTH

KEEP 1.5 METRES DISTANCE

AVOID RAW ANIMAL PRODUCTS

STAY AT HOME UNTIL RECOVERED

SEEK MEDICAL CARE EARLY

Source 1

Infographic showing ways to prevent transmission.

Technology and our response

As a result of having to physically distance ourselves from others, we needed to 'be together' in new ways. Use of online meeting platforms and social media increased exponentially, and the National Broadband Network (NBN) recorded a 71 per cent increase in user traffic as people tried to work, learn and socialise from home.

Internet traffic increase Feb–Mar 2020

- 28 Feb (Pre COVID-19 baseline)
- 20 Mar
- 27 Mar

+71% Increase in business hour traffic from pre COVID-19 baseline levels
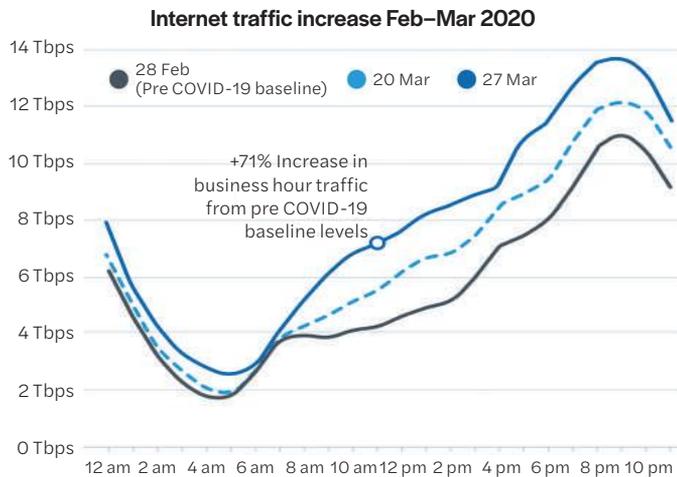
Source 2

Graph released by NBN Co., showing the increase in user traffic during initial lockdowns. For more information, see page 160.

Remote learning became essential to continuing the schooling process, and teachers had to learn new ways to engage with students who were not allowed in the classroom. All over the world, people were quick to download apps that would enable them to stay connected (and entertained!) during the pandemic, as shown in Source 3.

The most downloaded apps in the USA, 26 March–1 April 2020

Zoom Tops Weekly Download Charts

Most downloaded apps in the U.S. from March 26 to April 1, 2020 (in million downloads)

App	Downloads
Zoom	3.2
Tik Tok	1.9
Hangouts Meet	1.2
Houseparty	1.1
Google Classroom	1.1
Perfect Cream	0.9
News Break	0.8
Save the Girl	0.8
Microsoft Teams	0.7

prioridata
statista

Apple and Android stores
Source: Priori Data
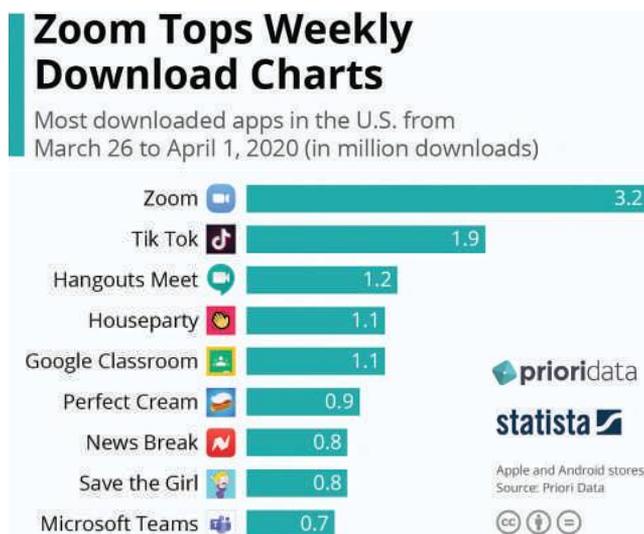
Source 3

The most downloaded apps in the USA from a week early in the pandemic lockdowns.

Learning ladder G3.7

Show what you know

1 Complete a mind map to illustrate your current understanding of COVID-19. Include headings such as symptoms, treatments, prevention methods, responses, news reports and any other categories that you may know of or have heard.

2 Define the term 'pandemic'. Explain why COVID-19 is classified as a global pandemic.

3 Hygiene plays a vital role in reducing the spread of COVID-19. Perfect your handwashing technique by going to http://mea.digital/GHV9_G3_5 to create a new poster for your bathroom using your favourite song.

Changes and implications

Step 1: I can identify that changes occur in the characteristics of places over time

4 Sources 1 and 3: Identify changes to living conditions caused by lockdowns that altered communities and our 'sense of place'.

Step 2: I can describe how places have changed over time

5 Access: http://mea.digital/GHV9_G3_6. Using data from the graphs, comment on the changes to COVID-19 cases over time.

Step 3: I can explain the causes behind the change over time in a place

6 Access http://mea.digital/GHV9_G3_7. Consider why the virus was able to spread so quickly on a:
   a local scale
   b regional scale
   c global scale.

Step 4: I can make predictions and outline consequences of change over time

7 Read through the executive summary for Australia's national COVID-19 response plan at http://mea.digital/GHV9_G3_8. Comment on the government response to the pandemic. Do you think it was effective in the short and long term? Why or why not? Use data and evidence from the report to support your response.

civics + citizenship

What are the dangers of a virtual world?

Social media has opened up a virtual world where people can stay in contact anywhere and at any time. The ease of connecting to people has opened up new opportunities for cyber criminals to undertake fraud, theft or harassment. Lawmakers and enforcers are working hard to keep up with these new threats.

Law enforcement in a virtual world

Our ability to connect virtually to place has greatly shortened the temporal distance (see pages 80–81) between locations. Social media applications allow people to travel virtually and access to mobile devices, such as phones, tablets and laptops, means that we can connect to any place at any time. These changes in technology have altered the way we communicate and connect with places. It has also had a major impact on law enforcement.

The development of a virtual world has created new classes of **cyber crime** and allowed existing offences to be committed in new ways, such as:

· crimes committed to disrupt, damage or infect computers and computer systems
· **computer intrusion** – unauthorised access to a digital device or network
· using technology to commit traditional crimes such as fraud, theft or harrassment.

Cyber crimes can be difficult to police because of the lack of geographic boundaries in the virtual online world. Australian law enforcement authorities can usually only take action when the perpetrator or computer server resides in Australia. Authorities in Australia have increasingly joined global law enforcement networks to fight the rising tide of cyber crime.

Law enforcement is also using the capabilities of new online technologies to fight back against cyber criminals. The Cyber Security Operations Centre coordinates cyber security capabilities across the Australian government and shares information with the Australian Federal Police, the Australian Security Intelligence Organisation and the Australian Signals Directorate. It uses its technological capabilities to disrupt and deter offshore cybercriminals.

Source 1

The Australian Cyber Security Operations Centre opened in 2010.

Cyberbullying

Cyberbullying is the use of technology to harass, threaten or embarrass another person with the intent to hurt them. This form of bullying can be particularly harmful because the victim can be publicly tormented wherever they are, while the bully can be anonymous.

Cyberbullying may occur through:
- abusive or aggressive messages or posts
- humiliating messages, photographs or videos
- pretending to be someone else online
- spreading upsetting online gossip.

If cyberbullying is happening to you, or you are a witness to it, tell an adult you trust. This can be difficult to do as you may not know the identity of the bully or may feel embarrassed. However, in severe cases the police may be able to identify an anonymous cyberbully, so it is important to report it.

Legal protection against cyberbullying

Lawmakers in parliament and the court system, along with law enforcement agencies, are working to keep up with the use of new technologies. New laws, penalties and enforcement strategies can help children and young people stay safe in the virtual world. These include:
- Section 474.17 of the *Criminal Code Act 1995* (Cwlth) makes it illegal to use a phone or online platform to threaten, harass or seriously offend a person. The maximum penalty for this offence is three years imprisonment.
- Section 21A(2)(d) *Crimes Amendment (Bullying) Act 2011* (Vic) amended the *Crimes Act 1958* (Vic) to include making threats, using offensive and abusive words and acting with the intention of causing the victim to fear physical or mental harm. This offence attracts a maximum penalty of 10 years imprisonment.
- *Sex Discrimination Act 1984* (Cwlth) criminalises the sexual harassment of people. In an online environment this could be sending unwanted sexual messages or images, making inappropriate and upsetting advances on social media or posting sexually explicit images.

Learning ladder G3.8

Civics and citizenship

Step 1: I can identify topics about society

1 What are two positive aspects and two negative aspects of social media?

Step 2: I can describe societal issues

2 What is cyber crime and how are law enforcement authorities fighting it?

Step 3: I can explain issues in society

3 What is cyberbullying and why might it pose a particular danger for young people?

Step 4: I can explain different points of view

4 Why is it difficult for police and other law enforcement agencies to detect and prosecute cybercriminals?

Step 5: I can analyse issues in society

5 There is no specific cyberbullying law in Australia. Do you think that existing laws adequately protect victims of cyberbullying?

How does trade connect places and people?

Trade has been occurring between places for thousands of years. Historians believe that the first long–distance trade was the exchange of expensive goods, such as textiles and precious metals, around 3000 BCE in Pakistan.

Global trade is the term now used for the import and export of goods and services that occurs within and between countries.

The benefits of trade

Today, 25 per cent of all products produced globally are exported. Trade is good for a country's **gross domestic product (GDP)**. GDP is the amount of money that a country earns from all its goods and services, and is often measured over a year. When a country exports more goods than it imports, the value of its GDP increases.

The cost of exporting goods has decreased over time due to technological advancements, which have reduced transaction and movement costs. This, along with other factors, has resulted in an increase in global exports from 17 per cent in 1979 to 24 per cent in 2017.

World shipping routes

ARCTIC OCEAN

Arctic Circle

EUROPE

13 Antwerp
18 Hamburg
11 Rotterdam

ASIA

16 Dalian
10 Tianjin
8 Qingdao
1 Shanghai
3 Shenzhen
7 Guangzhou
4 Ningbo/Zhoushan
20 Laem Chabang

6 Busan

14 Xiamen
15 Kaohsiung
5 Hong Kong

Suez Canal

Tropic of Cancer

9 Dubai

AFRICA

Equator

12 Port Klang
19 Tanjung Pelepas
2 Singapore

ATLANTIC OCEAN

Tropic of Capricorn

INDIAN OCEAN

AUSTRALIA

ANNUAL SHIP JOURNEYS

Over 5000	500 to 1000
2000 to 5000	Under 500
1000 to 2000	●16 20 Busiest container terminals, rank

Source 1

Trade routes on a global scale

Shipping containers full of goods for export waiting to be loaded on a dock

NORTH
AMERICA

17 Los Angeles

ATLANTIC

OCEAN

PACIFIC OCEAN

*Panama
Canal*

SOUTH
AMERICA

N

0   1500   3000 km

Source: Matilda Education Australia

Learning ladder G3.9

Show what you know

1   Compare the terms 'goods' and 'services'.

2   Source 1: Comment on the interconnection between trade, technology and temporal scale.

3   Create a timeline showing how trade has changed over time, using dates and data to support your summary.

Spatial distributions and patterns

Step 1: I can identify spatial distributions and patterns

4   Access http://mea.digital/GHV9_G3_9. Identify what this interactive map is showing.

Step 2: I can use data to quantify spatial distributions and patterns

5   Access http://mea.digital/GHV9_G3_10. Select one country on the globe and identify what goods are imported or exported to that place. Research two pieces of data to support your observations.

Step 3: I can describe spatial distributions and patterns

6   Visit http://mea.digital/GHV9_G3_11. Comment on the movement of goods during 2012. Alter the filters and colours and explore the changes it makes to the map's appearance.

Step 4: I can use data to support exceptions to spatial distributions and patterns

7   Visit http://mea.digital/GHV9_G3_12. Are there any locations where shipping appears not to occur? Consider why this is the case. Research how these places may receive goods and services other than via shipping.

Australia's biggest trade partners

Trade is one of Australia's biggest economic contributors — the country earned $387 billion in 2017 from trade alone. As demand for goods increases globally, especially in Asia, the value of Australia's goods grows. In 1990 trade contributed 32 per cent to Australia's GDP; by 2017, it accounted for 42 per cent of GDP.

Trade partners

In Australia, our top five trading partners are China, Japan, the United States, South Korea and India. Australia is China's seventh largest trading partner. In 2016–2017, our largest import was tourism and travel; Australians spent more than $28.6 billion overseas. Iron ore was our largest export and earned the country $66 billion.

Top 5 Australian exports 2016–2017

Iron ore | Coal | Education services | Gold | Natural gas

Source 1

Australia's top import and export goods and services
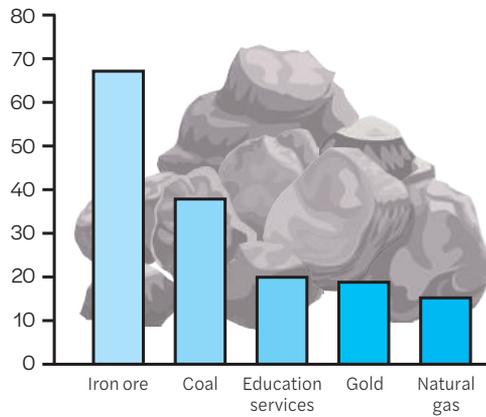
Top 5 Australian imports 2016–2017

Travel/ tourism | Cars | Petrol | ITC equipment | Freight transport
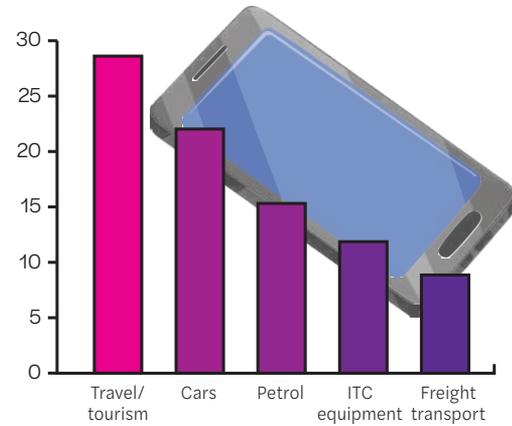
Source: data from SBS.com

GDP per capita, 2016

N

0   2500   5000 km
Scale true at equator
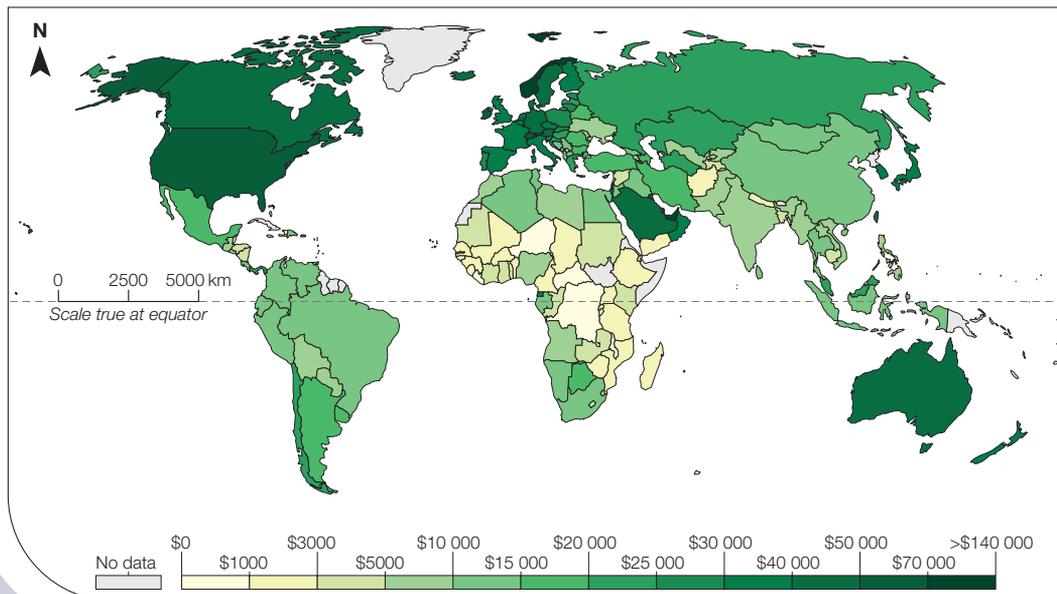
Source 2

How countries share the world's wealth

Source: data from Worldbank

No data | $0 | $1000 | $3000 | $5000 | $10 000 | $15 000 | $20 000 | $25 000 | $30 000 | $40 000 | $50 000 | $70 000 | >$140 000

The impact of COVID–19 on trade

The COVID-19 pandemic has caused much uncertainty when it comes to trade, especially with our major partner China. Reports on changes to global goods values, import/export quality checks and suspensions show that many industries are concerned about a 'global economic shutdown'.

Currently, most governments are primarily focused on health and maintaining health services, which is very different to other recessions, such as the **Great Depression** of the 1930s. As a result, lockdowns and restrictions have meant major job losses, financial debt and alterations to governmental budgets. These budget changes aim to support both communities and industries, so that after the pandemic, the countries and their trade capacities are able to recover.

Exports from China from Oct 2019 to Jun 2020

Month	USD Billions
Oct 2019	2129.79
Nov 2019	2214.42
Dec 2019	2386.38
Jan 2020	1463.89
Feb 2020	1463.89
Mar 2020	1851.33
Apr 2020	2001.14
May 2020	2071.47
Jun 2020	2135.74
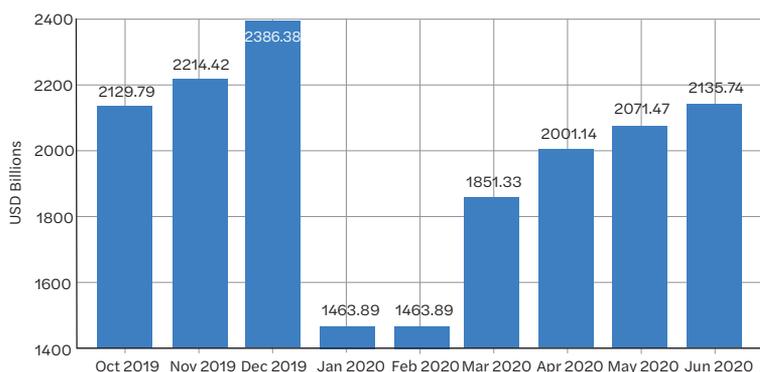
Source 4

This graph shows the sudden, massive drop in exports from China in January and February 2020, as well as the gradual increase from that point.

Learning ladder G3.10

Show what you know

1 Compare the terms 'imports' and 'exports'.

2 Why is trade important to Australia's economy and connection with surrounding regions?

3 Consider Source 2 and rank the countries listed according to their share in the world's Gross Domestic Product (GDP).

Patterns and interconnections

Step 1: I can provide short explanations for patterns and interconnections

4 Discuss why China is one of our most important trade partners.

Step 2: I can explain patterns and interconnections

5 Source 4: Explain why COVID-19 would create such uncertainty in global trade.

Step 3: I can use data to support explanations of patterns and interconnections

6 Source 2: How would having only a few countries holding most of the world's wealth affect economies of LEDCs?

Step 4: I can use relevant sources to research further reasons for patterns and interconnections

7 Because of COVID-19, 2020's trade and stock data does not match what was predicted prior to the crisis. Conduct some research and report on any changes that have occurred in Australia's major trade industries as a result of the pandemic.

Masterclass

Learning ladder

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

EU trade partners and susceptiblity to climate change
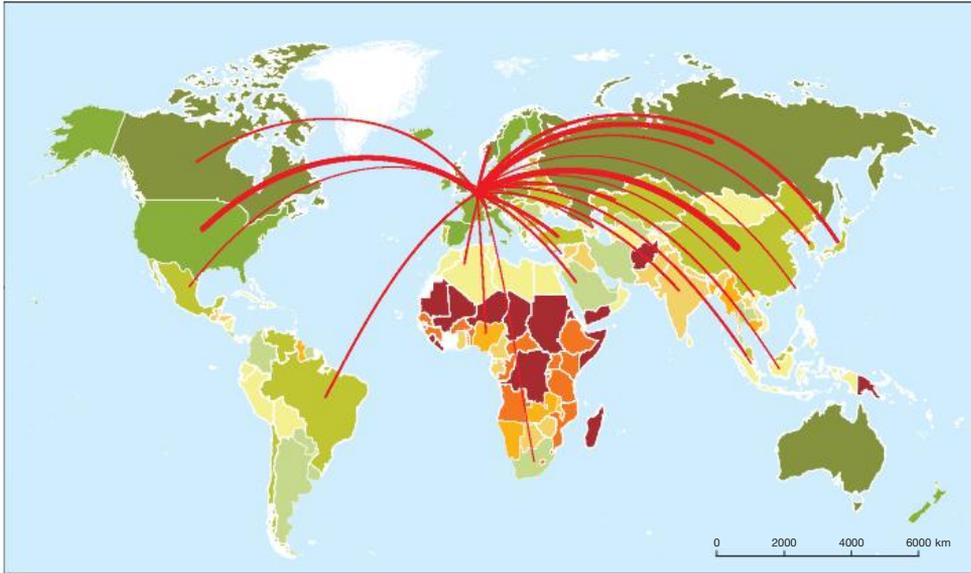
Vulnerability to global climate change and EU imports from outside EU, 2014

Vulnerability score

< 0.25 | 0.25–0.30 | 0.30–0.35 | 0.35–0.40 | 0.40–0.45 | 0.45–0.50 | 0.50–0.55 | 0.55–0.60 | > 0.60 | No data

Import flow (billion EUR)

15–25 | 25–50 | 50–100 | 100–250 | > 250
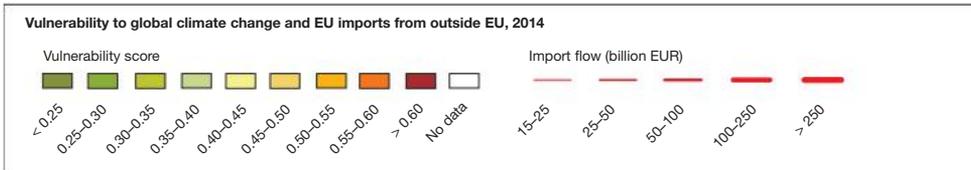
Source: Matilda Education Australia, European Environment Agency, 2014

Global trade as a share of GDP, 2016
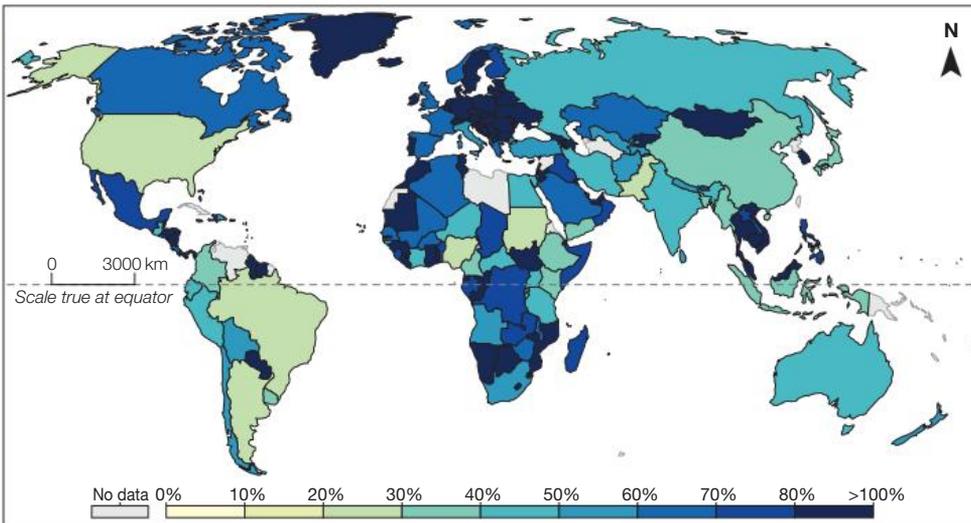
No data | 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | >100%

Source: Matilda Education Australia, World Bank, WDI, 2016

Step 1

a   I can identify spatial distributions and patterns

Source 1: List the countries that the EU imports goods from.

b   I can provide short explanations for patterns and interconnections

Source 1: Provide a brief explanation as to why regions in Africa may be more vulnerable to the impacts of climate change than Australia.

c   I can identify that changes occur in the characteristics of places over time

Consider your time at high school so far. How have your experiences helped develop your sense of place as a student?

d   I can list primary and secondary methods useful for my study

Create a list of primary and secondary methods that would be helpful in investigating people's sense of place in your local region.

e   I can interpret different map types using cartographic conventions

Visit http://mea.digital/GHV9_G3_13. Describe the distribution of billionaires in the world.

Step 2

a   I can use data to quantify spatial distributions and patterns

Source 1: Rank the countries that the EU imports goods from according to potential risk of impact from climate change.

b   I can explain patterns and interconnections

Source 1: Using SHEEPT, explain how global climate change may affect EU imports.

c   I can describe how places have changed over time

Refer to Source 2. Describe how the outbreak of COVID-19 may impact exports and imports on a global scale.

d   I can successfully use data collection methods

Locate secondary sources about Australia's imports and exports for this year. Create a table highlighting Australia's key imports and exports for this year.

e   I can construct paper maps using correct cartographic conventions

On a blank world map, display the top five countries for GDP growth in 2017 from the data in Source 3.

Country	GDP per capita growth (%) 2018	GDP per capita ($US) 2018
Afghanistan	−0.6	524
Australia	1.4	57 396
Sierra Leone	1.3	534
Egypt	3.2	2549
New Zealand	2.8	42 950
Germany	1.2	47 639
Sweden	0.7	54 589
Japan	0.5	39 159
USA	2.4	62 840
Chile	2.5	15 924

Source: World Bank, WDI

Source 3

Trade data for selected countries, 2018

Step 3

a   I can describe spatial distributions and patterns

Conduct a PQE analysis on Source 2, describing the patterns of countries whose GDP rely on trade.

b   I can use data to support explanations of patterns and interconnections

Visit http://mea.digital/GHV9_G3_14. Compare the rail networks for the different regions highlighted in the link above. Consider how these differences may impact local people in terms of connection to other people and places.

Masterclass

c **I can explain the causes behind the change over time in a place**

Given people's strong connection to place, discuss why town planners would choose to alter a place over time.

d **I can filter collected data**

Source 3: Which column of data would be most helpful in creating a map like the one shown in Source 2?

e **I can access and use spatial technology platforms such as GIS**

Visit http://mea.digital/GHV9_G3_14 again. How does this interactive transport map assist locals and tourists to navigate Europe?

Step 4

a **I can use data to support exceptions to spatial distributions and patterns**

Visit http://mea.digital/GHV9_G3_15. Using data, describe the distribution of income on a global scale.

b **I can use relevant sources to research further reasons for patterns and interconnections**

Source 1: Identify why some countries may be more susceptible to climate change than others.

c **I can make predictions and outline consequences of change over time**

Visit http://mea.digital/GHV9_G3_16. Using different layers from the Content tab, discuss how the cost of products varies between places. How may this have an impact on a person's sense of place?

d **I can organise data collected according to relevance for a research question**

Using data from Source 3, graph the GDP per capita for at least five countries.

e **I can manipulate data using digital and spatial technologies**

Visit http://mea.digital/GHV9_G3_17. Use the legend and zoom button to explore the locations of Nike workers on a global scale. Note their locations and consider why they might be in these areas.

Step 5

a **I can identify multiple spatial distributions and patterns**

Suggest how the outbreak of COVID-19 may alter human landscapes and people's sense of place.

b **I can interpret causes of patterns and interconnections**

Refer to Sources 1 and 2. How will increased climate change have an impact on imports and exports worldwide?

c **I can interpret data to quantify predictions based on research**

Research predictions of how technology may change in the future, and then suggest how such changes may influence our connections to people and places.

d **I can evaluate the success of research methods**

Now you have explored some of the weblinks listed in this Masterclass, write one or two paragraphs evaluating how successful spatial technologies are in understanding interconnections between people and places.

e **I can draw conclusions from geographical information in digital and spatial technologies**

Visit the Center for International Development at the Harvard University website at http://mea.digital/GHV9_G3_18. Comment on the complexity of world trade and explain why it is such an important way of connecting with other places.

Capstone

How can I understand perceptions and places?

In this chapter, you have learnt a lot about perceptions and places. 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.

mea.digital/GHV9_G3

Scan this QR code to find the capstone project online.

Choices
and
changes

G4

HOW IS AUSTRALIA
CONNECTED
WITH OTHER PLACES
AND CULTURES? page **104**

How can I understand choices and changes?

The choices we make about what we eat, what technology we use and where we travel have huge implications for the environment. We need to ensure that we are making sustainable choices, so that future generations can enjoy the same experiences we do today.

learning ladder

step 5

I can identify multiple spatial distributions and patterns
I can take my PQE one step further to find links or relationships that exist in places in relation to choices and changes.

I can interpret causes of patterns and interconnections
I can use multiple sources to find links or relationships that exist in relation to choices and changes and can explain 'Why?'.

I can interpret data to quantify predictions based on research
I can use external data from research as evidence of the positive and negative impacts of a change I have predicted.

step 4

I can use data to support exceptions to spatial distributions and patterns
I can use data to answer 'Why?' about the exceptions identified in a PQE analysis of places in relation to choices and changes.

I can use relevant sources to research further reasons for patterns and interconnections
I can use sources other than this textbook to further research patterns I observe in places in relation to choices and changes.

I can make predictions and outline consequences of change over time
I can use my knowledge of natural processes and world regions to make an educated guess about the positive and negative impacts of change.

step 3

I can describe spatial distributions and patterns
I can describe patterns, quantify them and point out exceptions (PQE) to describe places in relation to choices and changes.

I can use data to support explanations of patterns and interconnections
I can use data from a map or graph to explain patterns I observe in places in relation to choices and changes.

I can explain the causes behind the change over time in a place
I can use my knowledge of natural processes and world regions to explain why changes may occur over time.

step 2

I can use data to quantify spatial distributions and patterns
I can read data and use it to measure key trends on a map or graph about places in relation to choices and changes.

I can explain patterns and interconnections
I can identify SHEEPT factors to help me explain places in relation to choices and changes.

I can describe how places have changed over time
I can use specific examples to describe changes over time.

step 1

I can identify spatial distributions and patterns
I can find key trends on a map or graph about places in relation to choices and changes.

I can provide short explanations for patterns and interconnections
I can write descriptions of patterns and interconnections that I find in places in relation to choices and changes.

I can identify that changes occur in the characteristics of places over time
I can read information and answer questions about changes over time.

Spatial distributions and patterns	Patterns and interconnections	Changes and implications

Warm up

Spatial distributions and patterns

1   Looking at Source 1, describe how the distribution of vegetation has changed over time in Koh Phi Phi.

Patterns and interconnections

2   Describe the interconnection between tourism and environmental degradation in Koh Phi Phi.

Changes and implications

3   How might tourism alter Koh Phi Phi in the future?

Communicate data

4   Research how tourist numbers to Koh Phi Phi have changed over time. Are they predicted to increase in the future?

Digital and spatial technologies

5   How could spatial technology be used to assess the changes caused by tourists over time?
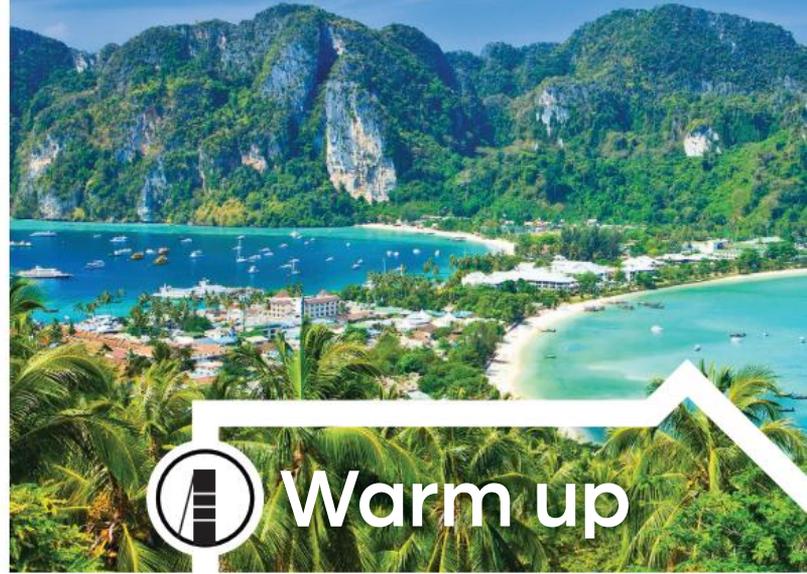
I can evaluate the success of research methods
On reflection, I can look back and comment on the data collection methods I used and evaluate how successful they were in helping me answer a research question in relation to choices and changes.

I can organise data collected according to relevance for a research question
I can review the data I have collected in the field and display it using graphs, tables, annotations and captions.

I can filter collected data
I can review my collected data and select the most relevant data to answer a research question in relation to choices and changes.

I can successfully use data collection methods
I can use primary and secondary data collection methods in the field and classroom to investigate choices and changes.

I can list primary and secondary methods useful for my study
I can create a checklist of methods to investigate a choice or a change and categorise them as primary or secondary methods.

I can draw conclusions from geographical information in digital and spatial technologies
I can interpret and analyse patterns by using different layers and features on spatial technology platforms.

I can manipulate data using digital and spatial technologies
I can work with layers and other features on spatial technology platforms to further explore data and interconnections.

I can access and use spatial technology platforms such as GIS
I can use spatial technology platforms to explore data and find patterns.

I can construct paper maps using correct cartographic conventions
I can use a pencil, paper and ruler to construct a map that follows BOLTSS conventions.

I can interpret different map types using cartographic conventions
I understand data found in different types of maps and graphs and use the data to answer questions in relation to choices and changes.

Communicate data

Digital and spatial technologies

How does consumerism impact places?

As our world changes, there is an increasing desire to keep 'up to date' and own the most recent technology, cars, clothes and gadgets. **Consumerism** can be defined as our desire to own products that exceed our basic human needs.

Consumerism can be a positive **phenomenon** because our increasing desire for goods and services means that industries and economies expand, and employment increases. However, consumerism can also have negative effects on social and environmental conditions.

In 2005, around 59 per cent of the world's resources were bought and owned by 10 per cent of the population, creating huge disparities between the haves and have-nots. According to a 2017 report by international bank Credit Suisse, the richest 1 per cent of the world's population owns more than 50 per cent of the world's wealth.

Mobile phone subscriptions, per 100 people

Mobile phone subscriptions per 100 people
- Over 130
- 115 to 130
- 100 to 115
- 75 to 100
- Under 75
- No data

0   2000   4000 km

N

Source: Matilda Education Australia

Source 1

Mobile phone usage on a global scale

How to be smart about your smart phone

WHAT ABOUT PACKAGING AND TRANSPORTATION?
Packaging consumes:
PAPER FROM TREES, PLASTIC FROM CRUDE OIL, ALUMINUM FROM METAL ORE

Transportation requires fossil fuels, which can contribute to global climate change.

BUT YOUR SMART CHOICES CAN MAKE A DIFFERENCE!

HOW TO BE SMART ABOUT YOUR SMART PHONE

Americans get rid of millions of cell phones every year. Minimize your environmental impact by maximizing the life of your phone!

CHOOSE YOUR SERVICE PROVIDER CAREFULLY.
Many companies sell their own phones, which are not always transferable between companies.

SELECT A PHONE WITH FEATURES YOU NEED AND A STYLE YOU LIKE, so you'll keep it longer. Bonus: you'll save money!

TAKE CARE OF YOUR PHONE.
- Protect it with a case
- Keep it out of extreme temperatures and away from liquids
- Charge the battery according to manufacturer's directions

Source 2

These two infographic panels from the US Environmental Protection Agency address smartphone technology, consumerism and the environment.

GIVE YOUR OLD PHONE A NEW LIFE!

You can reduce the amount of raw materials mined and energy used to produce more phones, as well as the packaging used to transport them—and make a difference in our environment!

FOR EVERY MILLION SMART PHONES RECYCLED, WE CAN RECOVER:
35,274 LBS OF COPPER
772 LBS OF SILVER
75 LBS OF GOLD
33 LBS OF PALLADIUM

GIVE OR DONATE
Help someone in need.
- Give your phone to a family member or friend
- Donate it to charity

RESELL
Make some extra money and help someone out.
- Sell your phone using a reputable website
Take advantage of a service provider's buy-back program.

RECYCLE
Drop your old phone off at an electronics recycling location or a take-back program. Phone parts and materials can be used in a new phone or product. For example:
- Metals can be used in automotive parts and jewelry
- Plastics can be used in garden furniture
- Batteries can be used in more batteries

EPA
United States
Environmental Protection Agency
www.epa.gov/recycle

Environmental impact of smartphones

Our attachment to smartphones is also detrimental to the environment. Although operating them does not use a lot of energy, researchers estimate that 85 per cent of a smartphone's emissions impact occurs during manufacturing. By 2040 it is predicted that technology will contribute more than 14 per cent of the world's total carbon footprint. Part of the problem is that people replace their technology too quickly, because they want the latest model, creating unnecessary **e–waste**.

	2013	2014	2015	2016
United States	20.5	20.9	21.6	22.7
China	18.6	21.8	19.5	20.2
European Union	18.3	19.5	20.4	21.6

Source: Kantar Worldpanel

Source 3

Smartphone life cycles (in months)

Learning ladder G4.1

Show what you know

1 Describe one positive aspect of consumerism and one negative aspect.

2 Explain why smartphones are a good example of the detrimental impacts of modern consumerism.

3 Use Source 3 to create a graph that illustrates the life cycle of smartphones in the United States, China and the European Union.

Spatial distributions and patterns

Step 1: I can identify spatial distributions and patterns

4 Source 1: Identify five countries that have high mobile phone usage.

Step 2: I can use data to quantify spatial distributions and patterns

5 Using data, identify how mobile phone usage varies within Asia.

Step 3: I can describe spatial distributions and patterns

6 Source 1: Use PQE to describe the distribution of mobile phone subscriptions on a global scale.

Step 4: I can use data to support exceptions to spatial distributions and patterns

7 Do any of the countries that have a high number of mobile phone subscriptions per 100 people surprise you? Why is that the case? Use data in your response.

PQE, page 136
Graphing, page 144

HOW TO

How does consumerism impact people?

Global trade brings many benefits to people around the world. Consumers are able to purchase the products they want while the manufacturing industry, through employment, can contribute to alleviating poverty in less economically developed countries (LEDCs). Manufacturing in LEDCs can, however, have significant negative impacts at the individual level. Many people work in unsafe conditions and do not earn enough income to lift themselves out of poverty.

The human cost

Profit is the major driver of trade; most businesses want to produce cheap products quickly and sell them at a global scale for a higher price than they cost to make. In order to reduce production costs, companies often outsource the manufacturing or development of their products to other countries where labour is cheaper.
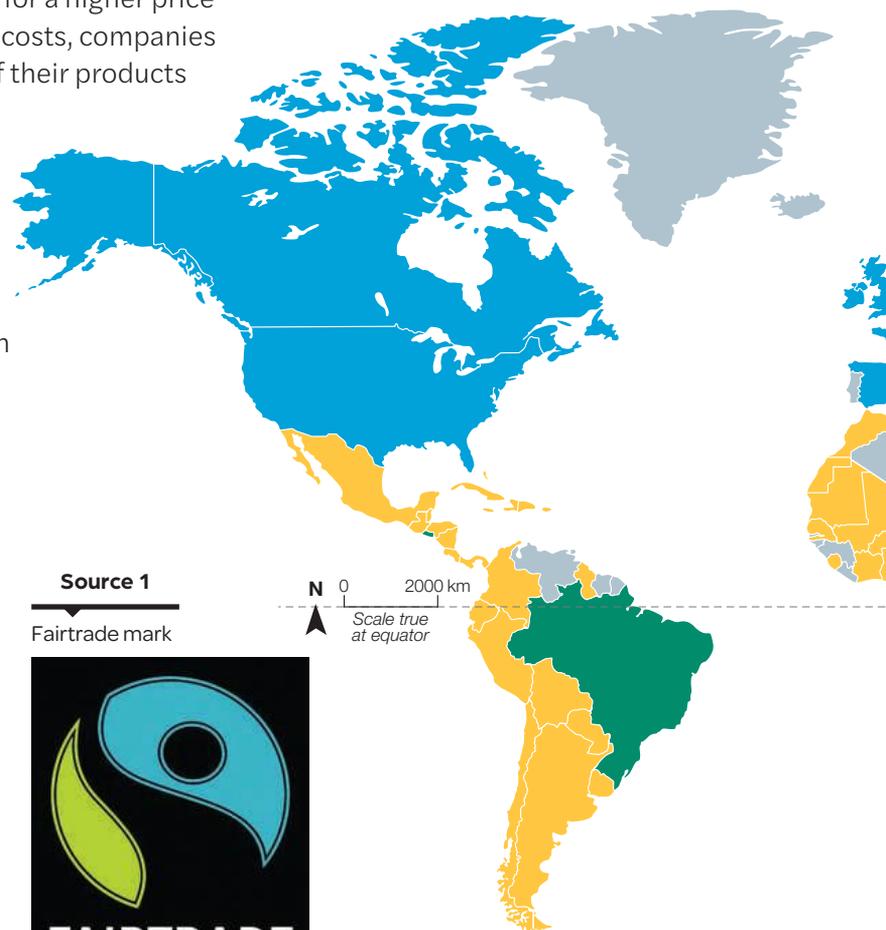
As a result, many people who work in manufacturing for large companies live in LEDCs and earn below the minimum wage. In some cases, even children are forced to work. According to World Vision, there are 73 million child labourers around the world, aged between 5 and 11 years old, and more than 50 per cent of them work in agriculture.

Fairtrade

You may have noticed the Fairtrade mark (Source 1) on some products you buy, such as coffee or chocolate. This mark means that the products have been made by small-scale companies that meet Fairtrade Australia and New Zealand's standards for workers' rights, environmental standards and pay.

The Fairtrade program is an international initiative that promotes education and awareness about fair trade in the broader community. In Australia and New Zealand, the foundation also helps marginalised and rural communities, especially those in the Pacific Islands, to earn a sustainable income and move out of the poverty cycle.

Distribution of Fairtrade (FT) producers and purchasers on a global scale

Source 1

Fairtrade mark

N   0   2000 km
     Scale true at equator

Source: Fair Trade Caravans, 2019

Learning ladder G4.2

Show what you know

1   Explain the economic benefit for global companies of outsourcing their manufacturing to LEDCs.

2   Outline how the Fairtrade program aims to reduce the impact of consumerism on LEDCs.

3   List at least three ways you could reduce the impact of your consumerism on LEDCs.

Patterns and interconnections

Step 1: I can provide short explanations for patterns and interconnections

4   Locate a list of Fairtrade products that are sold in Australia. Explain why some products are not yet sold with the 'fair trade' philosophy.

Step 2: I can explain patterns and interconnections

5   Source 3: Using SHEEPT, explain the distribution of countries that produce Fairtrade products.

Step 3: I can use data to support explanations of patterns and interconnections

6   'Countries that buy Fairtrade products tend to be more economically developed countries (MEDCs).' Justify this statement using data from Source 3.

Step 4: I can use relevant sources to research further reasons for patterns and interconnections

7   Research the Fairtrade program and its impact on LEDCs. Create an infographic that contains at least five facts and two images showing this impact.

HOW TO   SHEEPT, page 138

Produces FT products

Buys FT products

Both
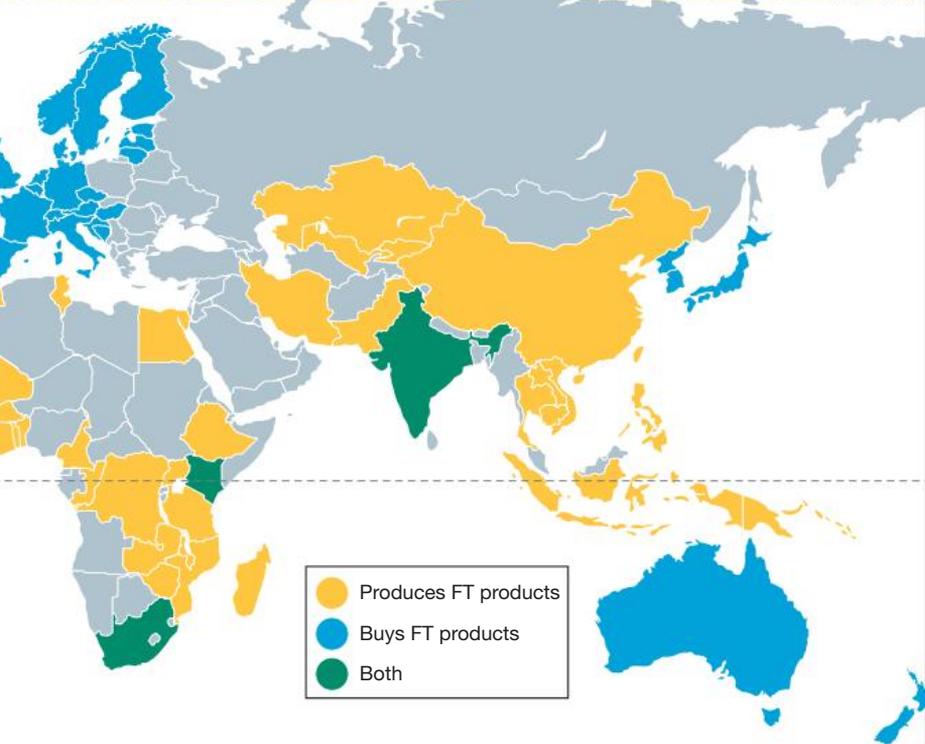
Source 3

Countries that produce or buy Fairtrade (FT) products

Choices and changes   101

economics + business

How does Australia export education?

While coal, minerals and other natural resources make up most of our exports, Australia also exports education services to other nations. We are the world's third–largest provider of international education services, and education is currently our fourth–largest export industry. However, the COVID–19 pandemic has severely affected the education industry, and it may take a long time to recover.

Tertiary education as an export

International students travel from their home country to another nation in order to get the education they desire. Universities around the world seek to attract students from other countries. Because these students bring money into the country, education is considered an export, even though no materials or services are sent overseas.

A variety of factors, including changes to **immigration** laws in other nations and a deliberate attempt by the government to market Australia to international students, led to a huge increase in Australia's income from international education over the last decade.

By 2019, international education contributed more than $37 billion dollars to Australia's economy, with more than 300 000 overseas students studying in this country. This income includes both the fees paid by students for their education and related spending such as the rent, taxes and visa fees the students pay while living in Australia.

More than half of Australia's international students come from five other nations: China (30%), India (11%), Nepal (5%), Malaysia (4%) and Brazil (4%). Universities, education providers and governments have focused on China and India in particular to attract students.

The impact of COVID–19

The COVID-19 pandemic affected the education industry in a number of ways – all of them negative. In the first stages of the pandemic, many students from China were barred from entering Australia, leading to a drop in enrolments. In the first quarter of 2020, international student arrivals were 21 per cent lower than in the first quarter of 2019; arrivals from China dropped by almost 50 per cent.

Source 1
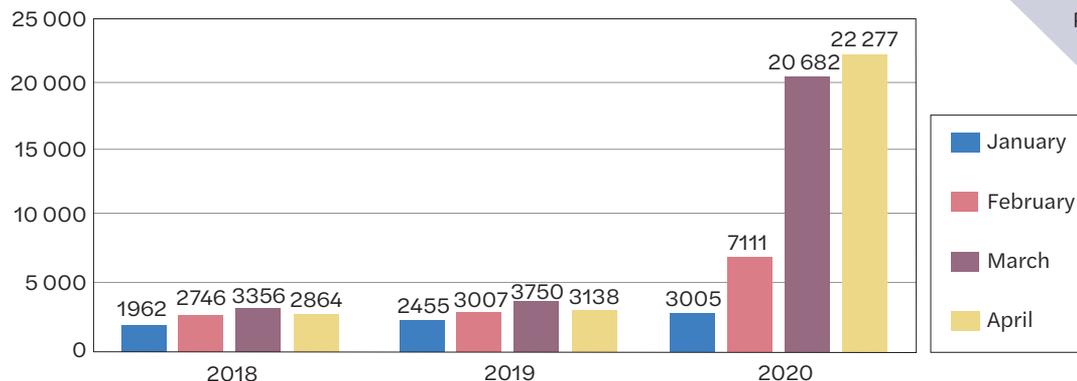
Australia's income from international education sources in the 2018–19 financial year.

2018–19 export income by state and territory

International education is worth **$37.6 billion** to the Australian economy

NT
$126 MILLION

QLD
$5,384 MILLION

WA
$1,998 MILLION

SA
$1,921 MILLION

NSW
$13,913 MILLION

ACT
$1,042 MILLION

VIC
$12,554 MILLION

TAS
$618 MILLION
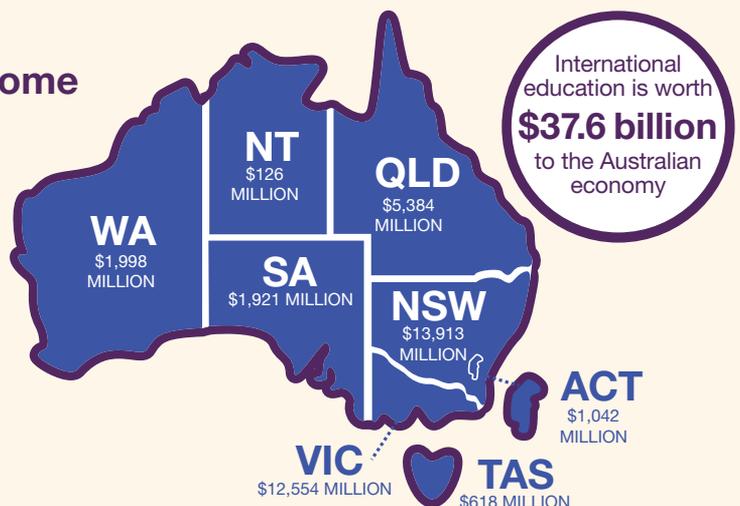
Enrolment deferments, all sectors, 2018–2020

- January
- February
- March
- April

2018: 1962, 2746, 3356, 2864
2019: 2455, 3007, 3750, 3138
2020: 3005, 7111, 20 682, 22 277

Deferment numbers for international students in Australia rose sharply in March and April 2020.

The situation escalated in March 2020, when Australia closed its borders to *all* international travel. Universities closed their campuses, cancelling classes or moving them online, and many international students deferred their studies for a year or more while attempting to find jobs or protect their health.

Potential students tour Sydney University. The pandemic forced educational institutions to cancel in-person classes and public events.

The university sector has been severely damaged by the drop in numbers, as most Australian universities used the income from international students as a big part of their revenue. It is estimated that education export revenue will fall by at least $3 billion across the country, leading to the loss of more than 20 000 jobs in Australia's 38 universities. It remains to be seen whether all of those universities will continue operating after the pandemic ends.

Learning ladder G4.3

Economics and business

Step 1: I can recognise economic information

1 Consider Source 1. Identify how much income Victoria received from international education exports in 2018–19.

Step 2: I can describe economic issues

2 Consider Source 3. Describe how this graph reflects how international students responded to the COVID-19 pandemic in the first quarter of 2020.

Step 3: I can explain issues in economics

3 Explain why the COVID-19 pandemic had such a significant impact on Australia's education export industries.

Step 4: I can integrate different economic topics

4 Explain why a drop in international student numbers would affect other industries and economies, not just the education sector.

Step 5: I can evaluate alternatives

5 Choose two Australian universities. Research the financial effects that the pandemic had upon these universities, and the actions they took to cope with those effects. Which university had the most effective response? Justify your answer using data.

How is Australia connected with other places and cultures?

As Australians, we are connected to people from around the globe through personal and virtual connections and through the pursuits we share: cultural, social, religious, culinary and so on. Trade, migration and tourism are three major pathways of connection.

Trade

Trade connects us with different regions of the world. Our major trading partners include East Asia and Europe. In 2017–18, our exports to East Asia and Europe earned Australia $231 002 000 and $21 712 000 respectively. China is a major market for imports and exports. Our main exports are primary products, including food, minerals and fuel.

Migration

Migration is the movement of people into (immigration) and out of (emigration) a country. Australia's migrant intake is adjusted each year and includes places for skilled workers (designed to fill gaps in Australia's labour market), family members of existing residents or citizens, and people seeking asylum.

International arrivals and departures

Source 1

International arrivals to and departures from Australia

North-western Europe
682 400 516 600

UK
744 000 651 400

EUROPE

Southern and Eastern Europe
228 100 670 600

ASIA

North-east Asia
2 706 800 1 421 500

Middle East and North Africa
124 700 260 500

South and Central Asia
457 100 637 700

South-East Asia
1 418 500 3 143 600

AFRICA

Sub-Saharan Africa
91 300 170 500

Oceania
1 586 700 2 036 700

AUSTRALIA

NORTH AMERICA

The Americas
1 125 400 1 394 300

SOUTH AMERICA

ARCTIC OCEAN

Arctic Circle

ATLANTIC OCEAN

Tropic of Cancer

PACIFIC OCEAN

INDIAN OCEAN

Equator

Tropic of Capricorn

N

0   1500   3000 km

Residents departing on short-term stays
3 000 000   2 000 000   1 000 000   500 000

Visitors arriving on short-term stays
500 000   1 000 000   2 000 000   3 000 000

Source: Matilda Education Australia

ARRIVED WANTING TO GET BACK TO NATURE.
DEPARTED NOT WANTING TO GO BACK HOME.
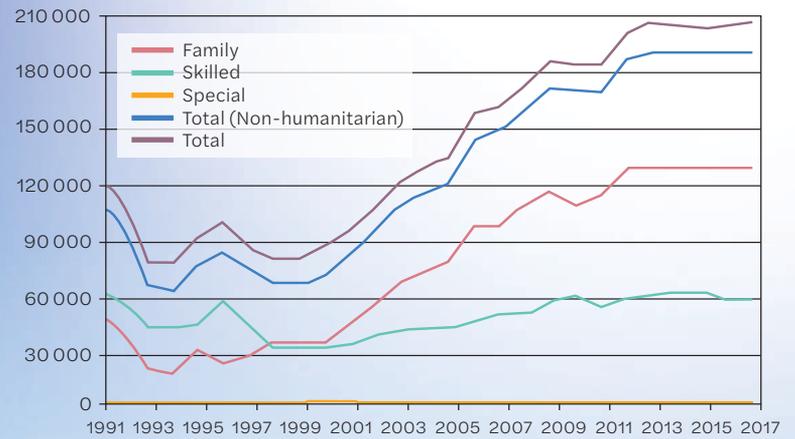
It's true what they say: to find yourself sometimes you need to lose yourself. In Australia they call this going 'walkabout'. And with their pristine white sandy beaches, unique flora and fauna and untouched ancient national parks, it's no wonder people are finding themselves here every single day. Visit Australia.com to find out how you can go walkabout.

Australia's permanent migration program

Legend:
- Family
- Skilled
- Special
- Total (Non-humanitarian)
- Total

Source 2

Australia's migration program since the 1990s

Source: Department of Immigration and MacroBusiness

Source 3

Advertisements like this one promote tourism in Australia

Tourism

Tourism is defined as a person, or group of people, visiting a place other than where they live or work, for more than 24 hours and less than 12 months. In 2018, the Australian tourism industry employed over 924 000 people, and it contributed around $55.3 billion to the nation's GDP. Tourists visiting Australia spent $135.4 billion.

Learning ladder G4.4

Show what you know

1 Source 1: Comment on how Australia is interconnected with other regions in the world.

2 How do migration and tourism play a major role in connecting us with other people, cultures and places?

3 Source 1: Create a graph showing the origins of people who travel to Australia.

Digital and spatial technologies

Step 1: I can interpret different map types using cartographic conventions

4 Locate a map that shows where migrants to Australia have come from.

Step 2: I can construct paper maps using correct cartographic conventions

5 Using a blank map of Australia, illustrate the rate of migrant settlement in each state.

Step 3: I can access and use spatial technology platforms such as GIS

6 Access http://mea.digital/GHV9_G4_1 and locate your town or local area. Identify the percentage of migrants that live there and their origins.

Step 4: I can manipulate data using digital and spatial technologies

7 Access http://mea.digital/GHV9_G4_2 and compare ABS migration data for both Victoria and NSW. Are there any key similarities or differences? Using one SHEEPT factor, write one reason for these similarities or differences in trends.

Mapping skills, page 134
SHEEPT, page 138

HOW TO

What is global tourism?

Another outcome of improving technologies is the increase in global tourism. Advancements in air transport mean that people can travel internationally within the space of a few hours – the **temporal distance** between countries is getting smaller.

Recently, Qantas began flying passengers to the UK from Australia without stopping. Improvements such as this will further reduce temporal distance and encourage the mass movement of people between places.

In 2017, France was the most visited country in the world, with over 87 million visitors, while Kuwait and Bhutan were two of the least visited countries. As the cost of travel reduces over time, it is becoming more accessible to young people. The World Tourism Organization (UNWTO) estimated that young people would have spent US$400 billion globally on tourism in 2020 – if they had been able to travel.

The impact of COVID–19

The health crisis created by the outbreak of COVID-19 changed travel and migration drastically. Suddenly tourism – a huge contributor to economies and livelihoods and a way to connect with other people, places and cultures – was viewed as a high transmission risk for COVID-19.

Suddenly, most countries disconnected from the rest of the world. Borders were closed or restricted, quarantining made allowing new people into regions expensive, and social distancing and lockdowns hindered internal travel. Some Australian travellers were trapped overseas, having to extend their hotel stays for weeks or even months.

Source 1

An advertisement for Contiki tours, created before the impact of COVID-19 was realised.

when 2020 is the year you watch less TV & more Santorini sunsets

contiki

VISIT SANTORINI, GREECE WITH CONTIKI

The long-term impact of the pandemic on tourism is not yet known. International flight numbers have plummeted, which has had a devastating impact upon our island nation. It may be a long time before the Australian tourism industry recovers, or before Australian tourists are able to travel overseas again.

COVID-19: Unprecedented Decline In Air Traffic

Number of flights tracked daily worldwide (01 Feb-30 Mar, 2020)

74,297

Source: Flightradar24

statista

Who's Most Vulnerable to COVID-19's Impact on Tourism?

Total contribution of travel and tourism to GDP of the world's largest economies in 2019*

Country	%
Mexico	15.5%
Spain	14.3%
Italy	13.0%
China	11.3%
Australia	10.8%
Germany	9.1%
United Kingdom	9.0%
United States	8.6%
France	8.5%
Brazil	7.7%
Japan	7.0%
India	6.8%
Canada	6.3%
Russia	5.0%
South Korea	4.2%

* incl. contributions from industries that deal directly with tourists (e.g. hotels, travel agents, airlines, restaurants) plus tourism's indirect and induced impact
Source: World Travel and Tourism Council

statista

Source 2

Numbers of national and international flights have dropped sharply during the pandemic.

Source 3

The countries most vulnerable to the pandemic's impact on tourism; Australia is fifth on the list
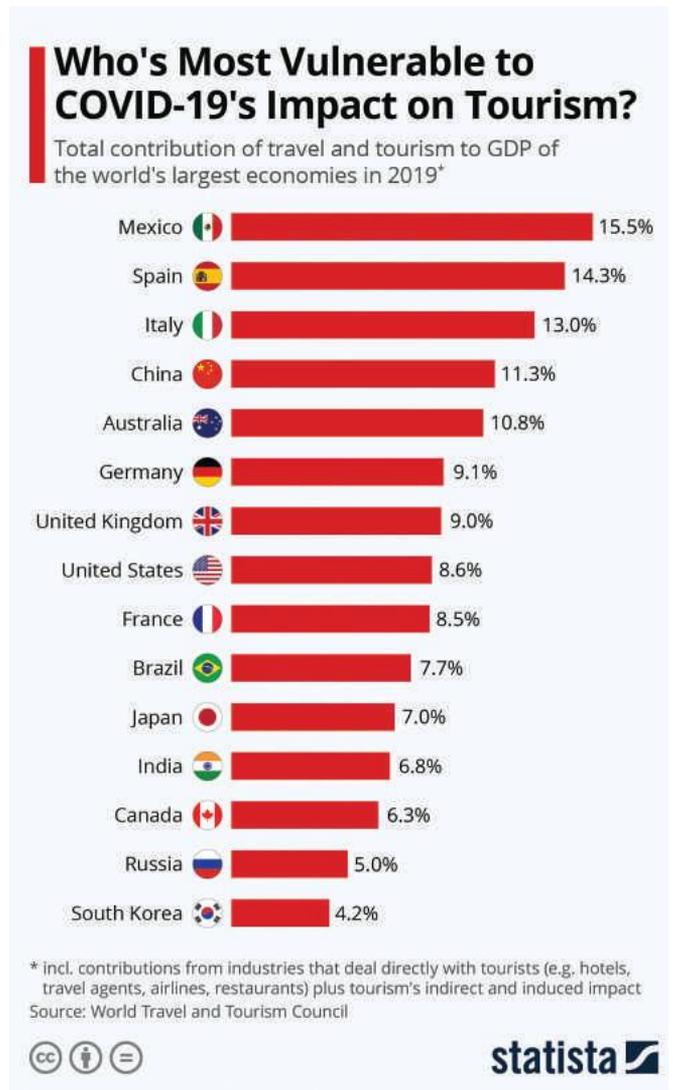
Learning ladder G4.5

Show what you know

1   Explain the interconnection between tourism and the reduction in temporal scale.

2   Describe how global tourism has changed over time

Communicate data

Step 1: I can list primary and secondary methods useful for my study

3   Create a survey to carry out in your class to answer the research question: 'Where have people travelled in the world?'

Step 2: I can successfully use data collection methods

4   Carry out the survey created in question 4. Graph the outcome and discuss your results as a class.

Step 3: I can filter collected data

5   Source 3: Consider how COVID-19 impacted travel and tourism in 2020. Which countries were affected most by the travel restrictions? Do they have any similarities? Why do you think these countries were most affected?

Step 4: I can organise data collected according to relevance for a research question

6   Consider the impact that the lack of travel has had on local and national economies. Choose a focal country and investigate the economic impact that tourism has had on that location before and after the outbreak of COVID-19.

Graphing, page 144

HOW TO

What determines where people travel?

Imagine you are planning your dream trip. There are no limits — you can go anywhere you want, experience new countries and cultures, explore beautiful natural locations or bustling cities. How do you start to plan? What factors will determine where, when and for how long you travel?

While financial restrictions may be at the forefront of your mind, you might also consider the cultural experience you want to have, the language spoken in the host country, how safe the host country is, the social or religious rules of the host country, and how you would 'fit in' with the local people. Proximity and cultural ties are other factors that influence where people choose to travel.

In recent history, recreational travel was largely based on choice and the interests of the individual tourist. However, during the peak of the global COVID-19 pandemic, border closures and strict travelling regulations both within and between countries significantly altered our ability to make these choices. Many people had to cancel their travel plans or became stranded in their host country. Travel suddenly became a necessity to return home to be with family and access healthcare. It is yet to be seen how the pandemic will change tourism and our travel choices in the future.

Source 1

The COVID-19 pandemic led to mass cancellations of international flights and airport shutdowns.

States of peace on a global scale, 2018

N

0   1000   2000 km

International travel controls during the COVID-19 pandemic.

N

0   2500   5000 km
Scale true at equator

No data   No measures   Quarantine from high-risk regions   Total border closure
           Screening   Ban on high-risk regions
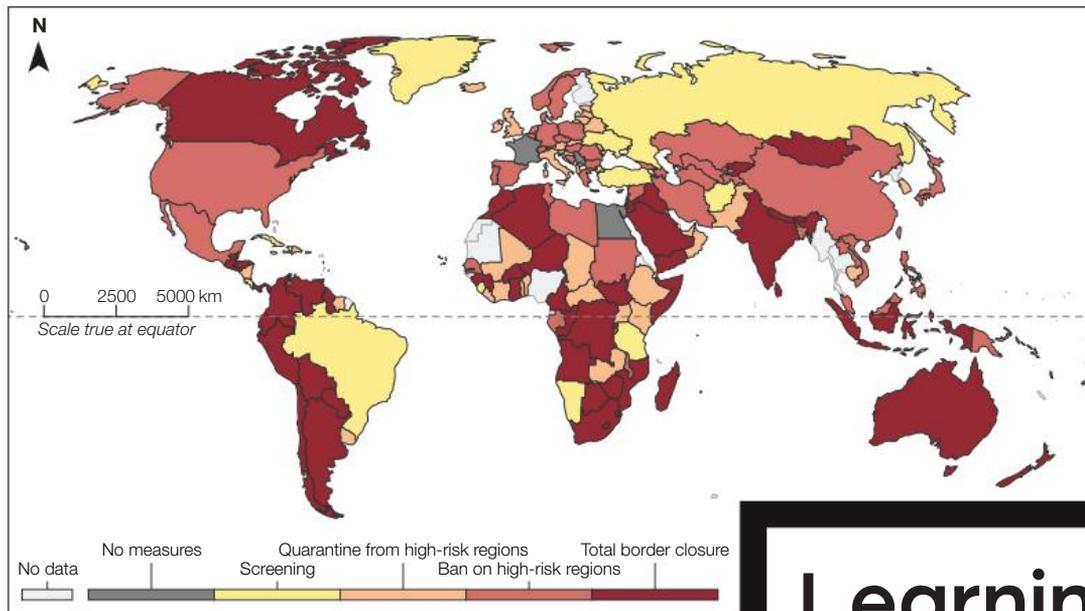
Source 2

International travel controls during the COVID-19 pandemic,
12 August 2020.

Source 3

This map comes from the Institute for Economics and Peace.
Their Global Peace Index ranks 163 independent states and
territories according to their level of peacefulness.

The state of peace

Very high   High   Medium   Low   Very low   Not included

Source: Institute for Economics and Peace, Global Peace Index Report 2019

Learning ladder G4.6

Show what you know

1 Define the term 'tourism'.

2 Create a table with the column headings 'Factors
   that encourage tourism' and 'Factors that restrict
   tourism'. Complete the table, considering the
   factors that would determine where, when and
   why you travelled to different places.

Spatial distributions and patterns

Step 1: I can identify spatial distributions and patterns

3 Identify the countries in Source 2 that had no
   measures in place for international travel during
   August 2020.

Step 2: I can use data to quantify spatial distributions and patterns

4 Source 3: Describe, using data, the distribution
   of the safest countries to visit on a global scale.

Step 3: I can describe spatial distributions and patterns

5 Consider what is meant by 'peace' in Source 3.
   How does this compare with the countries
   that have high-level travel restrictions during
   COVID-19? Outline any similarities and differences
   between these two maps.

Step 4: I can use data to support exceptions to spatial distributions and patterns

6 Use PQE to describe the distribution of countries
   that have high-level travel restrictions. Provide
   data to support both your pattern and exception.

HOW TO
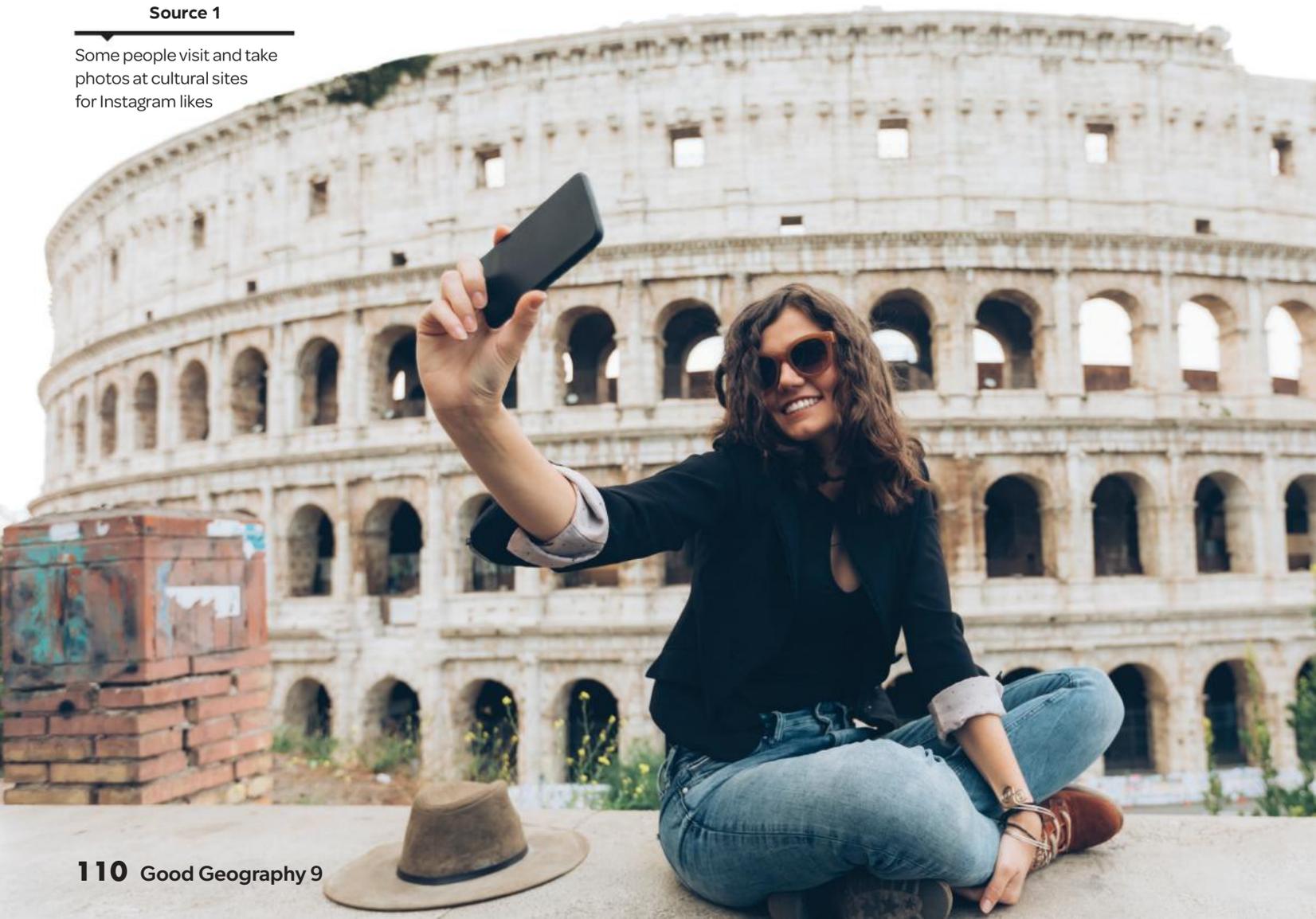
PQE, page 136

How does travel impact the culture of a region?

Tourism can have positive and negative effects on place. One major benefit is the huge economic contribution that the industry makes to local economies, creating employment opportunities for the host country. For example, tourism accounts for over 76.2 percent of the GDP of Palau, a small Micronesian nation in the Pacific. One major negative effect of tourism is when a local culture is **commodified**. Important practices can be cheapened if they are marketed and sold to tourists.

Source 1

Some people visit and take photos at cultural sites for Instagram likes

The commodification of culture

When travelling, many tourists want to experience different cultures, and so will pay to attend shows, festivals or rituals. While this may initially have a positive effect by renewing interest in traditional practices, it may become difficult for locals to separate sacred events from spectator events.

When an event, ritual or practice is packaged and sold for monetary gain it is said to have become commodified. By putting a price on culture, its value and meaning for communities may be diminished. Consider someone buying a boomerang as a toy, rather than appreciating its significance as part of Indigenous Australian culture, or joining a tour group to have a private 'cultural experience' when overseas? These are both examples of cultural commodification.

Source 2

Almost no destination in the world is free from the commodification of local culture and customs.

Source 3

Tourism industries often promote traditional weapons and tools as designer products rather than cultural artefacts.
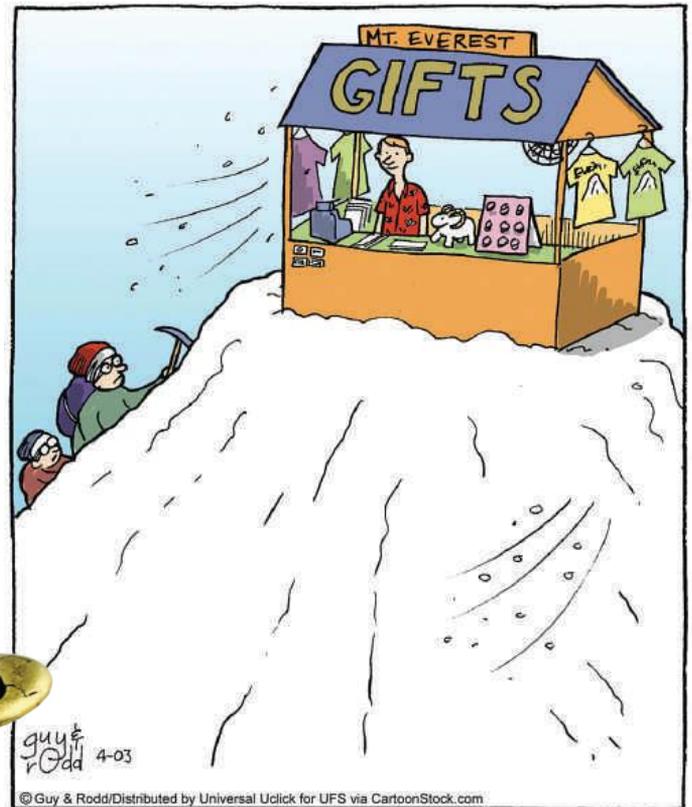
Learning ladder G4.7

Show what you know

1   Define the term 'commodification' in relation to tourism.

2   What are some positive outcomes of commodification?

3   As a class, create a list of items or souvenirs you have bought that might have supported cultural commodification.

Changes and implications

Step 1: I can identify that changes occur in the characteristics of places over time

4   Explain how tourists alter local culture and traditions in a host country.

Step 2: I can describe how places have changed over time

5   Consider one country you have visited or would like to visit. Research how this country has changed over time due to tourism and commodification.

Step 3: I can explain the causes behind the change over time in a place

6   Comment on how commodification could assist a country's economy, especially in regards to local jobs and industry.

Step 4: I can make predictions and outline consequences of change over time
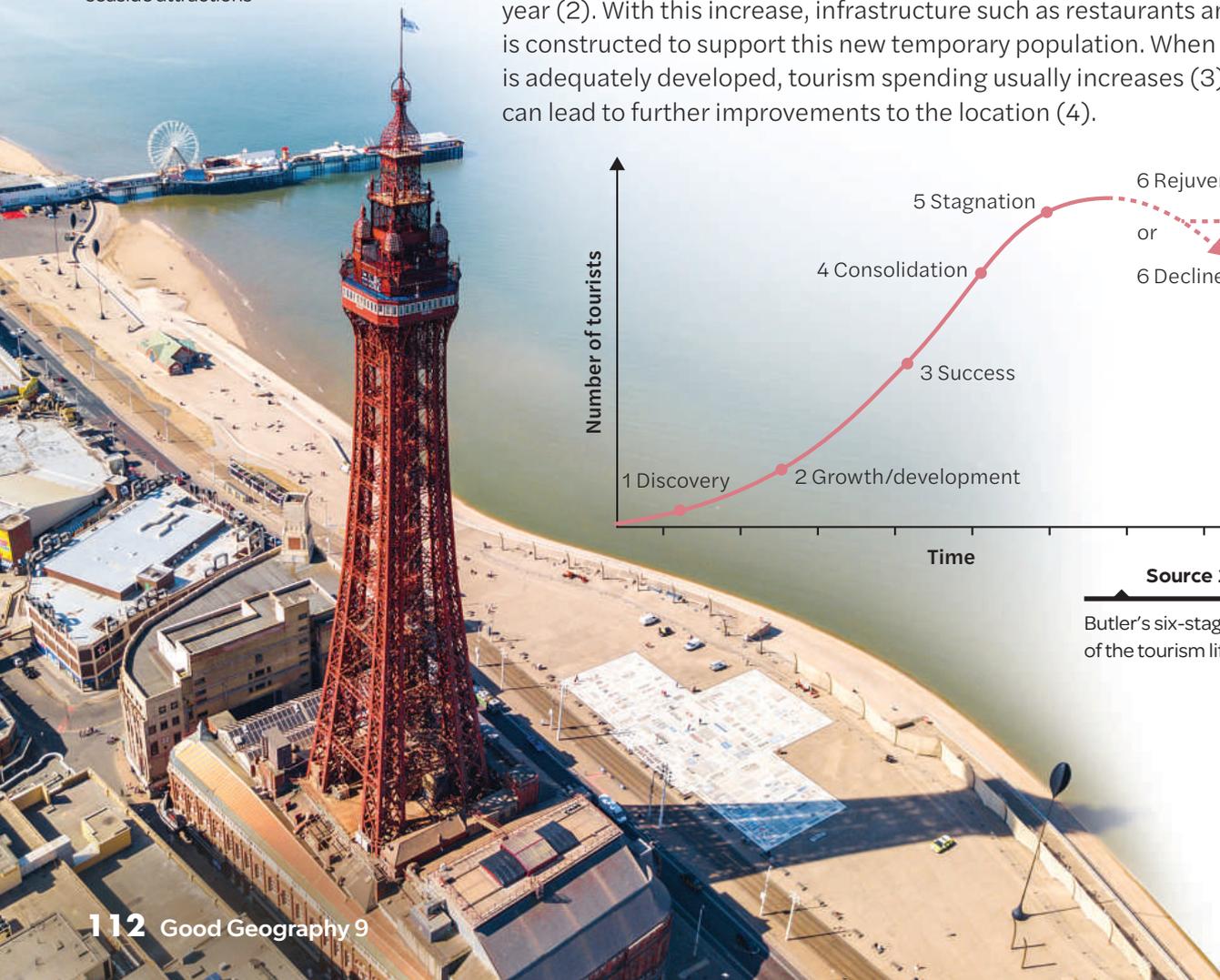
7   Commodification is one example of how culture is impacted by travel. Using examples, suggest other ways tourists could bring change to host countries. Consider both positive and negative changes that could occur in these places.

8   In an attempt to reduce the spread of COVID-19 in 2020, many countries closed or put hard restrictions on their international borders. How could the resulting decline in international tourism reduce commodification of cultures in some places?

How do tourist destinations change and adapt over time?

In 1980, Geography researcher Richard W. Butler proposed a six–stage model to describe the impact tourism can have on a location. His model shows that tourist destinations initially benefit from an increase in tourism, but must carefully manage ongoing tourism to avoid stagnation while holding on to what makes a place special for both tourists and residents.
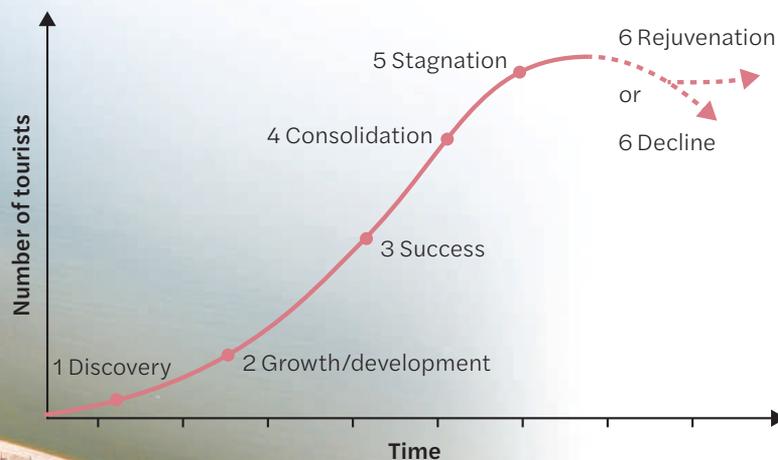
An aerial perspective of Blackpool's seaside attractions

Butler's model

As shown in Source 2, once tourists 'discover' a place (1), the news of the location usually spreads and leads to an increase in tourists arriving each year (2). With this increase, infrastructure such as restaurants and hotels is constructed to support this new temporary population. When the place is adequately developed, tourism spending usually increases (3), which can lead to further improvements to the location (4).

Source 2

Butler's six-stage model of the tourism life cycle

Blackpool at night

However, infrastructure ages and mass tourism can contribute to the degradation of a space over time through pollution, environmental damage or building decline (5). Once a location reaches this stage, it may undergo rejuvenation through new government or business funding (6) or continue to decline to the point that tourists no longer wish to visit (6).

The Blackpool example

The development of Blackpool, a seaside town in the UK, is a good example of the six-stage model. In the 1800s, wealthy tourists travelled to Blackpool as a coastal destination. As the town's popularity increased and transport improved, infrastructure was developed and fairgrounds, light shows and hotels were built. Tourism numbers peaked in 1939; as overseas holidays become more affordable, visitor numbers declined and Blackpool went into a state of disrepair.

In more recent years, Blackpool's Town Council has spent over £100 million to rejuvenate the main street, build a modern conference centre, extend public transport systems and improve existing roads and networks, all to encourage tourists back to the seaside township.

Learning ladder G4.8

Show what you know

1   Describe each stage of Butler's model using examples from Blackpool.

2   Create a photo essay on Blackpool, with at least six images representing each stage of Butler's model.

Changes and implications

Step 1: I can identify that changes occur in the characteristics of places over time

3   Identify a tourism hotspot in Victoria. How has this region changed over time as a result of tourism? Outline these changes and discuss them with a partner.

Step 2: I can describe how places have changed over time

4   Source 2: How might the growth/developmental stage of Butler's model have positive impacts on a place? (Hint: Consider the SHEEPT factors in your response.)

Step 3: I can explain the causes behind the change over time in a place

5   Using examples, explain why Blackpool changed so significantly over time. What were the main causes of this change?

Step 4: I can make predictions and outline consequences of change over time

6   Do some further research on Blackpool today. Predict whether Blackpool will become popular again or continue to decline.

Can tourism be sustainable?

Although tourism can benefit economies and employment in different regions, it also contributes to more than 10 per cent of global carbon emissions per year. Consider what you use when you travel. You may travel by plane or car to your destination, eat packaged food, take longer showers, have fresh towels sent to your hotel room each day and use the air conditioner for hours on end (depending on the climate). All of these actions have an impact on the environment.

Source 1

Ecotourism is not just about exploring the natural environment of a location. It is also about travelling sustainably, being educated about local practices, environments and traditions, and ensuring waste is minimised.

Source 2

Do you agree with this cartoon?
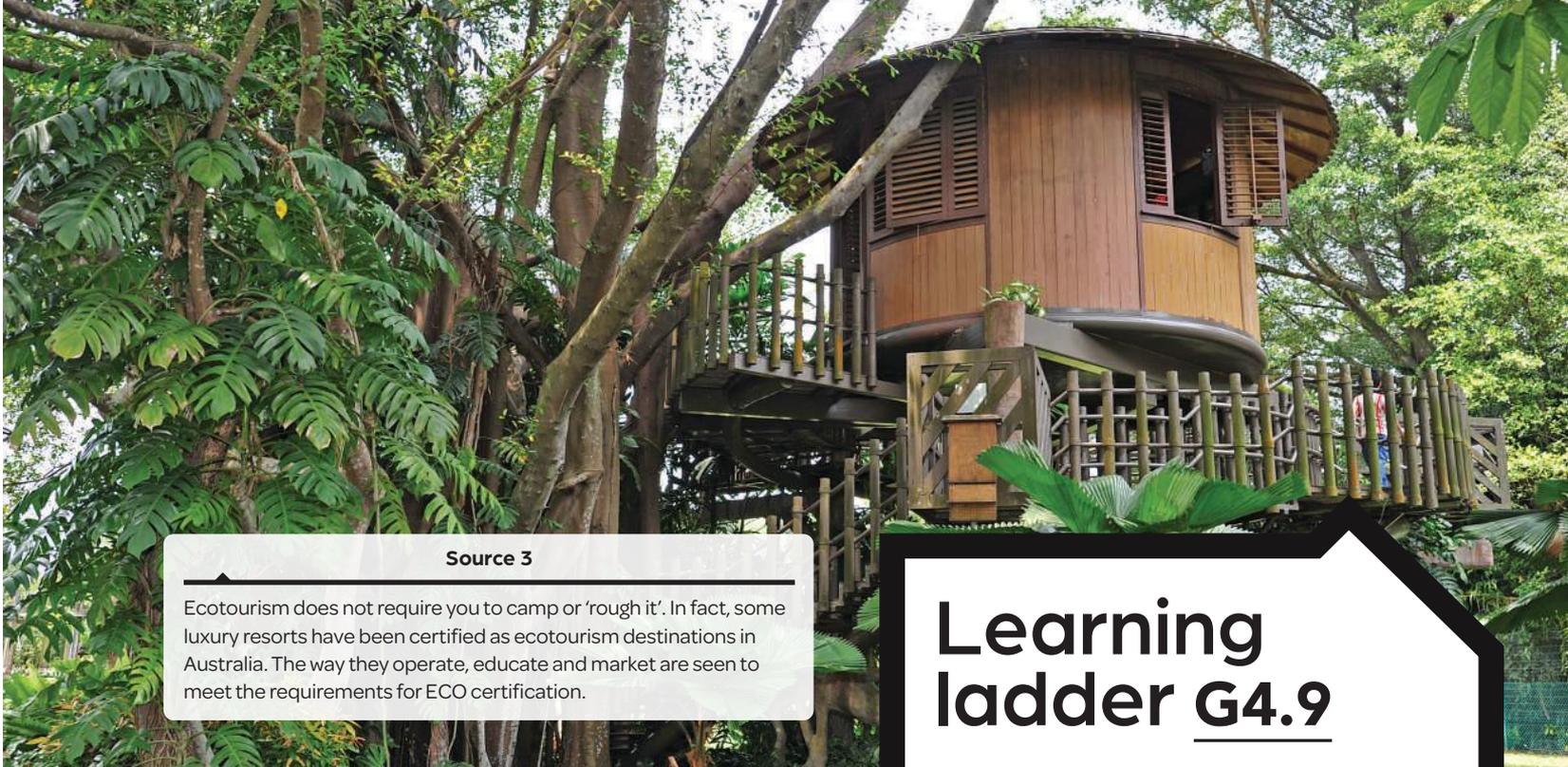
ECO-TOURS
The World's most environment-friendly holidays!

Surely the most environment-friendly holiday is staying at home.

GALAPAGOS GETAWAYS

RAINFOREST RAMBLES

CORAL CRUISES

FLIGHTS

ANTARCTIC ADVENTURES

CHRIS MADDEN

Ecotourism

The primary aim of **ecotourism** is to experience the natural world and learn how to protect, sustain and conserve the environment for future generations. In order to be considered an ecotourism destination, tours or resorts must meet the following criteria:

- protection of the environment through habitat, species and traditional culture conservation and the minimisation of waste
- presentation of information that educates tourists about local values, heritage and culture
- honesty in marketing, reporting of pollution, managing protected areas and supporting local Indigenous communities.

ECO certification in Australia

To become a certified ecotourism destination in Australia, tours, resorts and other operators need to apply through Ecotourism Australia, a non-profit organisation established to promote ecotourism in our region. The operator's application is reviewed to ensure it meets the above criteria.

As travellers become increasingly aware of how their carbon footprint contributes to our changing climate, demand for ecotourism destinations is increasing. By supporting ecotourism, tourists can travel, learn about different environments, minimise their local and regional impact and help local communities to be more sustainable.

Learning ladder G4.9

Show what you know

1   Outline the criteria that must be met for a location to promote itself as an ecotourism destination.

2   Explain how ecotourism is different to other forms of tourism.

3   Given the carbon emissions caused by travelling, exploring and staying in a new location, can tourism even truly be 'sustainable'?

Communicate data

Step 1: I can list primary and secondary methods useful for my study

4   Imagine you are assessing a new resort to determine whether it could claim to be an ecotourism destination. What primary data collection methods would you require to gain evidence on their eligibility?

Step 2: I can successfully use data collection methods

5   Select a popular travel destination and investigate how many criteria it meets for ecotourism. What simple things could it change to become more sustainable for travellers?

Step 3: I can filter collected data

6   Research ecotourism destinations in Australia. Critically investigate the activities offered at these places and discuss as a class whether they are true ecotourism destinations.

Step 4: I can organise data collected according to relevance for a research question

7   Choose one of the locations you investigated in question 6 that meets all the criteria. Create a sketch map of the location and annotate your map with examples of how it meets the criteria.

How has tourism changed Phillip Island?

Victoria's Phillip Island has long been a holiday destination for domestic and international tourists. The island is widely recognised for its beaches, natural landscapes and wildlife.

Phillip Island has been marketed as a natural tourist site since around 1840, when wealthy families would sail to the island from the mainland. These visitors introduced invasive species such as rabbits, pheasants and foxes in order to hunt them for sport.

In 1940, a bridge connecting Phillip Island to the mainland was built, which led to an ongoing influx of tourists. Currently, Phillip Island hosts more than 4 million visitors annually. Natural tourism attractions are highly developed, with advanced viewing platforms and an education centre.

Phillip Island has a small community of 7000 permanent residents. The local council has forecasted that the population will be stable over the next few years, and increase slowly from 2028 (Source 1). However, the island has four major supermarkets and many restaurants open year-round. This imbalance between the local population's needs and infrastructure for visitors is another example of how seasonal tourism can have a large impact on how a place changes over time.

Source 2

Overlooking the penguin reserve at Summerland Beach, Phillip Island, c. 1920–1954.

Phillip Island forecast population change

Number of persons

Forecast year (ending June 30)
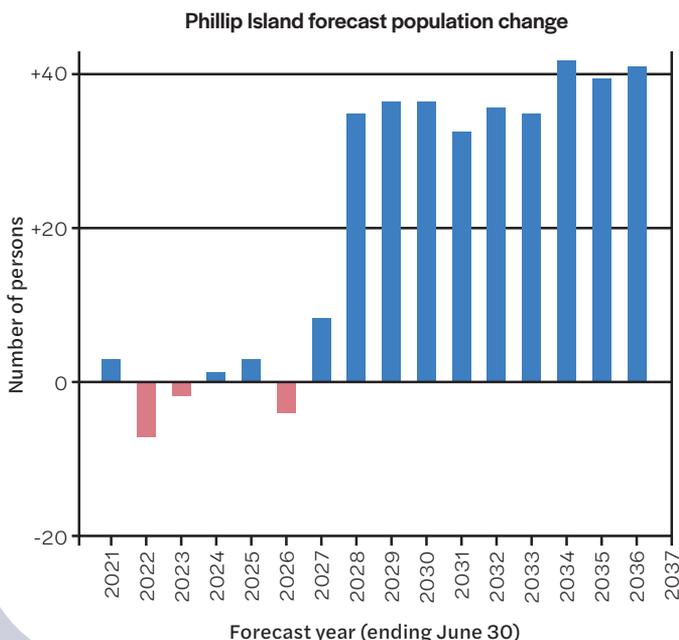
Source 1

Forecasted local population change on Phillip Island. From 2028, the local population is predicted to increase by 30–40 people per year, while visitor numbers will continue to boom.

Source: id, the population experts, November 2017

People wait for the penguin parade at Phillip Island in 2017. How is the infrastructure different to the image in Source 2?
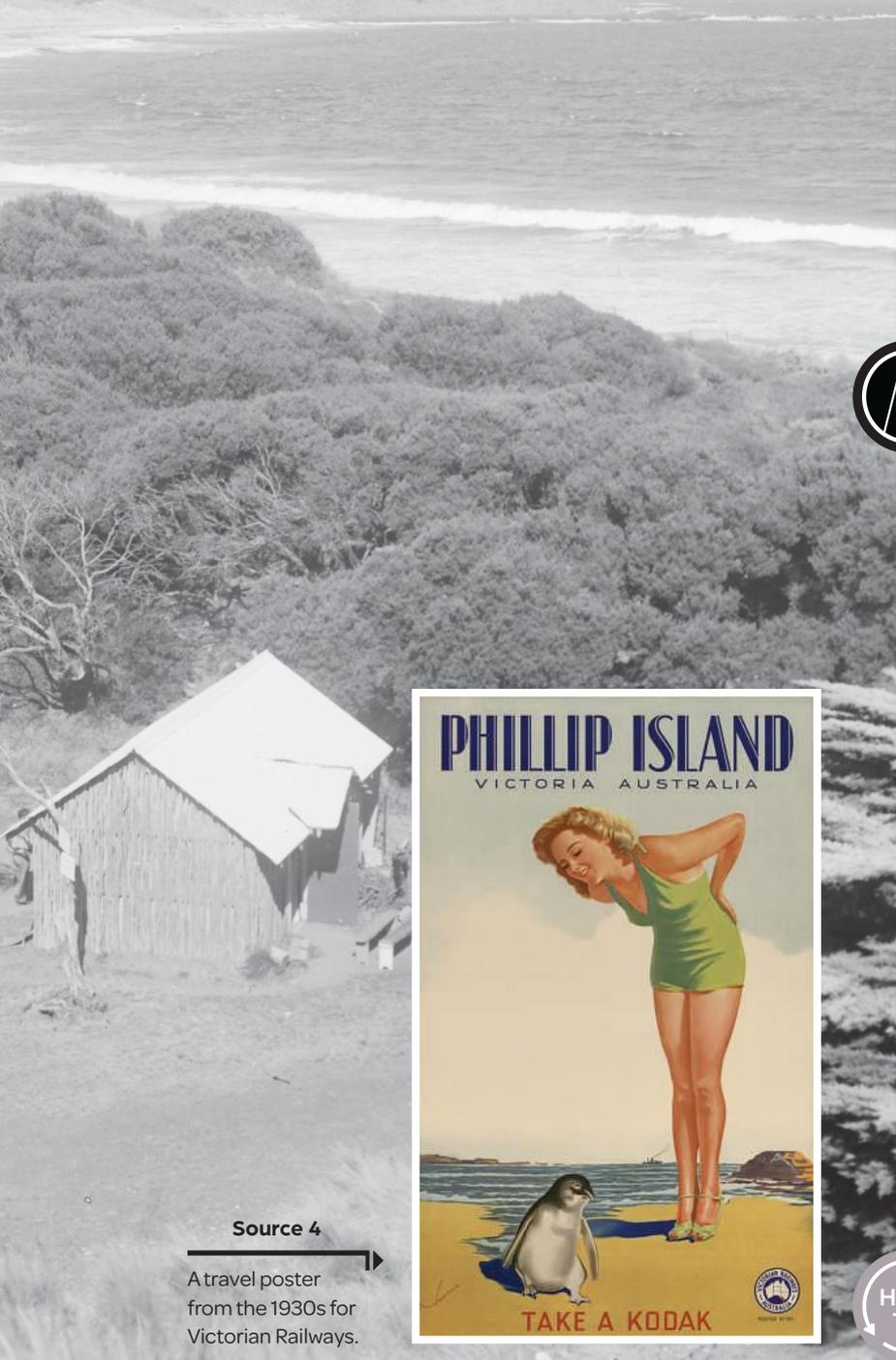
Source 4

A travel poster from the 1930s for Victorian Railways.

PHILLIP ISLAND
VICTORIA AUSTRALIA

TAKE A KODAK

Learning ladder G4.10

Show what you know

1   Use Google Earth to identify the relative and absolute locations of Phillip Island.

2   Create a timeline showing the changes over time in tourism and the infrastructure of the island.

3   Create a photo essay to illustrate the changes highlighted in question 2.

Digital and spatial technologies

Step 1: I can interpret different map types using cartographic conventions

4   Using Google Maps, outline the directions to travel by car from your school to Phillip Island.

Step 2: I can construct paper maps using correct cartographic conventions

5   During the summer months, the bridge to Phillip Island can be choked with traffic. Ferries and additional bridges have been suggested as ways to address this. Construct a sketch map to illustrate an idea you think could solve this problem.

Step 3: I can access and use spatial technology platforms such as GIS

6   Visit the Google Earth Engine website at http://mea.digital/GHV9_G4_3 and search for Phillip Island. Comment on how the island has changed over time since 1984.

Step 4: I can manipulate data using digital and spatial technologies

7   Search Phillip Island at http://mea.digital/GHV9_G4_3 again. This time, pause the the panel at the bottom of the screen to study different years. When do you think Phillip Island experienced the most change? Discuss with a partner why these changes may have occurred at this time.
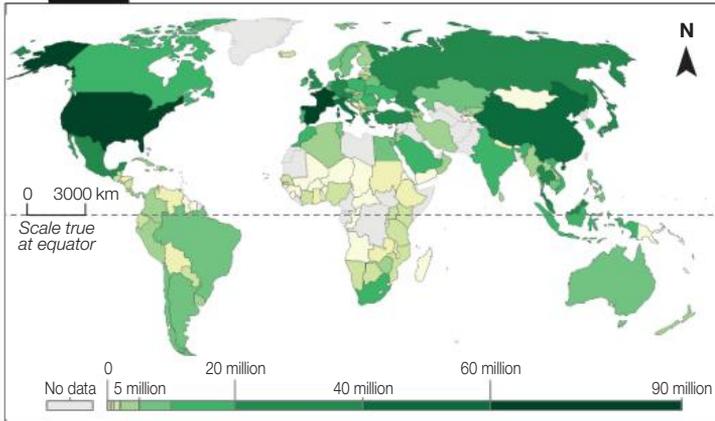
Masterclass

Learning ladder

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

International tourism: Number of arrivals, 2016

0   3000 km
Scale true at equator

No data | 5 million | 20 million | 40 million | 60 million | 90 million

Source: Our World in Data

Tourist visits globally, 2017

Tourists per year (2017)
- 0–5 000 000
- 5 000 000–15 000 000
- 15 000 000–25 000 000
- 25 000 000–35 000 000
- Over 35 000 000 (Top 10 countries)
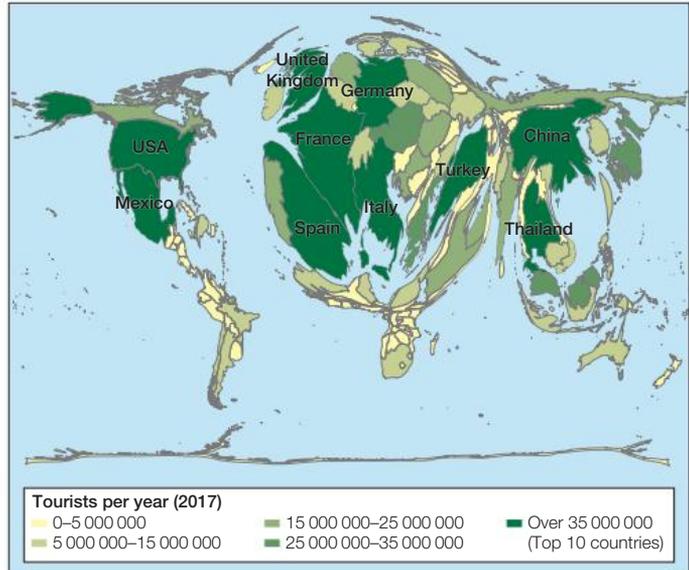
Source: Matilda Education Australia, UN World Tourism Organisation

Source 1

For this map, tourists are described as overnight visitors who travel to a country and whose main purpose in visiting is not commercial.

Source 2

This cartogram represents the most popular tourist destinations as the biggest countries on the map

Source 3

This map shows how patterns of migration are changing. Some areas have seen increased migration in recent years.

Traditional and emerging centres of migration growth, 2017

0   2500 km
Scale true at equator

- New centres of international migration growth.
- Sources of international and/or internal migrants.
- Traditional centres of international migration growth.
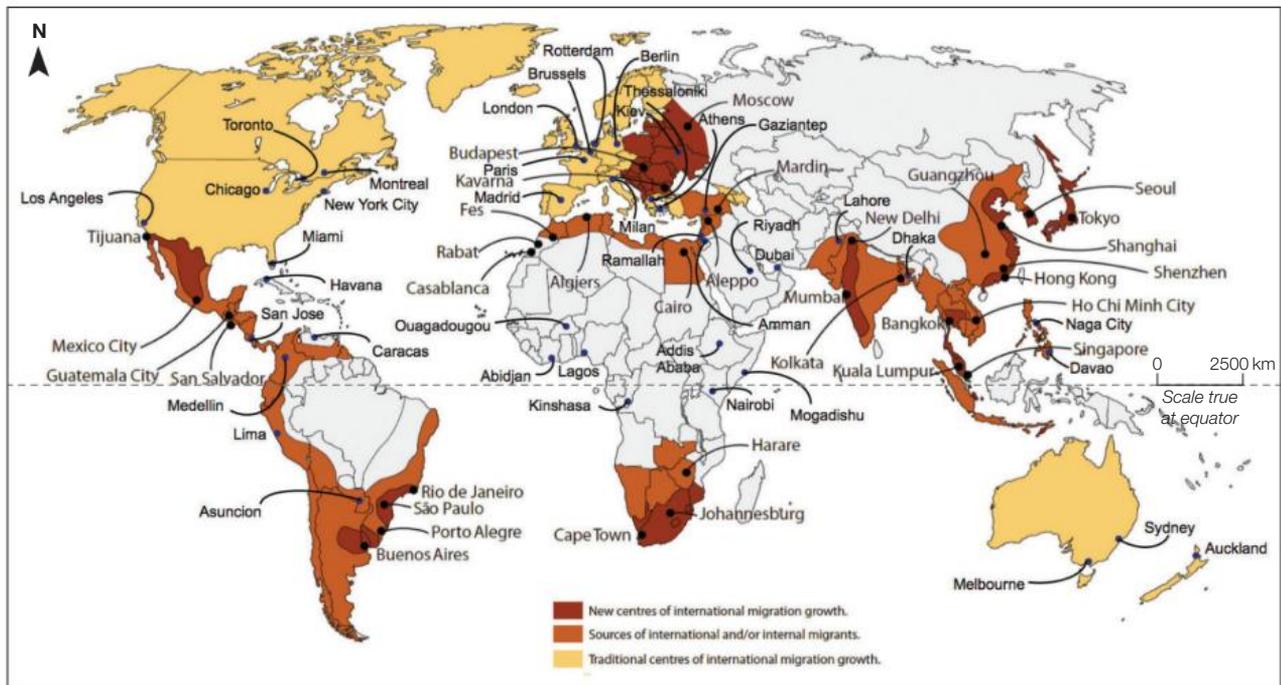
Source: World Economic Forum
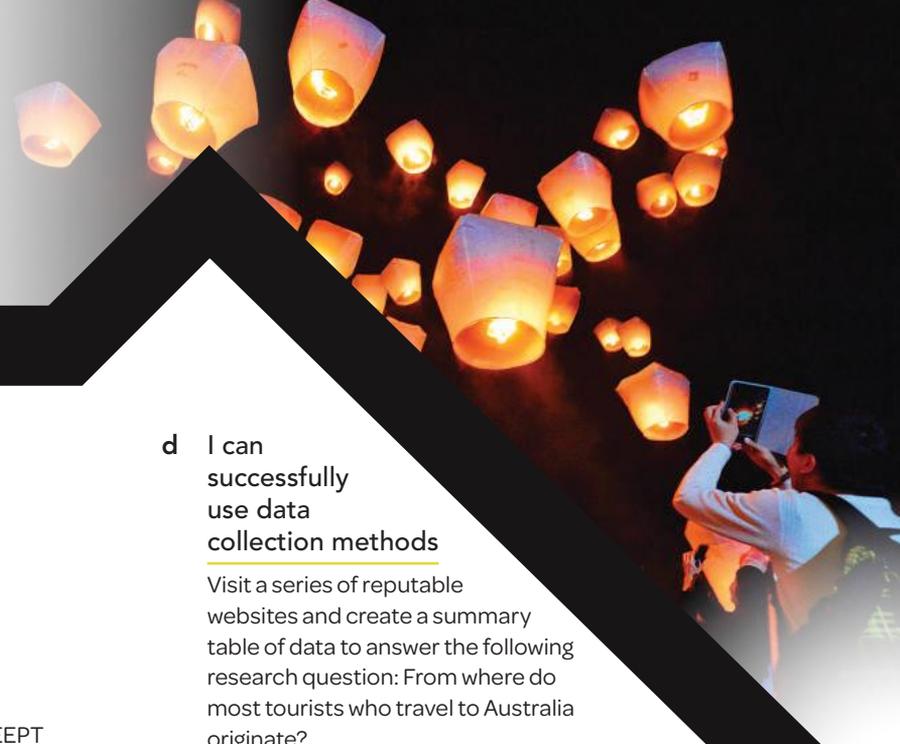
Step 1

a I can identify spatial distributions and patterns

Source 2: Identify three countries that have the highest number of foreign visitors.

b I can provide short explanations for patterns and interconnections

Explain why some countries attract more migrants than others. (Hint: consider the SHEEPT factors.)

c I can identify that changes occur in the characteristics of places over time

Consider the example of Phillip Island on pages 116–17. Outline the major changes that have occurred in this place over time as a result of tourism popularity.

d I can list primary and secondary methods useful for my study

Imagine you were carrying out a research project investigating how a local tourist site fits in with Butler's model (see pages 112–13). Create a list of primary and secondary methods that would help you collect relevant data for this study.

e I can interpret different map types using cartographic conventions

Interpret the key trends highlighted in Source 1.

Step 2

a I can use data to quantify spatial distributions and patterns

Source 2: Using data, rank the continents according to tourism popularity.

b I can explain patterns and interconnections

Using SHEEPT, explain the movement of people around the world in Source 3.

c I can describe how places have changed over time

Describe how commodification may influence change in tourism destinations.

d I can successfully use data collection methods

Visit a series of reputable websites and create a summary table of data to answer the following research question: From where do most tourists who travel to Australia originate?

e I can construct paper maps using correct cartographic conventions

Visit the National Geographic Migration Data Table at http://mea.digital/GHV9_G4_4. Create a map that shows the origin of migrants who move to Australia.

Step 3

a I can describe spatial distributions and patterns

Source 2: Using PQE, describe the distribution of tourism popularity on a global scale.

b I can use data to support explanations of patterns and interconnections

Using data, explain how mobile phones and PCs have changed in popularity over time.

c I can explain the causes behind the change over time in a place

Suggest how consumerism causes further segregation between LEDCs and MEDCs on a global scale.

d I can filter collected data

Create a photo essay using secondary sources that shows the impact of commodification on regional tourist destinations.

e I can access and use spatial technology platforms such as GIS

Visit the Cool Maps website at http://mea.digital/GHV9_G4_5. Comment on the distribution of shipping container traffic worldwide and how it has changed over time.

Masterclass

Step 4

a I can use data to support exceptions to spatial distributions and patterns

Source 3: Using data to support both your pattern and exception, describe global migration patterns.

b I can use relevant sources to research further reasons for patterns and interconnections

Using the internet, locate satellite images that represent change over time in a location near you. Discuss how these changes may have been caused by trade, migration or tourism in the area.

c I can make predictions and outline consequences of change over time

Predict how Phillip Island will continue to change in the future based on assumed increased resident and tourism numbers.

d I can organise data collected according to relevance for research question

Visit the World Bank Data website at http://mea.digital/GHV9_G4_7. Create a summary table showing countries that have experienced an increase in tourism and a decrease in tourism over time.

e I can manipulate data using digital and spatial technologies

Visit the GIS for Schools website at http://mea.digital/GHV9_G4_8. Using the layers in the 'content' tab, explore migration within Australia and discuss any major patterns or findings as a class.

Step 5

a I can identify multiple spatial distributions and patterns

Conduct a PQE on Sources 2 and 3. Comment on the interconnection between tourism popularity and the countries that people choose to migrate to.

b I can interpret causes of patterns and interconnections

Refer to Sources 1 and 2. Discuss the data presented in both maps and how the representations interconnect.

c I can interpret data to quantify predictions based on research

Using research, predict how future population growth may positively and negatively impact people and places. Consider tourism, migration, consumerism and need for resources.

d I can evaluate the success of research methods

Visit the Cool Maps website at http://mea.digital/GHV9_G4_6 again. Evaluate the success of this map as a resource showing how trade creates interconnections between people and places.

e I can draw conclusions from geographical information in digital and spatial technologies

Visit the Cool Maps website at http://mea.digital/GHV9_G4_9. 'Global migration is evenly distributed on a global scale over time.' Discuss with reference to the source provided.

Capstone

How can I understand choices and changes?

In this chapter, you have learnt a lot about choices and changes. 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.

mea.digital/GHV9_G4

Scan this QR code to find the capstone project online.

Fieldwork

HOW DO I CREATE AND ANSWER A RESEARCH QUESTION?

How do I create and answer a research question?

Fieldwork is an important part of Geography. It is how we discover new things, learn about patterns and relationships and explore the world around us. In the previous Geography chapters, you explored biomes, food security and interconnections between people and places. Now you will conduct your own research within your local area to answer a research question and write a fieldwork report.

Creating a research question

A **research question** is an overarching idea you want to investigate. Once you develop a research question you will need to write a hypothesis. A **hypothesis** is an 'educated guess' about what the answer to the research question might be. In this chapter, you will be guided to create your own research question and hypothesis and then design fieldwork to answer your research question.
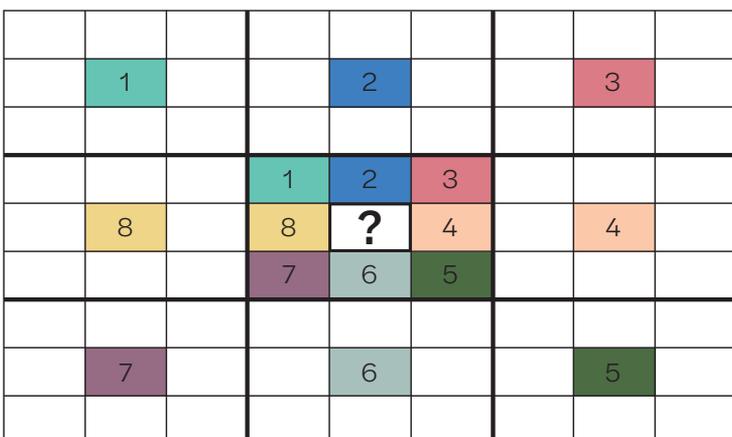
Choosing a fieldwork location

Choosing the right location to conduct fieldwork is very important. The place you choose will depend on your topic, research question and hypothesis. Make sure you confirm the location of your fieldwork before you begin to conduct research and collect data.

Pre–fieldwork research

Before you start your fieldwork, do some background research so that you understand the field site, its characteristics and other relevant information.

Researching via the web is the most obvious and accessible source of information; however, you should only use reliable websites. Government, educational and other approved sites are most useful and contain data that is reliable. Blogs, social media and other public-based sites may be **biased** and misleading. Books, handouts and other paper resources are also useful when conducting research.

Source 1

A lotus diagram is a tool to help you develop key ideas and themes regarding a research question. To use the diagram:

1 Write your research question into the central rectangle.

2 Come up with eight related ideas you wish to investigate. These ideas might include the SHEEPT factors for your chosen location (see page 138). Write each idea in the boxes marked 1–8.

3 Conduct some research for each idea, and fill out the remaining squares with relevant notes.

Method	Primary or secondary?	Description	This data will help me answer my research question because …	How will I gather the data?
Photos	Primary	I will take five photos of infrastructure, natural environments and recent developments in the field site using a digital camera.	Taking photos provides a visual representation of the human and natural environments present at the research site.	Using a digital camera, which can then be uploaded to my report

Collecting data

Conducting fieldwork involves collecting data. There are two main kinds of data: **quantitative** and **qualitative**. Quantitative data tends to be recorded in numbers. The number of people in a population and the flow rate of a river are examples of quantitative data. Qualitative data tends to be more observational: descriptions of a place, field sketches and photos all provide qualitative evidence to answer your research question. Both aspects of data collection are important. Collect both quantitative and qualitative data in your fieldwork.

Primary and secondary methods of data collection

As a class, you need to develop a list of **primary** and **secondary methods** of data collection. Primary methods are tasks that you will do in the field to find data to answer your research question, and prove or disprove your hypothesis. Secondary methods are ways you can collect data back in the classroom to help you answer the questions, such as research using websites, books or other publications.

Record your research methods clearly and consistently so that you can repeat them.

Some examples of primary methodologies:

- observations
- photographs
- note taking
- surveys (questionnaire or observational)
- field sketches
- mapping.

Using the table in Source 2 as a template, discuss and record some primary and secondary methods that may help you answer your research question.

Note taking is an important part of fieldwork.
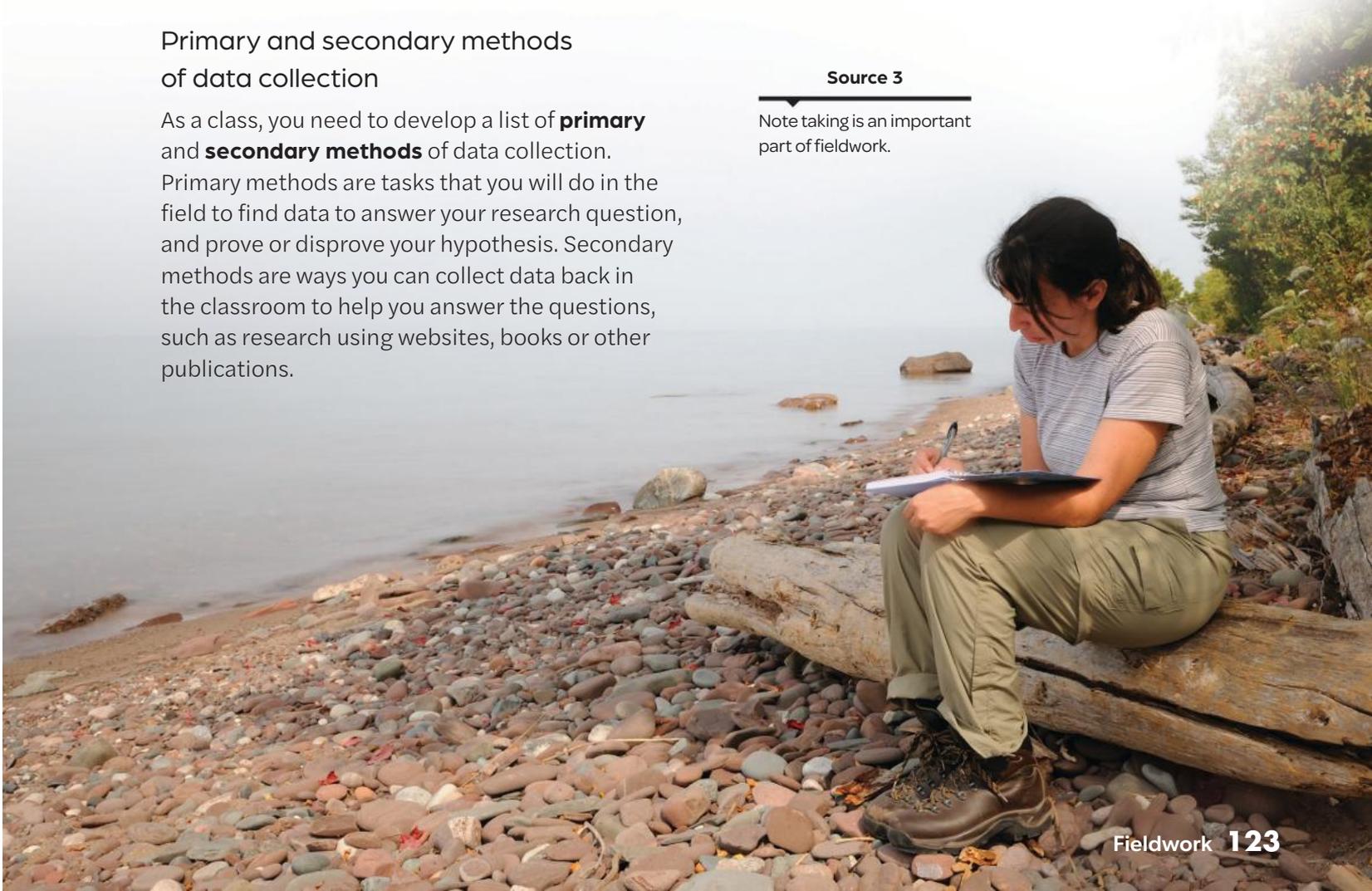
Preparation for fieldwork

Before you go out in the field, create a checklist of items you need to bring and data you need to collect. For example:

- clipboard
- paper (blank and lined)
- pencils
- camera
- number of cars that pass through an intersection in 30 minutes
- survey questions.

Source 4

Share your research data with classmates to assemble a larger and more useful bank of information.

Communicating your findings

Once you have collected data in the field using primary and secondary methods, you need to communicate your findings. You could communicate your research via a report or display it as a poster or presentation. You can also present your photos and sketches in a slideshow presentation, or as a hardcopy folio of evidence.

When you communicate findings, ensure that you highlight any patterns, interconnections or significant data that answers the research question and proves or disproves the hypothesis. Presenting data clearly is vital so that your reader can understand your analysis and conclusions.

Writing research reports

To prepare for your future studies, begin practising communicating fieldwork results and analysis as a formal report. Using subheadings, referencing and acknowledging sources are important aspects of formal reports because they show the depth of your research and understanding, and give your reader a clear structure to follow.

Your subheadings might be:
- Introduction (background research, question and hypothesis)
- Primary methods
- Secondary methods
- Presentation of data
- Data analysis
- Conclusions
- Evaluation
- References (bibliography).

Evaluating the success of your methods

Before you go out in the field, you need to decide on the methods you are going to use. Unfortunately, sometimes the methods selected are not successful, and need to be improved before they can help collect more valuable data. The evaluation section of your report requires critical reflection on your use of data collection methods. You do not need to reflect on your time management or how much you enjoyed the trip. Your evaluation should focus on the following questions.
- What was the most successful primary method and why?
- What was the least effective primary method and why?
- What was the most successful secondary method and why?
- What was the least effective secondary method and why?
- If you were to repeat this study, what would you do differently next time?

Stage 2
Plan of investigation (schedule)

Stage 3
Gathering and processing data

Stage 1
Topics, aims and hypotheses

Stage 4
Presentation and evaluation of findings

Source 5

You need to be organised when planning a fieldtrip and writing your report.

How can we explore biomes virtually?

Background to fieldwork approach

Biomes vary on a number of scales. Because they are so diverse, the way we use them to produce resources, such as food, also varies. Dry, desert-like areas produce less than regions that receive high levels of rainfall and sunlight. Studying biomes can help us understand our world better.

Our choice of fieldwork location is usually limited to accessible places near school. However, we can use virtual fieldwork as a viable alternative to investigate research questions. In this section, you will conduct a virtual fieldwork inquiry using Google Earth to answer a research question you design as a class.

Research question

The research question you create needs to be focused on how the world's biomes have changed over time because of human actions. As a class, brainstorm these terms and craft a question that you will be able to answer via virtual fieldwork. Some questions you may consider:

- How have humans changed Earth over time?
- How do human actions affect our food security?
- How does increasing human population lead to loss of agricultural land?
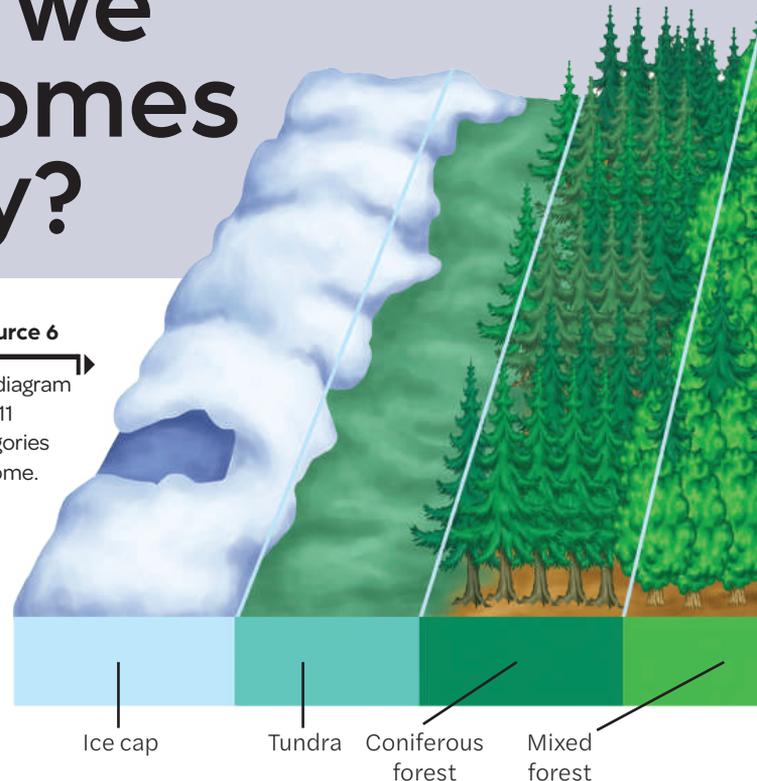
Once you have a question, you need to create a hypothesis. You may all have a slightly different hypotheses, but that will create a more interesting analysis.

Pre–fieldwork research

Once you have decided on a research question, you are ready to complete some pre-fieldwork research. Explore the internet, books and other resources for information about key concepts or processes that readers must know in order to understand your report.

Source 6

This diagram uses 11 categories of biome.

Ice cap   Tundra   Coniferous forest   Mixed forest

Introduction and method

1. State your research question and hypothesis.
2. Provide some background information so that readers will understand all key terms and concepts in your report.
3. State two primary fieldwork techniques you used to complete this fieldwork and describe how they were helpful in answering the research question.
4. State two secondary resources you used to prepare for your fieldwork and describe how they were helpful in answering the research question.

Collecting your data

As this is a virtual fieldtrip, you need to decide as a class which area of the world you will focus on. You might instead choose to break into research groups and look at different parts of the world.

These weblinks may help when exploring your chosen question.

- Visit the Google Earth Engine website at http://mea.digital/GHV9_G5_1.

Deciduous forest   Temperate grassland   Chaparral (shrubland)   Desert scrub   Desert   Tropical grassland   Broadleaf evergreen forest
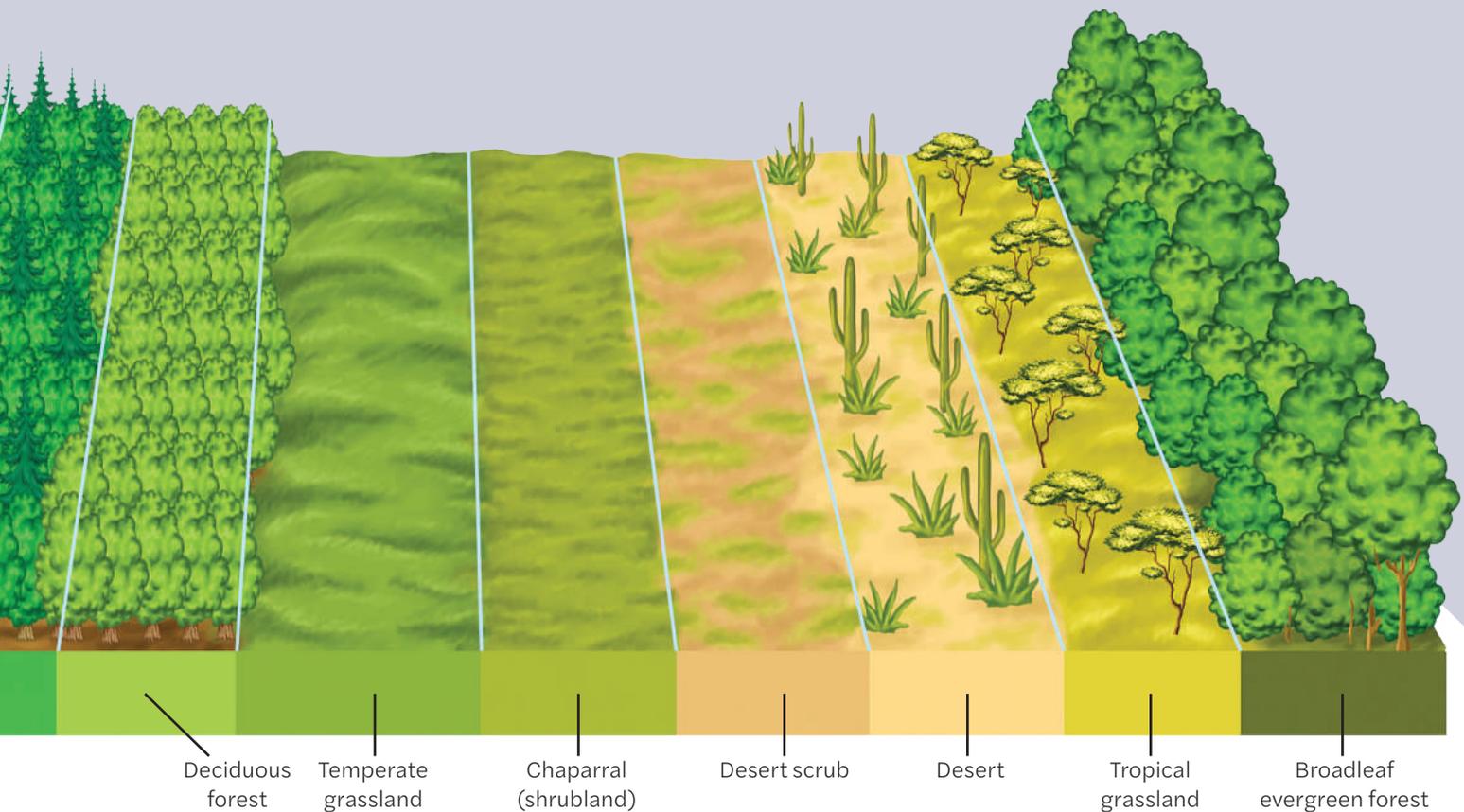
- Read an article about time lapse data at http://mea.digital/GHV9_G5_2.
- Go on a virtual nature tour from Google Earth at http://mea.digital/GHV9_G5_3.
- Visit the Biome viewer website at http://mea.digital/GHV9_G5_4.
- Discover world human population change over time at the World Population History website at http://mea.digital/GHV9_G5_5.

Presenting your data

Present the data you collected using tables, graphs, annotated sketches and photographs.

Analysing your data and drawing conclusions

Using the data you collected while on your virtual fieldtrip, consider how this information helps you to answer the research question. Does it support your hypothesis? Or are you beginning to change your mind? Complete the following tasks.

1. Summarise the key findings of your research.
2. Was your hypothesis correct (supported)? Why/why not?
3. Record five key pieces of evidence (data, photos, sketches or surveys) that prove or disprove your hypothesis.
4. Which methods were the most successful for collecting data to answer the research question? Why?
5. Which methods were the least successful for collecting data to answer the research question? Why?
6. What changes to your fieldwork approach would you suggest to future Year 9 students completing the same task?

Handing in your report

Once you have completed all the steps of your fieldwork report, you are ready to collate your work into a folio and submit it to your teacher.

How can we explore our interconnection with *place*?

Background to fieldwork approach

Exploring interconnections between people and places has been a major theme throughout the Geography chapters of this textbook. People can be physically connected to places through transport networks. They can also be connected to places virtually through technology. This is particularly important for rural communities who may otherwise not have access to the same services and resources as people who live in urban areas.

In this fieldwork project, you will investigate how people are connected both physically and virtually to your local place. You will explore other people's sense of place and create a summary of the services that attract people to the region.

Research question

You may choose to create your own research question for this investigation or use one of the suggestions below. Either way, your question should encompass place, people and interconnection. As a class, brainstorm these terms and formulate a question that you will be able to answer through doing fieldwork in your local area. Some questions you may consider:

- What facilities or services in your local area increase the community's sense of place?
- How does sense of place differ between people within your local community?
- How does virtual connection to place play a role in your local community?
- Is virtual or physical connection to place more important in your community?

Once you have decided on a question, you need to create a hypothesis. You may all have slightly different hypotheses, but that will create a more interesting analysis.

Pre–fieldwork research

Once you have decided on a research question you are ready to complete some pre-fieldwork research. Explore the internet, books and other resources for information about key concepts or processes that the reader will need to know in order to understand your report.

Introduction and method

1. State your research question and hypothesis.
2. Provide some background information so the reader will understand all key terms and concepts used in your report.
3. State two primary fieldwork techniques used to complete this fieldwork and describe how they helped to answer the research question.
4. State two secondary resources you used to prepare for your fieldwork and describe how they were helpful in answering the research question.

Collecting your data

The best way to collect data on people's opinions is through surveys. As a class, design a survey that asks locals about their sense of place, the services they feel connected to and the facilities they think are required to increase the sense of connection to their local area.

Once you have created the surveys, go into the community and gather data. If you all do a couple of surveys each and collate the class data, your sample size will be larger and your results will be more reliable. Remember, your class is your research group. Work together to share photos, survey results, data and other secondary sources.

Presenting your data

Present the data you collected using tables, graphs, annotated sketches and photographs.

Community gardens, such as this one in central Melbourne, are a great source of connection.

Source 8

Technology can both connect and divide us

Analysing your data and drawing conclusions

Using the data you collected while on your fieldtrip, analyse how this information helps you to answer the research question. Does it support your hypothesis? Or are you beginning to change your mind? Complete the following tasks.

1 Summarise the key findings of your research.

2 Was your hypothesis correct (supported)? Why/why not?

3 Record five key pieces of evidence (either data, photos, sketches or surveys) that prove or disprove your hypothesis.

4 Which methods were the most successful for collecting data to answer the research question? Why?

5 Which methods were the least successful for collecting data to answer the research question? Why?

6 What changes to your fieldwork approach would you suggest to future Year 9 students completing the same task?

Handing in your report

Once you have completed all the steps of your fieldwork report, you are ready to collate your work into a folio and submit it to your teacher.

How do I write a fieldwork introduction?

Where do you start when writing a fieldwork report? Your introduction provides a background on what you are investigating and why it is important. In other words, it provides context for your research.

- When writing an introduction, start with your broadest ideas, and finish with your research question and hypothesis. Your opening lines may need to define some key terms or provide background information about your research topic.
- A formal fieldwork report does not use pronouns such as 'me' or 'I'.

- Cite research to show where you sourced information and to demonstrate you have used reliable sources.

  Use the SPICESS concepts as prompts to help you explore your research question and create a detailed introduction. These are annotated on the sample shown.

Example research question: *What influences young people's sense of place in my region?*

Example hypothesis:
Sense of place for young people is developed through local community engagement.

In our constantly changing world, it is more important than ever to feel engaged and that we belong. Individuals develop a 'sense of place' by forming emotional or spiritual connections to their local area. Each person may have a different opinion about, or attachment to a place. These perceptions develop over time and depend on factors such as family history and economic status and are influenced by tolerance to negative factors such as traffic or noise. People can develop a 'sense of place' through involvement with community, such as with sporting teams or other local groups, and through sharing common interests.

Officer is a small suburb located in southeast Victoria (38.0611° S, 145.4151° E), 48km from the CBD (Google Maps, 2020). Officer is part of the southeast growth corridor and has a rapidly growing population reaching just over 7000 residents (ABS, 2016). Before urbanisation, Officer was a small rural town, characterised by open farmland, low-density housing and small-scale industry. As the demand for residential spaces close to the CBD increased, Officer began to expand with a range of high-density housing estates and residential streets now dominating the landscape.

Because of its rapid population growth, Officer township and other necessary infrastructure are yet to be constructed and so locals need to travel to surrounding townships for resources. Given the ongoing changes, it may be difficult for new or existing locals to develop a sense of community and place. In particular, it is important to understand the needs of the youth in this growing community in order to provide appropriate groups and other resources to help create a sense of belonging for young people. Therefore, the question was asked, 'What influences young people's sense of place in my region?' and it was hypothesised that young people could develop a sense of place through access to more local groups for community engagement.

Interconnection and change: How does this place connect to surrounding regions? How has this place changed over time? Why is this a good place to conduct your research?

Environment and sustainability: Describe the human and natural characteristics of this place. Are there any other environmental factors your reader needs to understand?

Space and place: Describe the location you are using for your study. What is the absolute and relative location? Why is this a good place to conduct your research?

Scale: Think about the scale of your research. In what areas will you be collecting data and for how long? How big is the space you are collecting data in? Why is this a good place to conduct your research?

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 9 and provide examples of how to use them.

Mapping with BOLTSS (NA)

Every map requires **BOLTSS** in order to be understood by the geographic audience, and some people add (NA) to the acronym to remind them to be neat and accurate. When you construct maps, use BOLTSS like a checklist to ensure you complete your mapping tasks correctly.

B Border

A border is important to show the edges of the mapping field. It provides a clear area inside which to construct your map and makes it appear clear and neat to readers.

O Orientation

An orientation, or compass, helps us understand direction when reading the map. Orientations can be drawn as a 4-point, 8-point or 16-point compass.
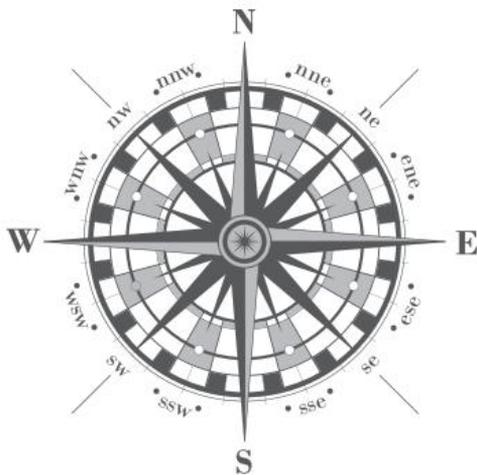
Source 1

A 16-point compass

Map of central Portland, Victoria

Search...   Go

Featured Sights
Parks and Activities
Shopping
Essential Services
Directions

Source 2

This map features all aspects of BOLTSS
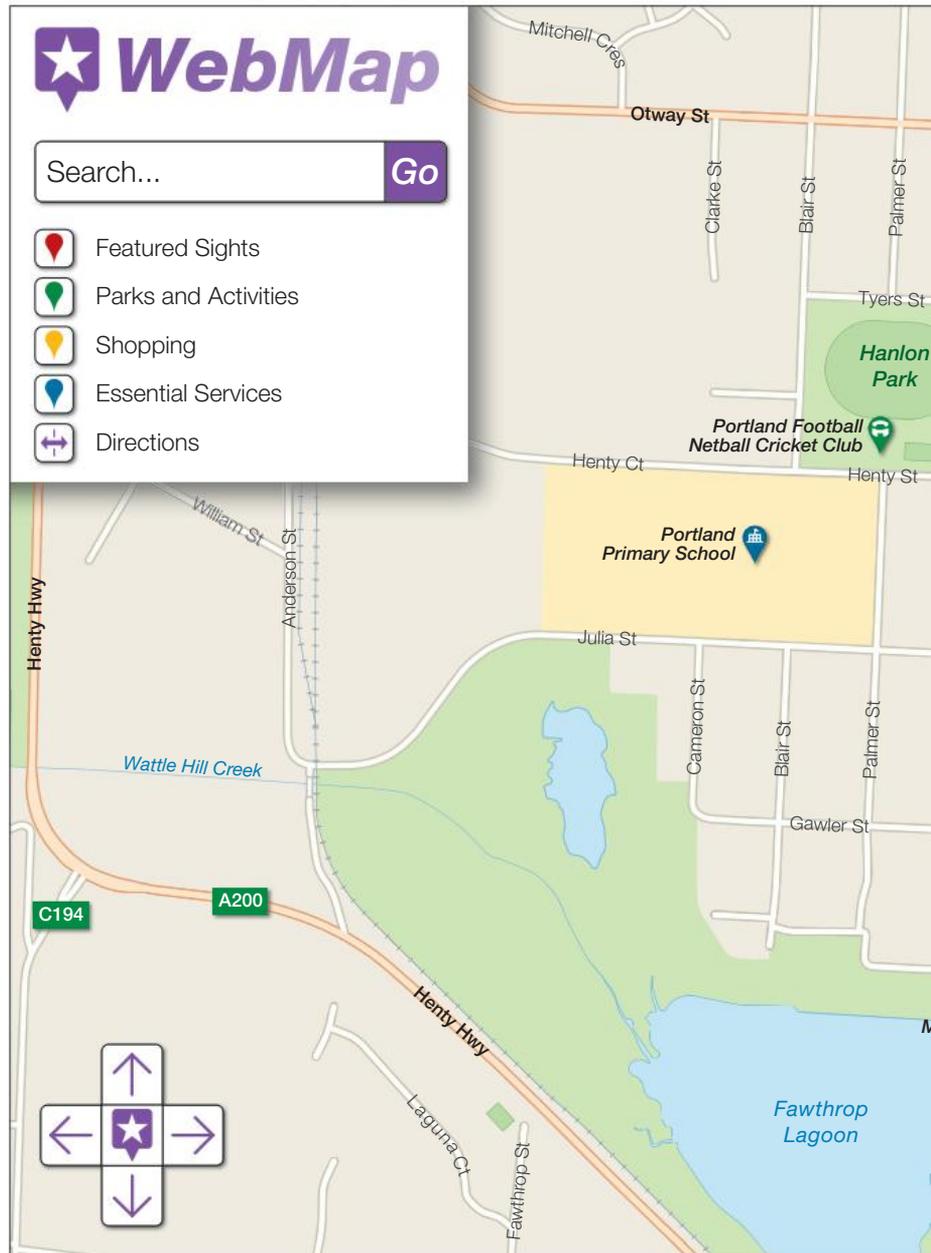
Source: Matilda Education Australia, Open Street Maps

Legend (Source 3)

HIGHWAY	
MAJOR ROAD	
SECONDARY ROAD	
RIVER	
PROPOSED ROAD	
BRIDGE	

HOUSING WITH NUMBER BESIDE ROAD

1   20
21   25   26

LIGHT RAIL & STATION
TRAIN RAIL & STATION
STATE BOUNDARY — ×××— ×××—
CITY BOUNDARY

PETROL STATION
RESTING AREA
SCHOOL
POLICE STATION
BUS STATION

LIGHT RAIL STATION
TRAIN STATION
AIRPORT
SEAPORT
FIRE STATION

LIBRARY
POST OFFICE
PLACE OF INTEREST
INFORMATION KIOSK
HOSPITAL

Source 3
A sample legend

L Legend

A legend, or key, is vital to understanding the map. Without a legend, colours and symbols would not make sense and we would not be able to interpret patterns or distributions.

T Title

A title gives us an understanding of what the map is showing. If you are drawing a sketch map, you should also provide a date and time. This allows you to monitor change in a location over time.

S Scale

A scale provides us with information on how big something is in real life. While a house on a map may be 2 centimetres across, it may be representing a 15-metre wide three-bedroom home. Scales can come in many forms: linear, ratio or fraction.

0   10   20 km

$$\frac{1}{1\,000\,000}$$

1:1 000 000

Source 4
Map scales: linear, fraction and ratio
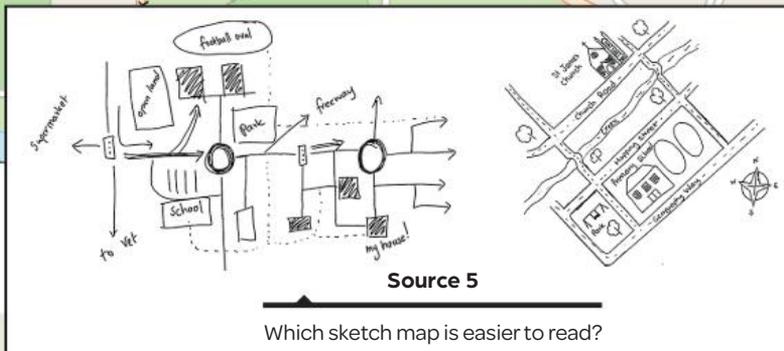
S Source

Always acknowledge the source of the information that you illustrate on your map. The source can also indicate whether the map is reputable or not.

(NA) Neatness and Accuracy

Some people add the final letters 'NA'. When we read a map, we rely on it being neat and legible and we expect that its data is displayed accurately. Therefore, when you construct a map it is important that you take the time to correctly illustrate the patterns and distributions you see in the data.

Map labels

0.25 km

N

Portland District Hospital
Otway St
Otway Ct
Percy St
Bentinck St
Hurd St
Nuns Beach
Portland CFA
Market Ct
St Johns Lutheran Church
Portland Presbyterian Church
Tyers St
Lee Breakwater
Supermarket
All Saints Catholic Church
Portland Maritime Discovery Centre
PORTLAND BAY
Henty St
Richmond St
Maritime Discovery Centre
Portland Uniting Church
Bank
Portland
St Stephen's Anglican Church
Julia St
Percy St
Bentinck St
Lee Breakwater Rd
Portland Yacht Club
Supermarket
Gawler St
Gawler St
Cliff St
Charles St
Portland Police Station
Powerhouse Motor Car Museum
Glenelg St
Glenelg St
Portland Leisure & Aquatic Centre
Botanical Gardens
Barton Pl
R B Anderson Rd
Powerhouse Museum
Hurd St

Source 5
Which sketch map is easier to read?

Mapping skills

Source 6

A compass

Northern hemisphere

Equator

Southern hemisphere

Source 7

Earth

Direction

In day–to–day life, we tend to use directions such as 'left' and 'right', 'above' or 'below'. While these words are helpful, in Geography we also need to use compass points: north, south, east and west.

Consider the world globe in Source 7. Around the centre there is a line of latitude called the **equator**. North of the equator is the **northern hemisphere**, which includes the continents of North America and Europe. South of the equator is the **southern hemisphere**; this is where we live!

It's a common mistake to use the word 'above' instead of 'north' or 'below' instead of 'south'. If you say something is 'above' the equator, you are actually saying it is floating in the air over the top of it! If you say something is 'below' the equator, you are describing something buried beneath it! Use directional terms carefully to ensure you are sending people in the right direction.

Latitude and longitude

How do you identify where you live? Most people have a street address that gives the exact location of their house. However, how do we identify the location of a place that doesn't have an address? Geographers use grid references and latitude and longitude to help identify these locations.

Source 8

A world map with lines of latitude and longitude shown
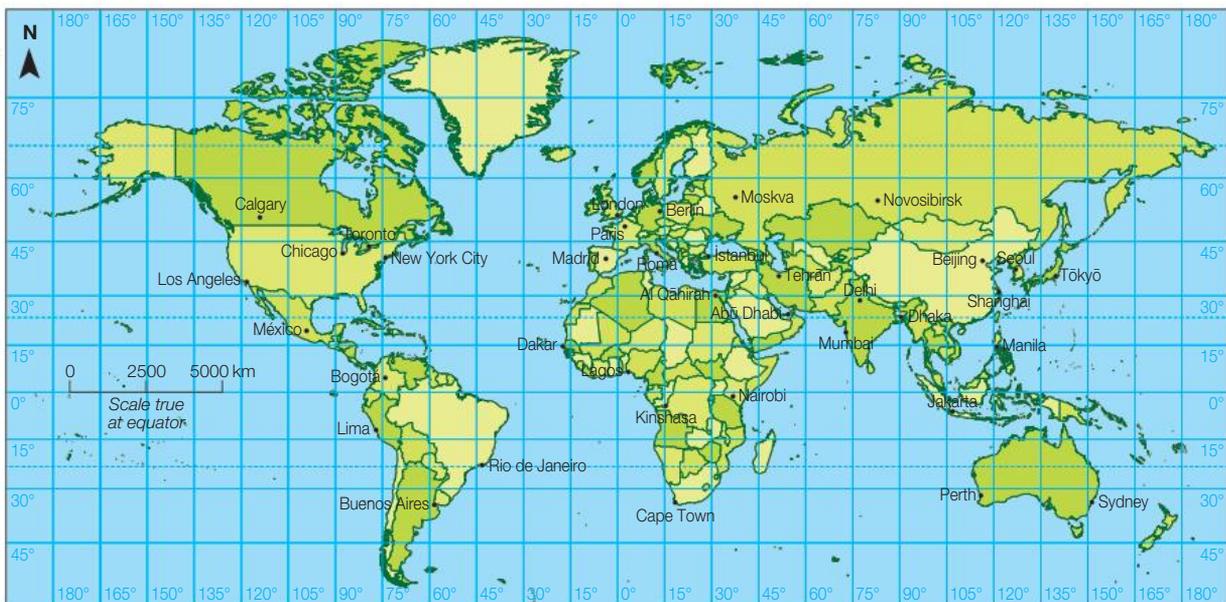
Latitudinal lines are shown running around Earth like a series of belts. We use the equator as a reference point, so it represents 0° **latitude**. Lines north of the equator are numbered 1, 2, 3 etc. degrees north (°N), all the way to 90°N at the North Pole. Lines south of the equator are 1, 2, 3 etc. degrees south (°S), all the way to 90°S at the South Pole.

Longitudinal lines are like jail bars wrapping around the globe from east to west. These lines are measured starting from the prime meridian (the line that passes through Greenwich, in the UK), which is 0° **longitude**. Lines of longitude east of the prime meridian are 1, 2, 3 etc. degrees east (°E) and lines of longitude west of the prime meridian are 1, 2, 3 etc. degrees west (°W). On the map in Source 8, Lima can be described as having an absolute location of 12°S and 77°W, as it is south of the equator near the 15° line of latitude and just over 75° west of the prime meridian.

Scale

Look at Source 7 again. Logically, we know that this image of Earth is not to scale. In reality, Earth is over 12 700 km in diameter!

Scale is important in Geography as it allows us to shrink maps and other images down to a size where we can see patterns, distributions and changes. 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 also be used to describe changes that occur over time. A 'large-scale change' indicates that something has caused major alterations to a region. A 'small-scale change' indicates that little has been altered. Review the images in Source 10. What is the scale of the city's change?

Source 9

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.

Source 10

Change over time to Las Vegas, 1967 to 2014

1967

2014

PQE

In Geography we use maps and graphs to understand what is happening around us. In many cases, these resources provide us with information on patterns and spatial distributions of phenomena.

The formula **PQE** helps us describe these patterns and distributions. **P** stands for pattern, **Q** stands for quantify and **E** stands for exception.

P Pattern

A pattern is a trend in the data. When looking for a pattern, read the legend and interpret what the colours or symbols mean. On a graph or map, you may notice that all the data points tend to be clustered in one spot or that there is an uneven distribution of data points. You may need to use the names of places or even your compass points to describe where these clusters appear on the map. For example, when observing Source 11 to the right, we notice that people in countries in the northern hemisphere tend to consume more eggs than those in the southern hemisphere.

Descriptive words that may help you describe patterns are: *clustered, even, uneven, highly distributed, north, south, east, west, increase, decrease* and *fluctuate.*

Q Quantify

When we quantify our pattern, we use numerical data to provide evidence of what we see. You can gather data by using the legend, measuring with the scale or doing a count. Ensure your data relates directly to the pattern you recorded earlier. For example, we noticed that people from countries in the northern hemisphere tend to consume more eggs than those in the southern hemisphere. To quantify, use the legend on the map. It shows that many countries in the northern hemisphere consume more than 12 kilograms of eggs per person per year, while in most southern hemisphere countries people consume less than 10 kilograms per person, per year.

E Exception

An exception is a trend on the map or graph that doesn't 'fit in' with our original pattern statement. When we observe an exception, it is also good to quantify it to provide a comparison to our original statement. For example, we noticed in Source 11 that people in countries in the northern hemisphere tend to consume more eggs than those in the southern hemisphere. However, people in Argentina, which is in the southern hemisphere, still consume quite a lot of eggs: more than 16 kilograms of eggs per person per year.

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; we do this in a SHEEPT analysis (pages 138–39). To **quantify** means to use percentages, counts, ratios or data to provide details about the patterns you are describing. To **qualify** a statement means to use general describing words such as 'large', 'many', 'broad' or 'small' to describe a pattern or change.

By using quantifiable data, we can more easily see key differences between locations or monitor change over time. If your PQE analysis states: 'Egg consumption varies worldwide', does this describe things clearly? Or does this quantified statement provide more detail: 'In the southern hemisphere, 29 out of 32 countries consume less than 10 kilograms of eggs per person, per year.'?

How do I start my PQE sentences?

When writing a PQE analysis, start sentences with the following key terms:

Pattern:
Overall …

For example:

Overall, countries in the northern hemisphere tend to consume more eggs than those in the southern hemisphere.

Quantify:
To quantify …

For example:

To quantify, according to the legend, people in 29 out of 32 countries of the southern hemisphere consume less than 10 kilograms of eggs per person, per year.
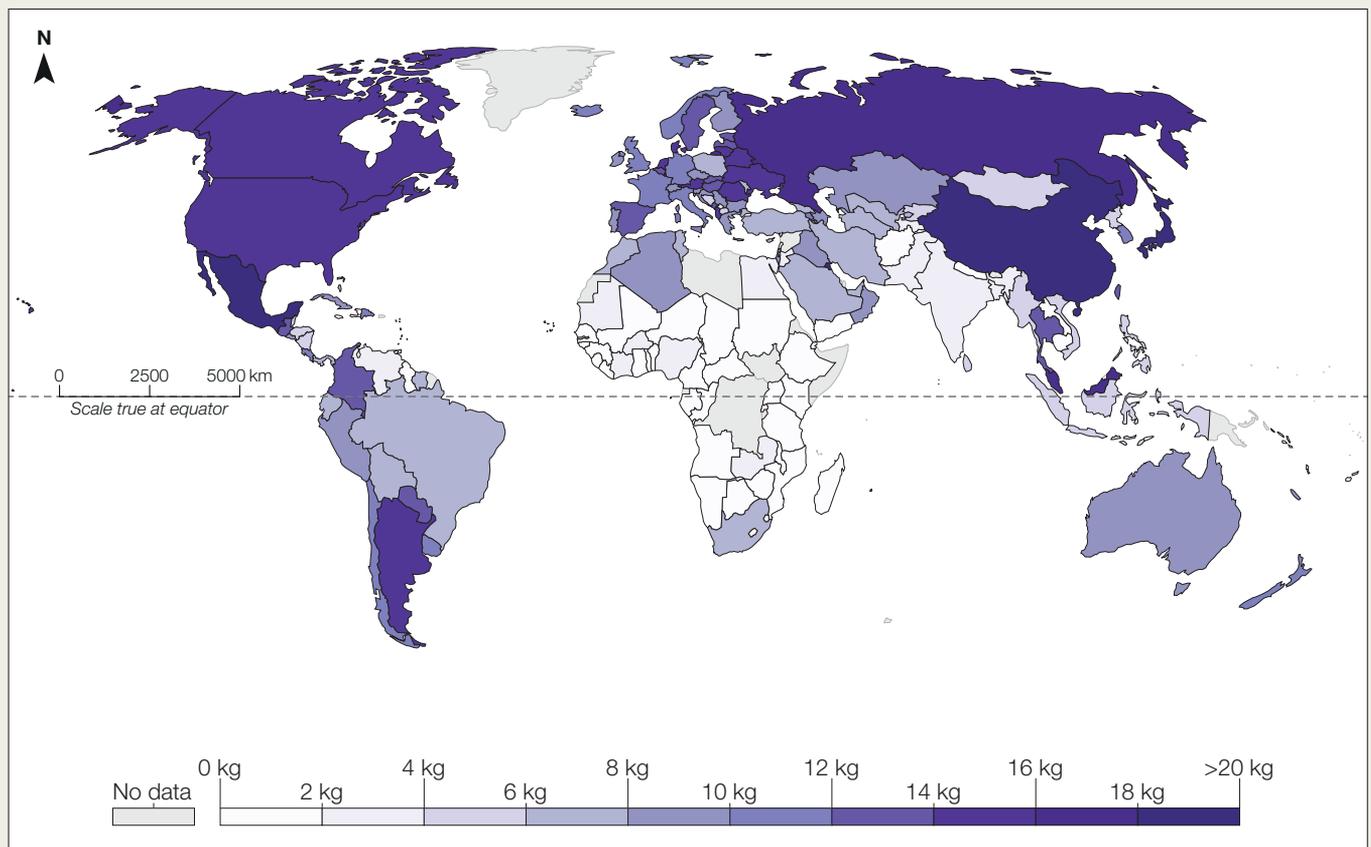
Exception:
However …

For example:

However, Argentina is in the southern hemisphere and they consume over 16 kilograms of eggs per person per year.

Per capita egg consumption, 2017

N

0   2500   5000 km
Scale true at equator

No data   0 kg   4 kg   8 kg   12 kg   16 kg   >20 kg
         2 kg   6 kg   10 kg   14 kg   18 kg

Source 11

Egg consumption throughout the world in 2017

Source: Our World In Data

HOW TO

SHEEPT

SHEEPT is an acronym that helps you remember the reasons why a spatial pattern occurs. It stands for: Social, Historical, Economic, Environmental, Political and Technological.

Source 12

Sydney, NSW

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. Sydney's urban landscape has changed significantly over time.

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 on a place.

How do I write a SHEEPT analysis?

SHEEPT is usually used to explain why patterns or distributions may occur in a particular region. It can also be used to expand our thinking when annotating images or considering new geographical content. The text on the right is an example of how to write a SHEEPT analysis for an image. The highlighted terms indicate the use of a SHEEPT term. Can you identify all of them? (The analysis does not need to include every term.)

Source 12 is an image of the Sydney CBD and its famous landmarks. The Sydney Harbour Bridge is a historical site that took eight years to construct and was opened by Premier Jack Lang in 1932. Today, the bridge is a major tollway and thoroughfare, with eight car lanes, train tracks and paths for bikes and foot traffic. The bridge is also a tourism site, with tourists paying to climb the structure and see the speculator views of the city, harbor and surrounding environment from the top.

E Environmental

Environmental factors are those relating to the natural or human environments on Earth. Humans can manipulate the environment to suit their needs. Here we see how parklands have been urbanised to support a growing population.

P Political

Political factors are those to do with the government or leading groups. When we consider political factors, we refer to 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**, medical technology or even roads, transport or basic machines used in the home.

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 1

Create a heading for your sketch that is clear and provides information on the location. You may wish to record both the **absolute** and **relative locations**.

O Orientation 2

An orientation shows the direction that you were facing when you conducted your sketch. In order to record a correct orientation, you need to use a compass.

A Annotations 3

Annotations 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. Ensure that lines pointing to your annotations are completed with a ruler and do not overlap.

THE GREAT ALPINE ROAD 1
Bright, Victoria:
9.8.2020 9.30 am 5 6

Green trees and lush mountain landscape indicates it is spring or summer and so not peak tourist seaon in this region

TOASTIE will help you remember the key skills when making a field sketch. It stands for Title, Orientation, Annotations, Scale, Time, Information and Edge.

S Scale ④

Most sketches are not 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 metre-rule or pace out an area that you have sketched. Then, using a small ruler, identify how large the same area is on your drawing. For example, you may estimate that the path you are looking at is 1 metre wide, and when you measure your drawing of the path it is 1 centimetre wide. Therefore, your rough estimated scale is 1 m = 1 cm.

T Time ⑤

By recording the time your sketch was completed, you can analyse how the environment changes over the course of a day, a month or even years!

I Information ⑥

Provide more than just one-word annotations on your sketch. Annotations should be at least one sentence and help your reader to identify any patterns.

E Edge ⑦

Draw a border so it is clear where your sketch starts and ends.

③ Mountains and local landscape are attractive to seasonal tourists Important for the local economy

⑦

Local small-scale shops and businesses to support residents year round

No parked cars or traffic indicating lower local population than in urban environments

②

④

3 m

Source 13

An annotated field sketch with accompanying photo.

Visual communication

Flow diagrams

Flow diagrams help show processes or how different parts of the environment are *interconnected*. The arrows represent the movement between stages or the connection between things.

Source 14

A flow diagram
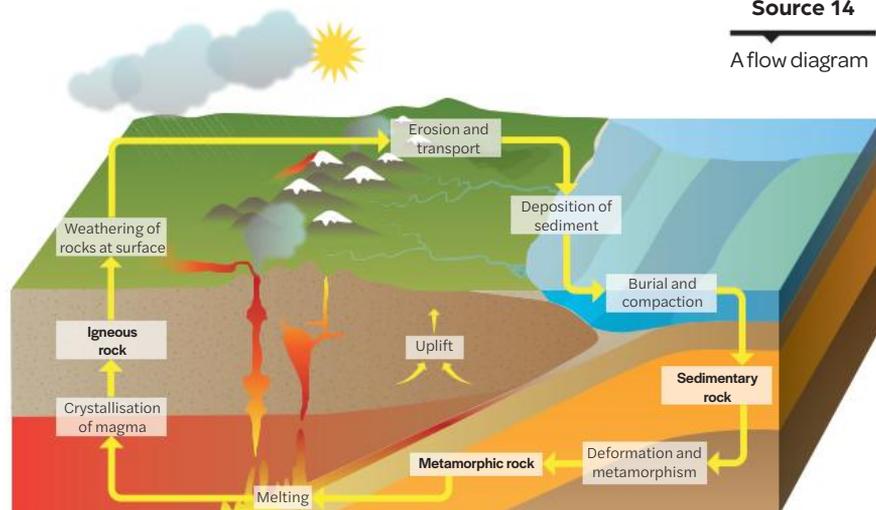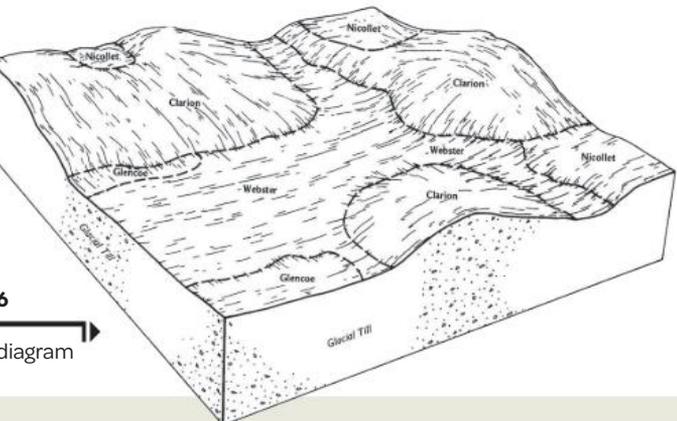
Block diagrams

Block diagrams are a useful way of drawing landscapes to show what is happening both above and below ground. For example, when we consider the movement of water, block diagrams help us visualise how water can move both on the surface of Earth through rivers, oceans and streams, as well as under the ground through water tables and pipes.

When you create a block diagram, you need to ensure that you draw it three dimensionally, with equal amounts of drawing room above and below the surface of Earth. Annotations are very important when drawing a block diagram, as this is how your audience can interpret your illustration.
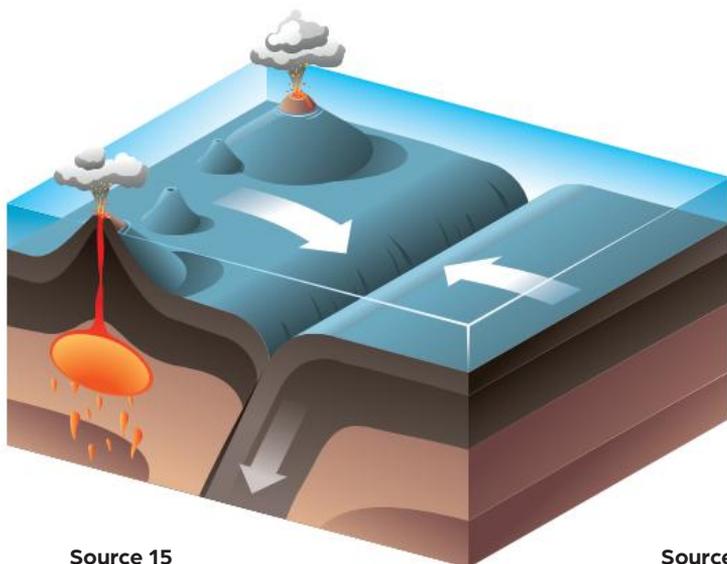
Source 15

A block diagram

Source 16

Sketch of a block diagram

Photo essays

A **photo essay** is a way of presenting information visually to show characteristics of a place or process. A photo essay usually includes a series of photos with specific annotations or captions that provide a brief background into the key features of the image or the meaning behind the image choice.

Source 17

A photo essay

An open field that has been altered by humans for agriculture

Evidence of vehicles and human interaction

Cleared and maintained for agriculture and farming

This is a mountainous biome. Due to the height of the mountains, snow may fall at their peaks.

Vegetation grows around the base and in the valleys.

Meltwater from the mountains runs off and forms a lake at the base in low-lying landscapes.

A coastal biome that contains a series of islands and rocky formations

Evidence of human interaction with this biome for recreation or fishing

These formations may have been formed by weathering and erosion over many years.

A riverine biome bordered by lush vegetation, which creates a range of suitable habitats for animal life

Vegetation uses the river for water to grow and photosynthesise.

The river provides water and habitat to animals living in this biome.

Graphing

Choosing a suitable graph

Graphing is an important way to display geographic information. By using the appropriate graph type we can clearly show patterns and changes over time.

Bar graphs are most suitable for comparing small changes over time that are harder to interpret on a line graph. For example, in Source 19, precipitation is represented in bars as it only ranges from 45–70 mm over the year.

Line graphs are more suitable to show and compare larger changes that occur over longer time periods. For example, in Source 18, population is shown to change significantly over many years.

The two fluctuating lines represent Australia's total population change and its immigrant population change. The steadier line shows the natural increase which has not changed as much over time.

Pie charts are best used when you want to show proportions. These charts are not suitable for showing change over time.

When creating a graph, use the acronym **SALTS** to guide you: scale, axis, legend, title and source.
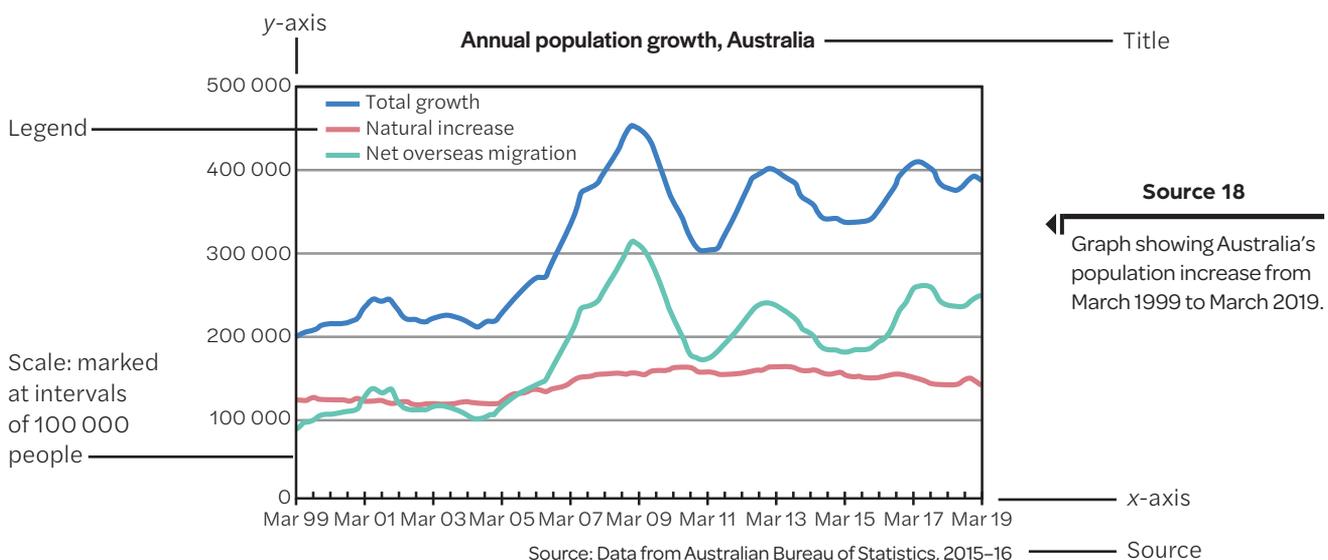
Scale: The scale of your graph will depend on the data you are trying to visualise. To choose your axis scale, identify the lowest and highest value (range), then fill in the numbers in between to mark your data points.

Axis: Each graph has an *x*-axis and *y*-axis. The *x*-axis is the horizontal axis and the *y*-axis is the vertical. Make sure you label each axis!

Legend: A graph often uses colours to represent data. A legend indicates to the audience what these colours mean and how to read the data.

Title: A title lets your audience know what your graph is showing.

Source: When you graph information, you must acknowledge where you obtained your data. By stating the source of your information, the reader knows how reliable it is.

y-axis

Annual population growth, Australia — Title

Legend

- Total growth
- Natural increase
- Net overseas migration

500 000
400 000
300 000
200 000
100 000
0

Mar 99 Mar 01 Mar 03 Mar 05 Mar 07 Mar 09 Mar 11 Mar 13 Mar 15 Mar 17 Mar 19

Scale: marked at intervals of 100 000 people

x-axis

Source 18

Graph showing Australia's population increase from March 1999 to March 2019.

Source: Data from Australian Bureau of Statistics, 2015–16 — Source

Climate graphs

A climate graph is simply two graphs in one.

The graph below shows the temperature (degrees Celsius) on the left *y*-axis, which relates to the red average temperature line; and the amount of precipitation (mm) on the right *y*-axis, which relates to the blue columns. The horizontal axis or *x*-axis, shows us the months of the year.

We notice that the red line, or average temperature, fluctuates throughout the year, peaking in December to March and decreasing from April to July. Precipitation fluctuates in a similar way, but tends to be highest in the spring from August to November, with the exception of another peak in May. Using two PQE analyses (one for temperature and one for precipitation) is the best way to describe the patterns we observe in a climate graph.

Use the left axis to read the degrees of temperature.

The bar graph shows the average precipitation for the month.

Use the right axis to read precipitation levels

Climate graph

Average temperature
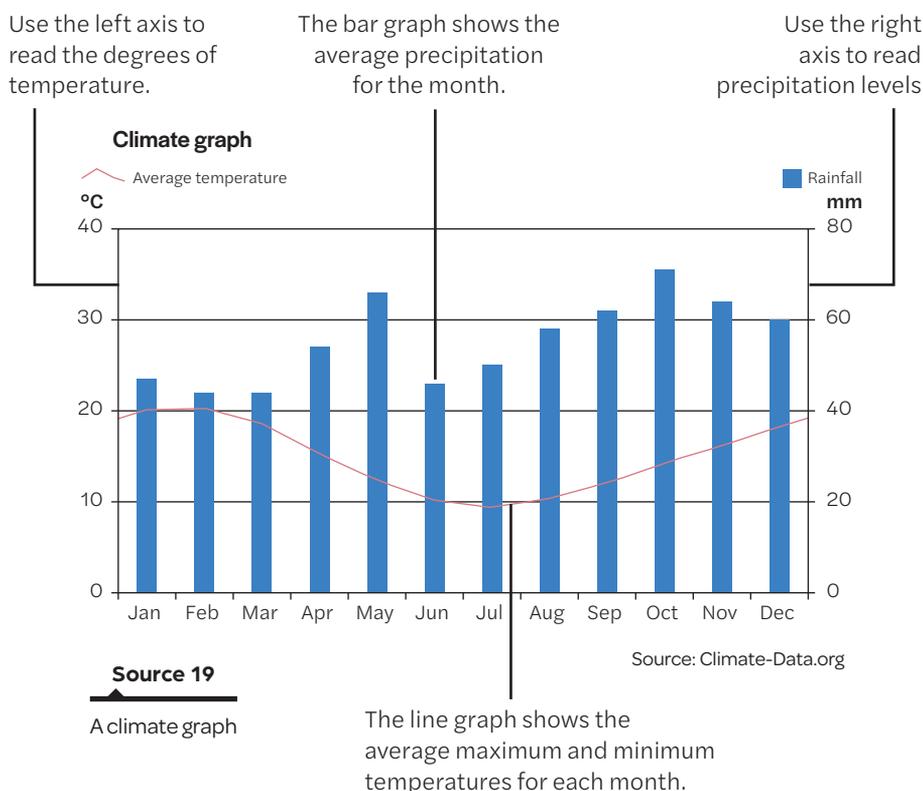
Rainfall

Here we need to apply SALTS! Label the axes, provide a title and a source. The legend is part of the axis labels: red line denotes average temperature in degrees Celsius; blue columns denote rainfall in mm.

Source: Climate-Data.org

Source 19

A climate graph

The line graph shows the average maximum and minimum temperatures for each month.

What is the difference between weather and climate?

Look outside your window and describe today's temperature and the amount of rainfall. What you have just described is the weather. Weather changes daily but we can usually predict it up to 10 days in advance.

Now close your eyes and describe the 'climate' of Australia. Do you imagine Australia as mostly 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 change over time.

Population pyramids

Population pyramids are graphs that show the number of females and males in particular age groups in a population; 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.

The shape of the pyramid tells us about the population:

- Triangular means the population is growing, because there are more young people than old
- Box-like means growth is slow or stable, as there are roughly equal numbers of old and young people.
- If the shape becomes wider towards the top, like a reduced pentagon, it represents an ageing or declining population, as there are more middle-aged people than young people.

How do I interpret a population pyramid?

Source 21 shows population pyramids for Australia in 1955 and 2018. In 1955, there were many young people in the age range 0–14. Approximately 5.5 per cent of the population were 0–4-year-old males and 5.3 per cent were 0–4-year-old females. We also had many working-age people. For example, 4.1 per cent of the population were 30–34-year-old males and 3.8 per cent were 30–34-year-old females. In 2018, there are significantly fewer young people and more old people in our population. Our population also grew to 25 million people.

Shape: Triangle
Growth : Fast
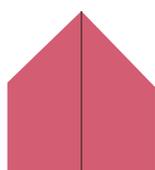
Shape: Extended triangle
Growth: Medium
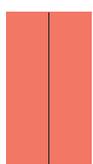
Shape: Column
Growth: Slow
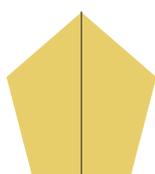
Shape: Reduced pentagon
Growth: Shrinking

Source 20

Various population pyramids. The shape of the pyramid tells you about the population.

Source 21

Population pyramids showing Australia's population in 1955 (left) and 2018 (right)

Age (years) | Male | Female

Australia 1955
Population **9 212 824**

Age (years)	Male 1955	Female 1955
80+	0.5%	0.7%
75–79	0.6%	0.8%
70–74	1.1%	1.3%
65–69	1.6%	1.8%
60–64	1.9%	2.2%
55–59	2.2%	2.3%
50–54	2.7%	2.5%
45–49	3.2%	2.9%
40–44	3.6%	3.4%
35–39	3.6%	3.5%
30–34	4.1%	3.8%
25–29	4.0%	3.6%
20–24	3.4%	3.1%
15–19	3.4%	3.3%
10–14	4.1%	3.9%
5–9	5.2%	5.0%
0–4	5.5%	5.3%

Percentage of the population (%)

Australia 2018
Population **24 966 530**

Age (years)	Male 2018	Female 2018
80+	1.6%	2.3%
75–79	1.3%	1.4%
70–74	2.0%	2.1%
65–69	2.4%	2.5%
60–64	2.7%	2.8%
55–59	3.1%	3.1%
50–54	3.1%	3.1%
45–49	3.3%	3.4%
40–44	3.2%	3.3%
35–39	3.4%	3.4%
30–34	3.8%	3.7%
25–29	3.7%	3.5%
20–24	3.4%	3.2%
15–19	3.0%	2.9%
10–14	3.1%	3.0%
5–9	3.3%	3.1%
0–4	3.3%	3.2%

Percentage of the population (%)

Source: PopulationPyramid

Satellite images

Satellite images are pictures of Earth taken from space. Satellite images give us the most information if taken during the day. Satellites orbit Earth and constantly take images, and we can use this data to see a change over time in land cover or other spatial patterns.
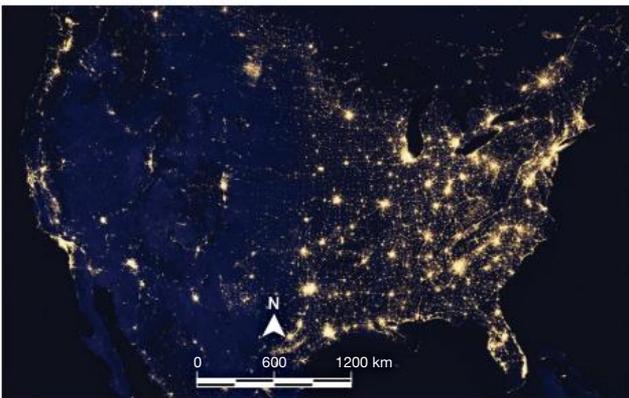
Source 22

Satellite images taken at night provide different information than those taken during the day. This photo of the US shows the extent of its urban areas.

When trying to interpret a satellite image, look for colour and shapes. Colour can give you an idea of land cover. For example, green usually indicates vegetation, blue is the colour of water and brown is desert or barren land. White can indicate either snow or clouds, so we use shapes to tell them apart. Clouds tend to look fluffy and can sometimes (depending when the images were taken) cast a shadow. Snow usually appears on the tops of mountains and you can observe where it is melting or following the slopes. Looking for shapes is also helpful when identifying rivers or reservoirs, which can be seen as meandering blue lines.

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

This satellite image shows the various geographical features of central Chile and Argentina. We can use this information to answer geographical questions and understand spatial patterns.

Autumn 17 Oct 2012   **Winter** 7 Jan 2013

Spring 20 April 2013   **Summer** 14 June 2013
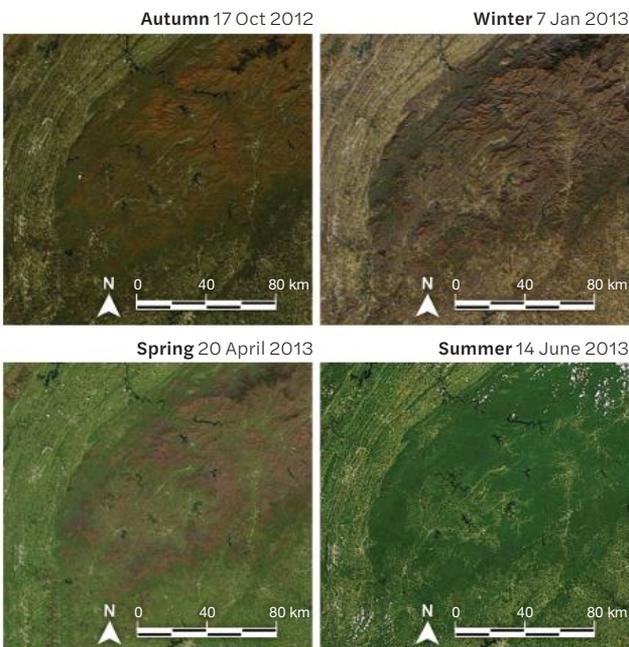
Source 23

These satellite images show the forests covering the Great Smoky Mountains of the southeastern US over four seasons. Satellite images are useful for seeing change over time.
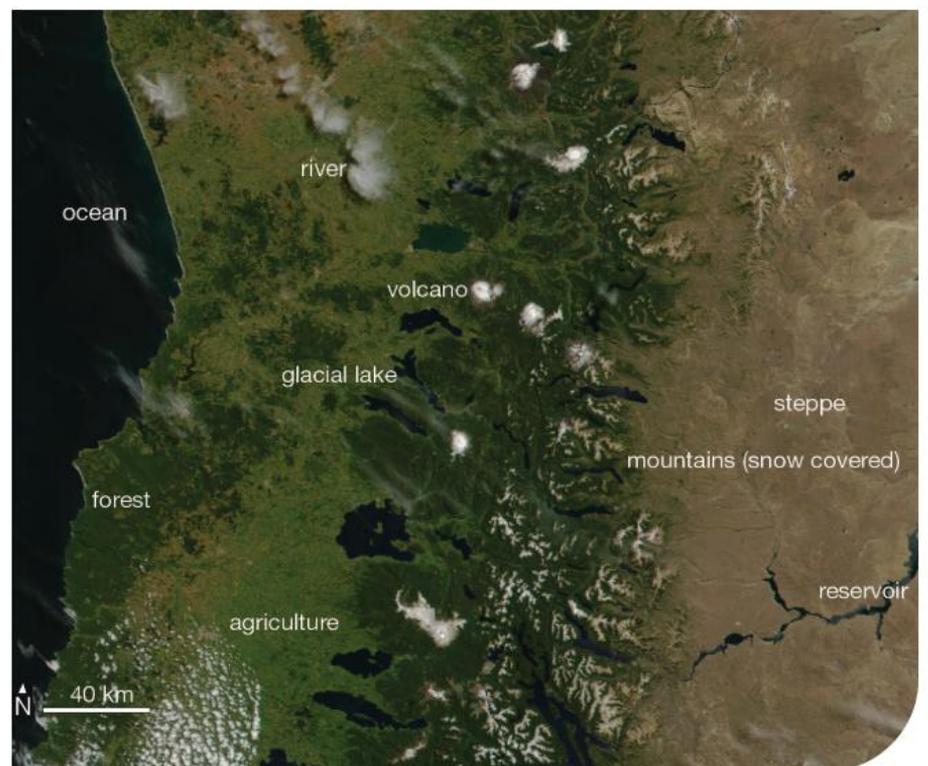
Overlay maps

Overlay maps are a way of creating layers on a paper map. Usually layers are presented digitally on software such as Geographic Information Systems (GIS). Layers are put over the top of a base map, which might be an outline map of the world or place, or even a terrain map. Each layer contains a different set of information or data that provides an insight into a process or spatial distribution occurring on that scale. By viewing multiple layers at the same time, you can observe interconnections between spatial patterns.

To create a layered paper map, you require the correct base map and some tracing or baking paper. Your base map should contain all elements of BOLTSS (see pages 132–33) except for a legend. Place a piece of paper over the top of the base map and colour in your first distribution. You do not need to trace the outlines of the countries, as this is what the base map is for.

Each layer requires a border (so you can line it up correctly with the base map) and a legend so it is clear what the layer is showing. You can create multiple layers and then overlay them all to observe patterns and trends.

Data source

Street data

Buildings data

Vegetation data

Integrated data

Data layers
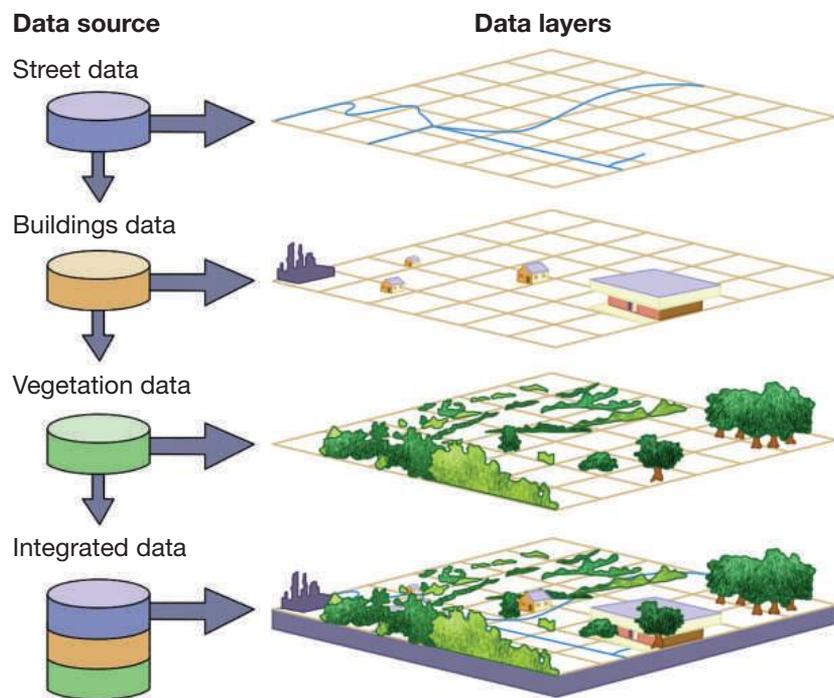
Source 25

Digital layers created to observe interconnections and trends

Spatial technology

Imagine you were given an Excel spreadsheet with over one million data points, all stating the latitude and longitude of McDonald's locations around the world. How would you analyse this data and explain or describe patterns or trends? Geographers use spatial technology such as GIS, a digital mapping platform that helps us visualise data.

Spatial technology is used every day. You probably are not even aware that you are using it! Google Maps (GPS) is a prime example, where you can visualise your location and destination and be guided along the shortest route. Uber Eats, Snap Maps, Instagram and other location services all use spatial technology to give their apps location data.

Transects

Transects are straight lines created on a surface (often with measurements marked on them like rulers) that help us observe a sample of the surface environment. They are useful tools for collecting information about species richness and investigating the characteristics of places.

Transects can be created both on land and underwater. Researchers and surveyors often use transects as a way to measure change over time in reefs or monitor species richness, as shown in Source 26. As a student, you will most likely undertake transects on land.

To complete a transect, first select a suitable location. For example, if you are investigating how urbanisation has affected the natural environment in your local area, you might lay down a 1-metre ruler in a field, then count the different species of plant you identify along the ruler transect. You would then repeat this transect technique in other random places within your study site, to create a more accurate picture of the impact of urbanisation.

You can also use transects to analyse photographs and consider how a place changes over a set distance, as was done for the Aral Sea, Source 1 on page 40. These transects are particularly helpful when identifying land use or environmental types.

Source 26

Amphibian researchers conduct a transect in a gallery forest in the savanna to identify amphibian biodiversity.

Cross-sections

A **cross–section** shows the shape of a geographical landscape or landform from the side, as if it had been sliced by a knife. This type of drawing can be helpful in visualising landforms from different perspectives. When hand drawing a cross–section, we finish with a 2D side–on view of the terrain; however, computer programs can create 3D representations to enhance our understanding.

What you see on your map
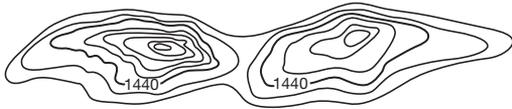
3D view of landmark
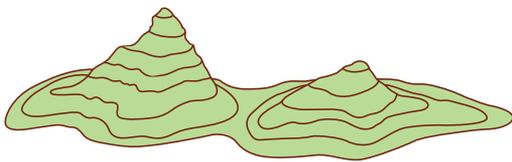
Source 27

The difference between what you see on a cross-section versus the 3D view of a landmark

Contour lines are used to construct a cross-section. The overlay on the aerial photograph of Uluru in Source 28 is a contour map. The contour lines are the numbered lines that join places of equal height. Close contour lines indicate a steep slope and widely spaced contours mean a gentle slope.

Source 28

An aerial photo of Uluru with contour lines overlaid.

Source: Contour map from Matilda Education Australia, Geoscience Australia

Source 29

A simple cross-section of Uluru, x and y are matched to the transect line in Source 28.
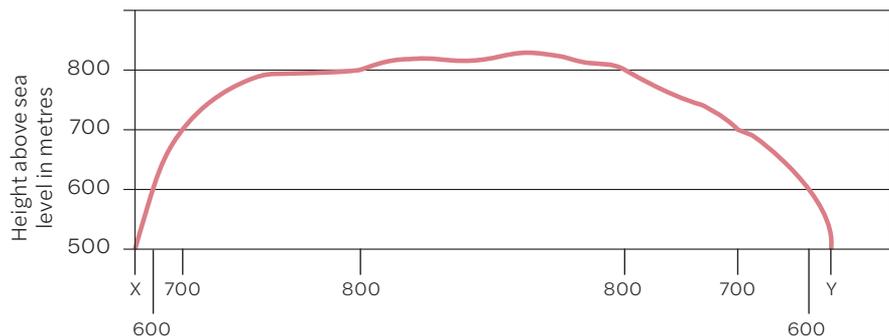
How to draw a cross–section

a Place a straight edge along the line between points A and B. Mark each contour line at the point it touches the edge of the paper and record the height.

Contour interval = 20 metres
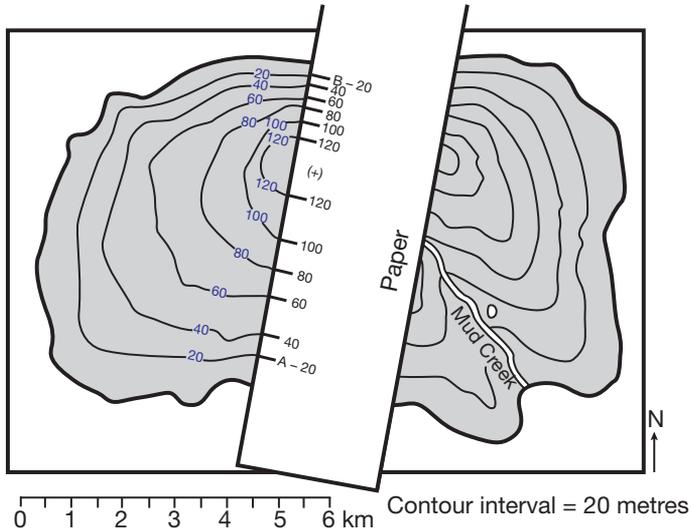
b Draw a vertical scale like the one below. You need to decide on a scale depending on the range of elevations presented on the contour map. For example, for the Uluru cross-section in Source 29, 1 centimetre represents 100 metres.
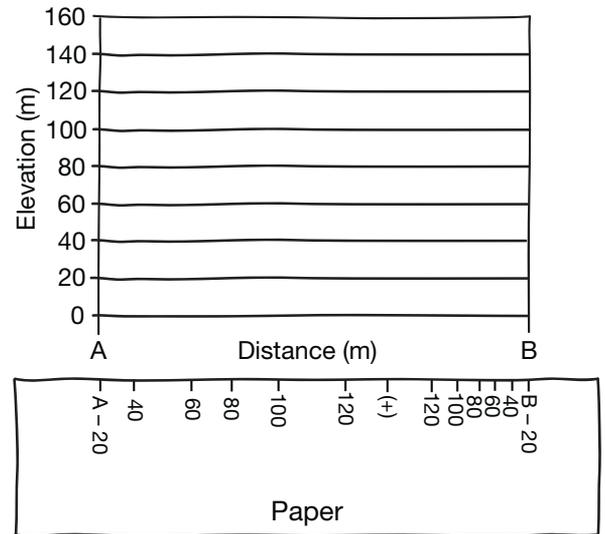
c Place the marked edge of the paper underneath the vertical scale and mark the appropriate height directly above with a dot.
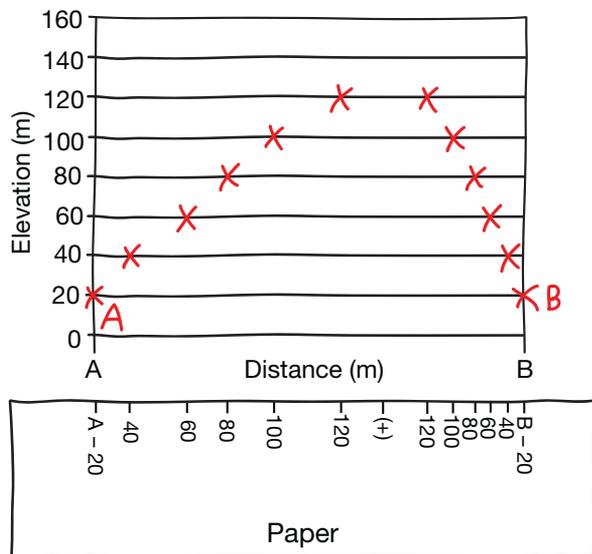
d Join the dots with a smooth line and add labels.
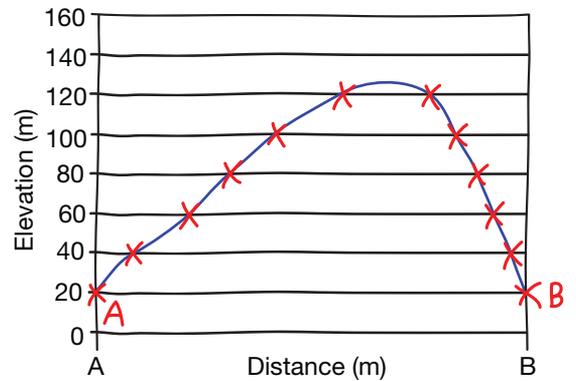
Glossary

absolute location a precise description of a place's location; for example, an address or geographical coordinates

arithmetically constant growth over a set period of time; for example, 1, 2, 3, 4 ...

atmosphere all the gases that surround Earth

awareness campaigns movements that promote understanding about an issue in the local or global community

bias to be for or against an idea, a person or a group, especially in a way that could be thought of as unfair

biodiversity the measure of variation in a community of animals or plants

biome a way of classifying environments based on their defining characteristics such as climate, soil type or vegetation

biosphere all of the living things on Earth

block diagram a three-dimensional diagram that shows how a system or feature works

BOLTSS(NA) the acronym for Border, Orientation, Legend, Title, Scale and Source (Neatness and Accuracy); used when constructing maps

capital resources human-made resources such as machinery, buildings, equipment and technology used to produce other goods and services

climate average temperature and precipitation in a certain place, over a year

climate change the natural fluctuation in temperature and precipitation over a long time period

climate graph a graph showing average rainfall and temperature for an area over a period of time

commodification the process of selling cultural traditions or artefacts for profit to tourists

community a group of people or animals connected in some way, by geography or by common interest

community transmission transmission of a virus within a community where there is no identifiable link to a source of the exposure (i.e. in COVID-19, transmission in the community that cannot be explained by an infected person having recently returned from overseas or being in contact with someone who has)

computer intrusion unauthorised access to a digital device or network

connection to Country the deep spiritual, physical, social and cultural relationship between Indigenous Australians and the land

consumerism our desire to own products that exceed our basic human needs

contour lines lines on a map that join points of the same height above or below sea level

cross-section an image that shows the shape of a geographical landscape of landform from the side; it usually creates a 2D side-on view of the terrain

cyber crime a crime committed via technology, such as the internet

cyberbullying the use of technology to harass, threaten or embarrass another person with the intent to hurt them

deforestation clearing of a forest to make room for a different land use such as farming

desertification occurs when land along the edge of a desert, or land previously not classified as desert, becomes damaged by drought and through overuse by humans and is replaced by desert

dryland an arid region; devoid of water

e-waste the amount of rubbish produced by the technology industry, such as old mobile phones

economics the study of how we produce and consume products and how wealth is established and distributed

ecosystems a community of animals and plants that are interconnected in space and time

ecotourism experiencing the natural world with the sole aim to learn how to protect, sustain and conserve the environment for future generations; ecotourism destinations need to prove they are protecting the environment, educating tourists and supporting local communities

entrepreneurship the ability to organise the factors of production and transform them into a business

equator the invisible line drawn around the centre of Earth to help describe phenomena, locations and hemispheres

erosion the process whereby rock particles are moved by flowing air (wind), water (rivers, sea and rain) or ice (glaciers)

exponentially refers to an increase that becomes more and more rapid; for example, 1, 2, 4, 8, 16, 32 ...

factors of production the resources that are used to create goods and services

flow diagram a diagram showing how one thing flows to another; arrows show the movement between stages, or show how different items are connected

food insecurity limited access to or unreliable access to safe and quality food or resources

food security consistent access to safe and quality food and resources in order to grow and thrive

genetically modified (GM) refers to organisms, often food crops, that are altered on a genetic level to enhance their growing capacity

geographic characteristic a naturally occurring feature of a place, such as its landforms and ecosystems

global citizenship a description of the way an individual acts and interconnects with the diversity of people and communities around them and across the world

global warming the unnatural rise in the Earth's temperature linked to the increase of fossil fuel use since the Industrial Revolution

goods and services resources that are produced or delivered by people in a population

Global Positioning System (GPS) a satellite navigation system used to determine the position of an object or person on the ground or at sea

Great Depression a severe economic downturn that began in 1929 and lasted for approximately 10 years

Gross Domestic Product (GDP) The value of the goods and services provided or produced by a country over a given time period (usually a year)

Hadley cell the atmospheric circulation of air moving upwards at the equator and downwards 30 degrees north and south

hydrosphere all the water on Earth

hypothesis a proposed explanation used as the starting point for further investigation

ice ages periods of time defined by wide expanses of glaciers across the globe

immigration the movement of people into a country to live or to work

irrigation the watering of crops and pastures from a water source other than precipitation; for example, with water from a river or lake

labour the physical work of people in industry; any work performed by a human being, whether physical or intellectual, to produce profits

labour resources any human input required for making a good or providing a service

latitude a coordinate that describes the location of a place north or south of the equator on the Earth's surface (0–90 degrees)

less economically developed country (LEDC) a low-income country experiencing severe barriers to development; also referred to as a developing country

leaching the loss of water-soluble nutrients from soil through rainfall or irrigation

lithosphere Earth's rigid outer layers; made up of the crust, upper mantle and tectonic plates; all the soil, rock, mountains etc. on the surface of Earth

longitude a coordinate that describes the location of a place east or west of the prime meridian on Earth's surface (0–90 degrees)

migration the movement of people into (immigration) and out of (emigration) a country

monoculture the practice of cultivation of a single crop or animal species in one area at a time

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

natural resources assets that occur naturally as part of the environment

net primary productivity a quantitative measure of how efficient a biome is

non-renewable resource a resource that cannot be regenerated or replenished within a human timescale once it is used up (for example, coal, oil)

northern hemisphere the half of Earth north of the equator

opportunity cost what is given up in order to obtain something else; e.g. forgoing the opportunity to grow crops is the opportunity cost of raising cattle

overlay map when layers containing different sets of information or data are created on top of a map

pandemic a disease that spreads in multiple countries around the world at the same time, usually affecting a large number of people

phenomenon something that is observed to exist or happen

photo essay a series of photographs used to present information visually to show characteristics of a place or process

photosynthesis the natural process that primary producers undertake to change carbon dioxide, water and sunlight into energy (glucose)

place a location on Earth's surface that has defining characteristics and has meaning to people

population density a measure of how many people live in a particular region or area

population pyramid a graph showing the number of males and females living in age groups in a population

PQE the 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 method a data-gathering activity undertaken in the field, such as field sketches

primary producer a plant or animal that creates its own glucose (energy) through photosynthesis

profit money that is received after expenses are taken out

producer an organism that uses sunlight, water and carbon dioxide to photosynthesise and produce its own energy

productivity the energy produced by the primary producers in an environment

quantify to use percentages, counts, ratios or data to provide details about the patterns you are describing

qualify to use general describing words such as 'large', 'many', 'broad' or 'small' to describe a pattern or change

qualitative data non-numerical data based on qualities or characteristics

quantitative data numerical data based on measurements or counts

relative location a description of where a placed is located in the world; for example, describing where your house is in relation to local landmarks

renewable resource a natural resource that can regenerate or replenish within a human timescale (for example, trees)

research question an idea to be investigated or a problem to be solved through research

resource a source of energy or material; a resource can be natural or man-made, or renewable or non-renewable

saline containing or resembling salt

SALTS the acronym for Scale, Axis, Legend, Title and Source; used when graphing

satellite image an image of Earth taken from space

scarcity the idea that resources are limited and that there is competition for them

seasonal migration moving from a place of origin to another place according to crop cycles and weather changes

secondary method a data-gathering activity undertaken outside of field studies, such as research; data collected by others outside of your research group

SHEEPT the acronym for Social, Historical, Environmental, Economic, Political and Technological factors; used when explaining the reasons why a spatial pattern occurs

sketch a simple drawing made to record data when in the field

social distancing a term developed to describe space required between individuals to limit the spread of disease; during the 2020 COVID-19 pandemic a social distance of 1.5 m was recommended

socially responsible acting morally and ethically towards others and towards the planet

spatial technology a computer system that interacts with real-world locations in some way

SPICESS an acronym that assists in using geographic language in responses; SPICESS stands for space, place, interconnection, change, environment, scale and sustainability

species richness the number of different species within a community

sustainable able to be maintained at a certain level, such as energy or air quality

southern hemisphere the half of the Earth south of the equator

temporal distance the amount of time that separates a person's present time and the time of an anticipated event in the future

TOASTIE the acronym for Title, Orientation, Annotations, Scale, Time, Information and Edge; used when making a field sketch

tourism the movement of people to a location other than their place of residence or work for more than 24 hours, but for less than a year

transect straight lines created on a surface (often with measurements marked on them like rulers) that help us observe a sample of the surface environment

urban sprawl the continual expansion of suburbs at the edges of large cities onto natural or farming land

United Nations (UN) an international organisation made up of 193 member states, aiming to maintain peace and security between and within nations

viral caused by or relating to a virus

weathering a process where rock is worn away, broken down or dissolved into smaller and smaller pieces by water, heat and cold; chemical weathering is a chemical change in a rock, while mechanical weathering involves rocks being broken into pieces

Index

Acknowledgements

Clarifying details for NBN graph, page 85: This graph shows TC-4 usage (measured in terabits per second for both upstream and downstream) over a 24-hour period (using Australian Eastern Standard/Daylight time on the dates shown in the key). It compares the results from those two dates against a corresponding 24-hour period from nbn's pre-COVID-19 baseline on 28 February 2020 (the last week of February). Each marker on the x axis represents an hour period in the day. The y axis shows, for each of the 60-minute periods in that 24-hour period: The downstream throughput measure calculated by recording the highest downstream throughput for our TC-4 service from the busiest 15-minute increment in that 60 minute period. The upstream throughput measure, calculated by recording the highest upstream throughput for our TC-4 service from the busiest 30-minute increment in that 60-minute period. The terabits per second (Tbps) value is rounded to one decimal place. The percentage increase is rounded to the nearest whole number.

good Geography