OXFORD

# INSIGHT GEOGRAPHY

AUSTRALIAN CURRICULUM FOR NSW

STAGE 5



DREW COLLINS
RICHARD CRIGHTON
KERRY McEWAN
MARK EASTON

OXFORD

# CONTENTS

# USING *OXFORD INSIGHT GEOGRAPHY*

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

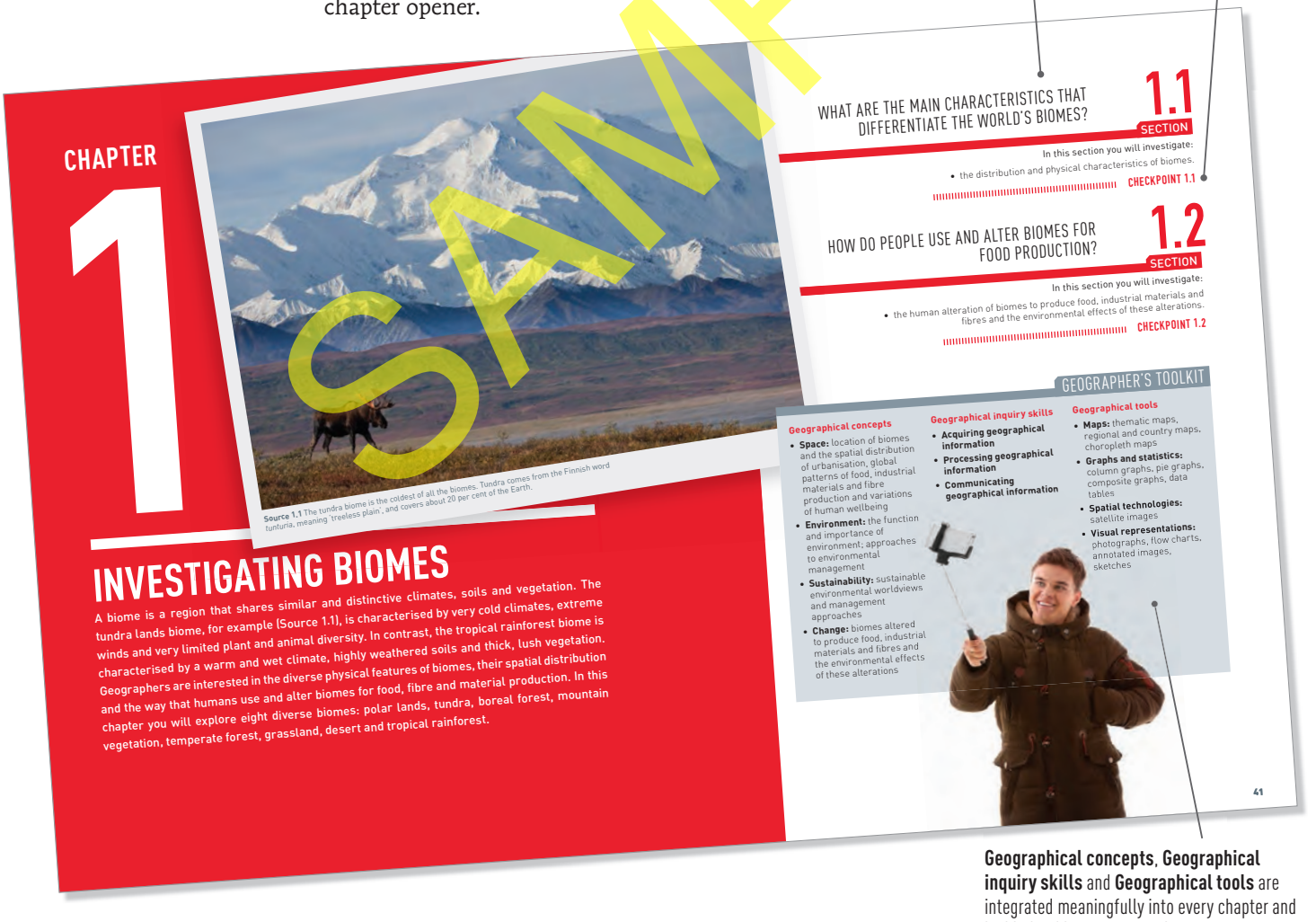
» optimise student understanding
» personalise teaching and learning
» deliver better results.

## OPTIMISE STUDENT UNDERSTANDING

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

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

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




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

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

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

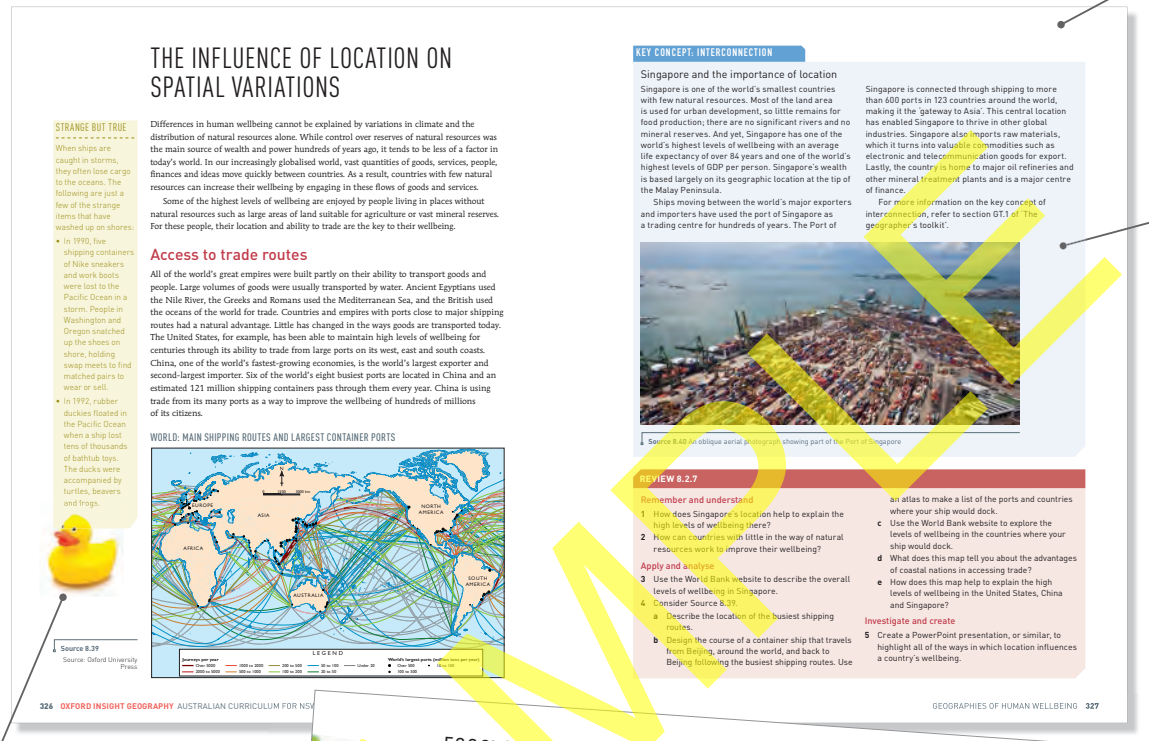
**Key concept** boxes encourage students to think geographically.

**Skill drills** support an explicit focus on geographical skills.

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

**Case studies** expose students to a range of sources.

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


THE INFLUENCE OF LOCATION ON SPATIAL VARIATIONS

STRANGE BUT TRUE

When ships are caught in storms, they often lose cargo to the oceans. The following are just a few of the strange items that have washed up on shores:

- In 1990, five shipping containers of Nike sneakers and work boots were lost to the Pacific Ocean in a storm. People in Washington and Oregon snatched up the shoes on shore, holding swap meets to find matched pairs to wear or sell.
- In 1992, rubber duckies floated in the Pacific Ocean when a ship lost tens of thousands of bathtub toys. The ducks were accompanied by turtles, beavers and frogs.

Source 8.39
Source: Oxford University Press

Differences in human wellbeing cannot be explained by variations in climate and the distribution of natural resources alone. While control over reserves of natural resources was the main source of wealth and power hundreds of years ago, it tends to be less of a factor in today's world. In our increasingly globalised world, vast quantities of goods, services, people, finances and ideas move quickly between countries. As a result, countries with few natural resources can increase their wellbeing by engaging in these flows of goods and services.

Some of the highest levels of wellbeing are enjoyed by people living in places without natural resources such as large areas of land suitable for agriculture or vast mineral reserves. For these people, their location and ability to trade are the key to their wellbeing.

## Access to trade routes

All of the world's great empires were built partly on their ability to transport goods and people. Large volumes of goods were usually transported by water. Ancient Egyptians used the Nile River, the Greeks and Romans used the Mediterranean Sea, and the British used the oceans of the world for trade. Countries and empires with ports close to major shipping routes had a natural advantage. Little has changed in the ways goods are transported today. The United States, for example, has been able to maintain high levels of wellbeing for centuries through its ability to trade from large ports on its west, east and south coasts. China, one of the world's fastest-growing economies, is the world's largest exporter and second-largest importer. Six of the world's eight busiest ports are located in China and an estimated 121 million shipping containers pass through them every year. China is using trade from its many ports as a way to improve the wellbeing of hundreds of millions of its citizens.

WORLD: MAIN SHIPPING ROUTES AND LARGEST CONTAINER PORTS

EUROPE
ASIA
NORTH AMERICA
AFRICA
AUSTRALIA
SOUTH AMERICA
LEGEND

326 OXFORD INSIGHT GEOGRAPHY AUSTRALIAN CURRICULUM FOR NSW

KEY CONCEPT: INTERCONNECTION

Singapore and the importance of location

Singapore is one of the world's smallest countries with few natural resources. Most of the land area is used for urban development, so little remains for food production; there are no significant rivers and no mineral reserves. And yet, Singapore has one of the world's highest levels of wellbeing with an average life expectancy of over 84 years and one of the world's highest levels of GDP per person. Singapore's wealth is based largely on its geographic location at the tip of the Malay Peninsula.

Ships moving between the world's major exporters and importers have used the port of Singapore as a trading centre for hundreds of years. The Port of Singapore is connected through shipping to more than 600 ports in 123 countries around the world, making it the 'gateway to Asia'. This central location has enabled Singapore to thrive in other global industries. Singapore also imports raw materials, which it turns into valuable commodities such as electronic and telecommunication goods for export. Lastly, the country is home to major oil refineries and other mineral treatment plants and is a major centre of finance.

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

Source 8.40 An oblique aerial photograph showing part of the Port of Singapore

REVIEW 8.2.7

Remember and understand

1 How does Singapore's location help to explain the high levels of wellbeing there?
2 How can countries with little in the way of natural resources work to improve their wellbeing?

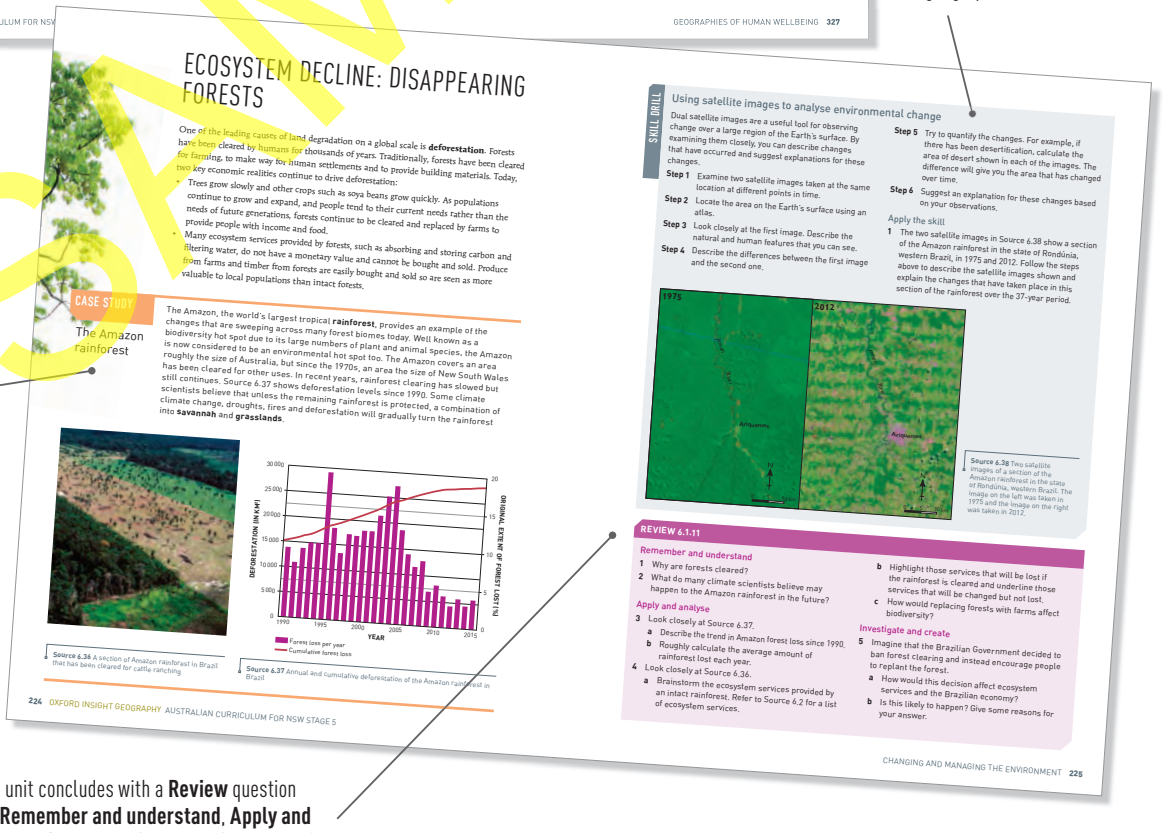
Apply and analyse

3 Use the World Bank website to describe the overall levels of wellbeing in Singapore.
4 Consider Source 8.39.
a Describe the location of the busiest shipping routes.
b Design the course of a container ship that travels from Beijing, around the world, and back to Beijing following the busiest shipping routes. Use an atlas to make a list of the ports and countries where your ship would dock.
c Use the World Bank website to explore the levels of wellbeing in the countries where your ship would dock.
d What does this map tell you about the advantages of coastal nations in accessing trade?
e How does this map help to explain the high levels of wellbeing in the United States, China and Singapore?

Investigate and create

5 Create a PowerPoint presentation, or similar, to highlight all of the ways in which location influences a country's wellbeing.

GEOGRAPHIES OF HUMAN WELLBEING 327


ECOSYSTEM DECLINE: DISAPPEARING FORESTS

One of the leading causes of land degradation on a global scale is **deforestation**. Forests have been cleared by humans for thousands of years. Traditionally, forests have been cleared for farming, to make way for human settlements and to provide building materials. Today, two key economic realities continue to drive deforestation:

- Trees grow slowly and other crops such as soya beans grow quickly. As populations continue to grow and expand, and people tend to their current needs rather than the needs of future generations, forests continue to be cleared and replaced by farms to provide people with income and food.
- Many ecosystem services provided by forests, such as absorbing and storing carbon and filtering water, do not have a monetary value and cannot be bought and sold. Produce from farms and timber from forests are easily bought and sold so are seen as more valuable to local populations than intact forests.

CASE STUDY
The Amazon rainforest

The Amazon, the world's largest tropical **rainforest**, provides an example of the changes that are sweeping across many forest biomes today. Well known as a biodiversity hot spot due to its large numbers of plant and animal species, the Amazon is now considered to be an environmental hot spot too. The Amazon covers an area roughly the size of Australia, but since the 1970s, an area the size of New South Wales has been cleared for other uses. In recent years, rainforest clearing has slowed but still continues. Source 6.37 shows deforestation levels since 1990. Some climate scientists believe that unless the remaining rainforest is protected, a combination of climate change, droughts, fires and deforestation will gradually turn the rainforest into **savannah** and **grasslands**.

DEFORESTATION (IN KM²)
ORIGINAL EXTENT OF FOREST LOST (%)
YEAR
Forest loss per year
Cumulative forest loss

Source 6.36 A section of Amazon rainforest in Brazil that has been cleared for cattle ranching

Source 6.37 Annual and cumulative deforestation of the Amazon rainforest in Brazil

226 OXFORD INSIGHT GEOGRAPHY AUSTRALIAN CURRICULUM FOR NSW STAGE 5

SKILL DRILL

Using satellite images to analyse environmental change

Dual satellite images are a useful tool for observing change over a large region of the Earth's surface. By examining them closely, you can describe changes that have occurred and suggest explanations for these changes.

Step 1 Examine two satellite images taken at the same location at different points in time.
Step 2 Locate the area on the Earth's surface using an atlas.
Step 3 Look closely at the first image. Describe the natural and human features that you can see.
Step 4 Describe the differences between the first image and the second one.
Step 5 Try to quantify the changes. For example, if there has been desertification, calculate the area of desert shown in each of the images. The difference will give you the area that has changed over time.
Step 6 Suggest an explanation for these changes based on your observations.

Apply the skill

1 The two satellite images in Source 6.38 show a section of the Amazon rainforest in the state of Rondônia, western Brazil, in 1975 and 2012. Follow the steps above to describe the satellite images shown and explain the changes that have taken place in this section of the rainforest over the 37-year period.

1975
2012
Arquipuana
Arquipuana

Source 6.38 Two satellite images of a section of the Amazon rainforest in the state of Rondônia, western Brazil. The image on the left was taken in 1975 and the image on the right was taken in 2012.

REVIEW 6.1.11

Remember and understand

1 Why are forests cleared?
2 What do many climate scientists believe may happen to the Amazon rainforest in the future?

Apply and analyse

3 Look closely at Source 6.37.
a Describe the trend in Amazon forest loss since 1990.
b Roughly calculate the average amount of rainforest lost each year.
4 Look closely at Source 6.36.
a Brainstorm the ecosystem services provided by an intact rainforest. Refer to Source 6.2 for a list of ecosystem services.
b Highlight those services that will be lost if the rainforest is cleared and underline those services that will be changed but not lost.
c How would replacing forests with farms affect biodiversity?

Investigate and create

5 Imagine that the Brazilian Government decided to ban forest clearing and instead encourage people to replant the forest.
a How would this decision affect ecosystem services and the Brazilian economy?
b Is this likely to happen? Give some reasons for your answer.

CHANGING AND MANAGING THE ENVIRONMENT 225

## PERSONALISE TEACHING AND LEARNING

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

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


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

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


Select from hundreds of auto-marking assessment tasks at various difficulty levels – foundation, standard and advanced.


Monitor student participation and track performance by graphing and comparing individual and group results.

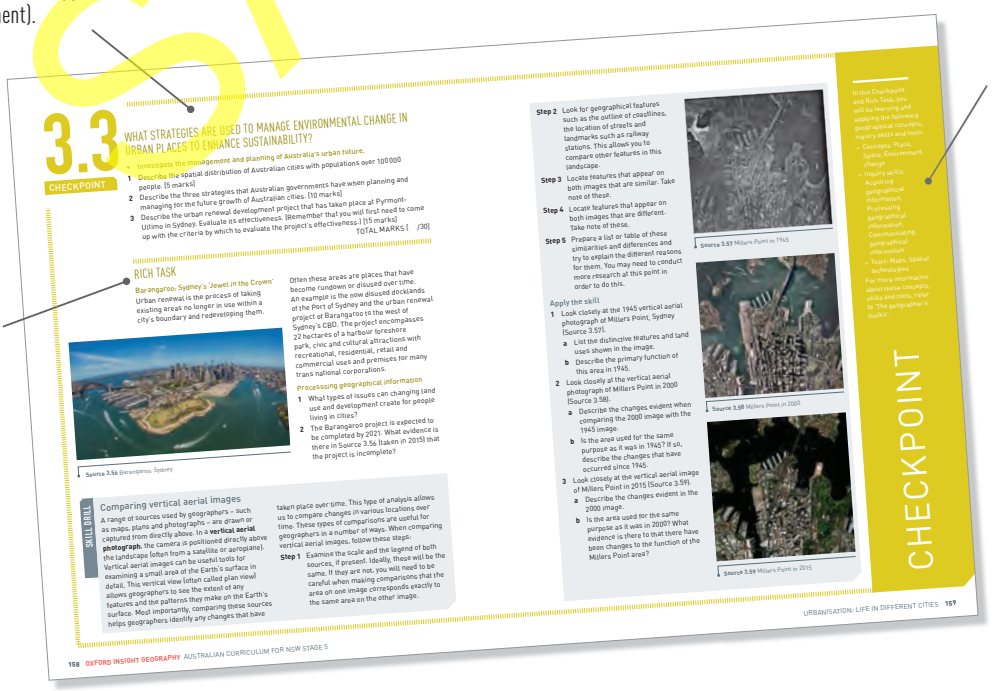
Create your own tests tailored directly to the needs of your students or assign ready-made tests complete with marking guidelines and suggested solutions.

## DELIVER BETTER RESULTS

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

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

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




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

CHAPTER

# 1

**Source 1.1** The tundra biome is the coldest of all the biomes. Tundra comes from the Finnish word *tunturia*, meaning 'treeless plain', and covers about 20 per cent of the Earth.



# INVESTIGATING BIOMES

A biome is a region that shares similar and distinctive climates, soils and vegetation. The tundra lands biome, for example (Source 1.1), is characterised by very cold climates, extreme winds and very limited plant and animal diversity. In contrast, the tropical rainforest biome is characterised by a warm and wet climate, highly weathered soils and thick, lush vegetation. Geographers are interested in the diverse physical features of biomes, their spatial distribution and the way that humans use and alter biomes for food, fibre and material production. In this chapter you will explore eight diverse biomes: polar lands, tundra, boreal forest, mountain vegetation, temperate forest, grassland, desert and tropical rainforest.

## WHAT ARE THE MAIN CHARACTERISTICS THAT DIFFERENTIATE THE WORLD'S BIOMES?

# 1.1 SECTION

In this section you will investigate:

- the distribution and physical characteristics of biomes.

CHECKPOINT 1.1

## HOW DO PEOPLE USE AND ALTER BIOMES FOR FOOD PRODUCTION?

# 1.2 SECTION

In this section you will investigate:

- the human alteration of biomes to produce food, industrial materials and fibres and the environmental effects of these alterations.

CHECKPOINT 1.2



## GEOGRAPHER'S TOOLKIT

### Geographical concepts

- **Space:** location of biomes and the spatial distribution of urbanisation, global patterns of food, industrial materials and fibre production and variations of human wellbeing
- **Environment:** the function and importance of environment; approaches to environmental management
- **Sustainability:** sustainable environmental worldviews and management approaches
- **Change:** biomes altered to produce food, industrial materials and fibres and the environmental effects of these alterations

### Geographical inquiry skills

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

### Geographical tools

- **Maps:** thematic maps, regional and country maps, choropleth maps
- **Graphs and statistics:** column graphs, pie graphs, composite graphs, data tables
- **Spatial technologies:** satellite images
- **Visual representations:** photographs, flow charts, annotated images, sketches

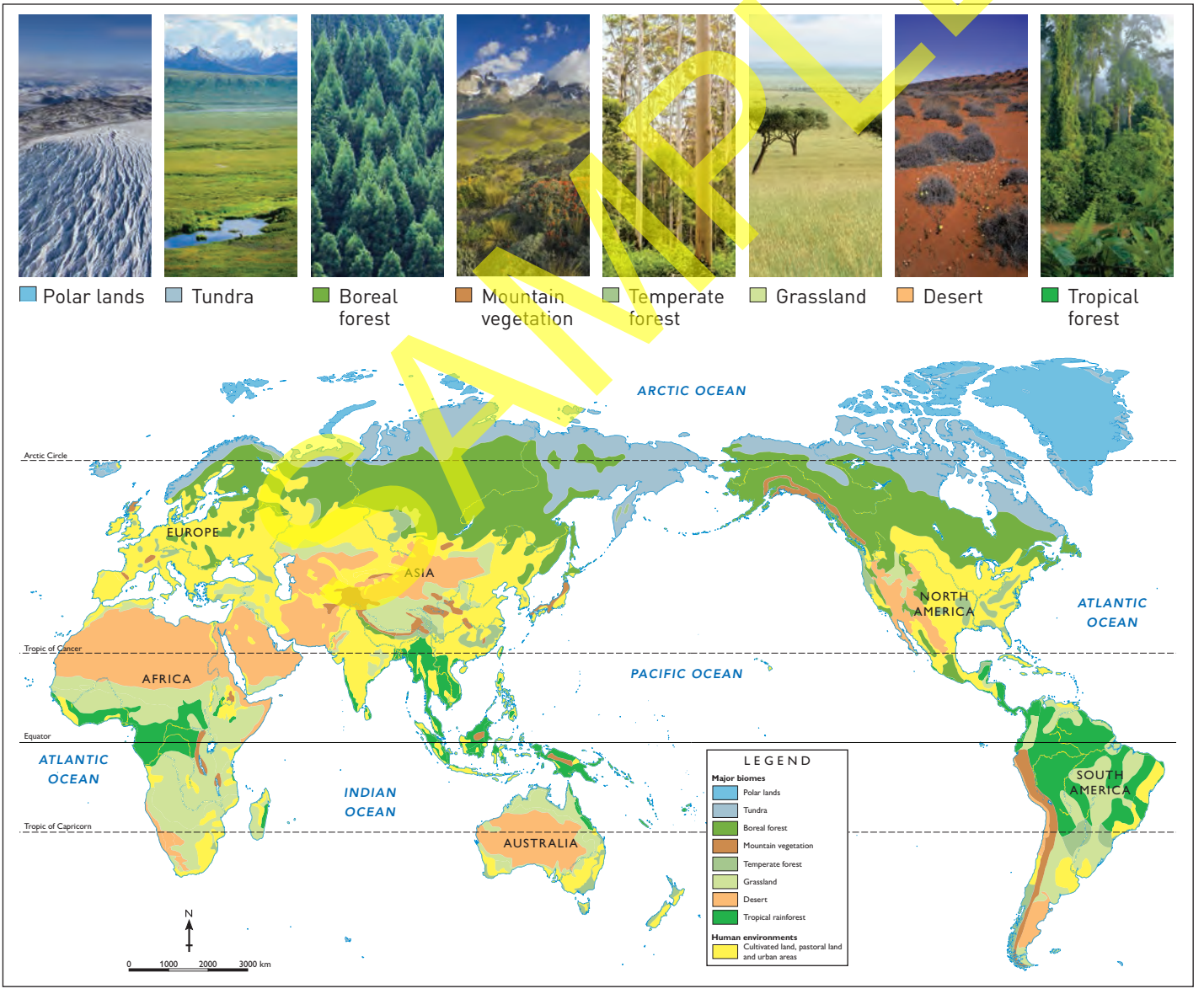
# 1.1 THE WORLD'S BIOMES

**WHAT ARE THE MAIN CHARACTERISTICS THAT DIFFERENTIATE THE WORLD'S BIOMES?**

In order to better understand the Earth's natural and human environments, geographers divide the Earth's surface into a number of distinct regions. Each region has particular features that make it different from other regions. One region may be hot and rainy most of the time, for example, and another might be dry and cold. This means the plant and animal life found there functions, adapts and interacts according to the conditions of the region it inhabits. Regions defined by landscapes that share similar climates and types of vegetation in this way are known as **biomes**.

In some biomes, such as **tropical forests** and grasslands, there is an abundance of plants and animals and therefore they are more able to sustain life. This is because the conditions favour a huge variety of species. A recent study of a Colombian rainforest, for example, found 596 bird species, 150 different species of amphibians and more than 200 species of mammals. Scientists estimate that there are more than 100 000 insect species per hectare in

WORLD: BIOMES




**Source 1.2**

Source: Oxford University Press

this rainforest and more tree species in a single hectare here than there are in the whole of North America. This explosion of life is due to the year-round high temperatures and rainfall in the region.

At the other end of the scale are the **tundra** and the **polar lands**, which are the coldest biomes. The tundra biome circles the North Pole. Tundra, meaning 'treeless plain', has short growing seasons, very little plant diversity and very low temperatures. Antarctica, a polar land, is twice the size of Australia and contains virtually no native land species. Only two flowering species of plants exist on the continent and the largest native land animal is a 1-centimetre-long wingless midge. There are no native mammals, amphibians or trees in Antarctica. It is simply too cold, too dry and too windy for plants and animals to flourish.

In the **mountain vegetation** biome, too, cold conditions determine plant life and the animals that live there. Plants in the mountain vegetation biome tend to be low and hug the ground to preserve warmth. The mountain vegetation biome has a long winter period, and animals that live in these areas need to be able survive the cold and the exposure to UV radiation.

**Aquatic biomes** exist too. The world's oceans, freshwater lakes, coral reefs and wetlands are all examples of these biomes, which are dominated by water and the plants and animals that call them home.

### STRANGE BUT TRUE

Epiphytes are plants that live happily together on other plants and depend on the air to bring them moisture and nourishment. Parasitic plants take nourishment from their host plants, directly feeding off them.

**Source 1.3** A red-eyed tree frog in the rainforest of Panama in Central America is one of the many species that lives in this rainforest biome.

**Source 1.4** A juvenile mountain gorilla in the tropical mountains of Varunga National Park (Democratic Republic of the Congo). Mountain gorillas today are endangered, numbering fewer than 1000 due to local poaching for their meat.

**Source 1.5** Wildebeest migrate the grasslands of Africa in search of fresh grasses after the monsoonal rains.



## REVIEW 1.1.1

### Remember and understand

1 What is a biome?

2 Why is there such an abundance of life in a rainforest?

### Apply and analyse

3 Where are the world's tropical forests located? Why do you think they are located in these places?

4 Describe the distribution of biomes in Australia.

### Investigate and create

5 Design a world tour that includes at least one visit to each type of biome. Research where you will go using a map that shows the world biomes, and then list the countries you would visit on this tour. Include some of the activities you might do at each place, based on the biome's climate and geographical conditions.

6 Work with a partner to rank the world's eight major biomes from a habitat of 'most species' to 'least species'. Compare your list with other groups. Were there some rankings you all agreed on? Were there others where there was little agreement?

# BOREAL AND TEMPERATE FORESTS

## Boreal forest biome

The largest biome on land is not the hot **desert** or treeless tundra – it is the **boreal forest** biome. Boreal forest, sometimes called **coniferous forest**, is composed of coniferous, evergreen trees that have needle-like leaves and cones, like pine cones. This biome is characterised by having a low number of species of plants when compared with other forests in more temperate regions or in the tropics.

**Source 1.6** This Canadian paper mill is situated by a large body of water. Paper is made by pulping woodchips from logs and mixing the pulp with water.

The boreal forest biome covers vast areas in the Northern Hemisphere, between the Arctic tundra and the north of Europe, Asia and North America. While the climate in these regions is not as harsh as that experienced in the polar lands or on the tundra, it is still cold enough to limit the number of plant and animal species that can survive, and winter is long. In fact, the boreal forest's longest season is winter. Average temperatures fall to about –15°C and snow is common. In summer, which lasts only one to three months, temperatures climb towards 20°C and humidity is relatively high. The plants and animals that survive in this biome must be able to handle great variations in rainfall and temperature, as well as large areas of permanently frozen ground and poor soils.

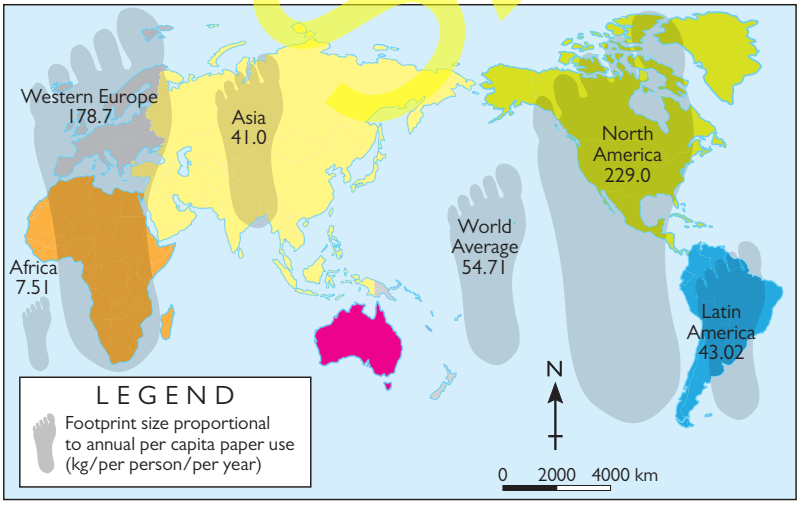
## Threats to the forest

Boreal forests have provided many important resources for people in both the past and the present. Historically, wood for construction, heating and cooking came from boreal forest trees. More recently, boreal forests have supplied the increased global demand for cheap wood and paper spurred by population growth and a change in global markets.

However, many boreal forests are under threat. One of the main threats to the boreal forest biome is the clearing of trees to make way for oil and gas exploration. It is estimated that huge reserves of petroleum products lie under the forests, and the ever-increasing demand for petroleum is pushing exploration into these areas.

In Canada and Russia, forests are logged extensively and many are being attacked by insect plagues and acid rain. Forests are also at risk from bushfires during the summer period. Climate change is causing some forest areas to spread further north. Rising temperatures in the Arctic region have seen the edge of the boreal forest slowly advancing northward, replacing tundra in some places.

WORLD: AVERAGE PAPER CONSUMPTION




**Source 1.7**

Source: Oxford University Press

## Temperate forest biome

Between the tropics and the cold polar regions is a large zone that is neither excessively hot nor excessively cold. For this reason it is called the temperate zone. The forests that grow in the temperate zone

experience a range of seasonal climate conditions. In winter, temperatures may fall below freezing and in summer they can climb above 40°C. In some temperate forests, rain falls reliably throughout the year. In others, there are more distinct wet and dry seasons.

Most of the world's population lives in the temperate zone and this has had a huge impact on the **temperate forest** biome over time. As the world's population spread and grew, temperate forest biome areas gradually became smaller. Cities were formed on land that was once covered in forest, and trees were cut down to clear land and to provide fuel and building materials. The forests gradually disappeared from these places. This happened in Europe, then in Western Asia and North America. Currently, little temperate forest remains in some of these places.

However, as explorers set out from Europe to colonise new lands, they often carried with them seeds and saplings of the trees with which they were familiar. They planted these in the places they travelled to, such as Australia, New Zealand and South Africa, and in this way temperate forest trees were spread around the world.

**Source 1.8** The spectacular deciduous trees in the town of Orange in NSW are mainly native to Europe half a world away.



## REVIEW 1.1.2

### Remember and understand

1 Describe the temperature variations experienced in the boreal forest biome.

2 How have trees from temperate forests spread around the world?

### Apply and analyse

3 What are some of the differences between boreal and temperate forests? What are some of the similarities?

4 Use the map in Source 1.2 to compare the distribution of temperate and boreal forests.

5 Why do you think the consumption of paper has increased dramatically in the last 50 years? What influence has this growth in demand had on the world's forests?

### Investigate and create

6 Examine Source 1.7, showing the average consumption of paper by person in each continent.

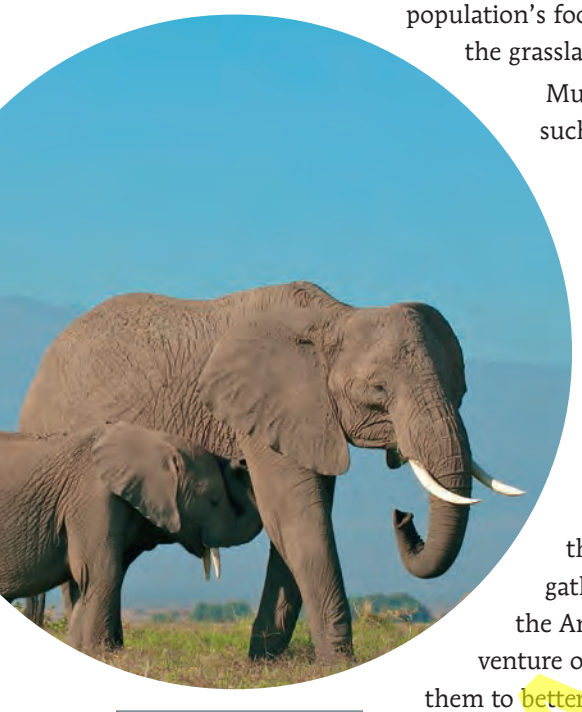
**a** Who are the biggest paper users? Who are the smallest?

**b** Australian consumption is not shown on this graphic. Draw the size you estimate Australia's paper footprint to be compared with one other continent. Explain how you decided on the size of Australia's footprint.

# THE GRASSLANDS BIOME

In places where it is too dry for forests and too wet for deserts lie a biome dominated by shrubs and grasses – the **grasslands** biome. In some places, regions that are part of this biome are also known as prairies, steppes or savannahs. In Africa the grasslands are often referred to as savannahs. In the United States of America they are often called prairies, and in parts of Siberia and south-eastern Asia, they are alternatively known as steppes.

Much of the world's food and fibre comes from plants and animals that live in the world's grasslands. Rice, wheat and corn, all grasses, provide the bulk of the human population's food, and many animals that are farmed to provide meat and milk also live in the grasslands biome.



**Source 1.9** Elephants on the savannah

Much of Australia can be considered grassland and many of our native animals, such as kangaroos, wallabies and wombats, thrive in this biome.

In Africa, too, grasslands dominate, covering more than half the continent. In this landscape the grassland is dotted with individual trees, providing little cover for the wildlife that live there. These grasslands support a variety of plant-eating mammals as well as predators that feed off them. The animals living here have developed an amazing array of physical and behavioural changes to adapt to the challenges of the open environment. The zebra's stripes, for example, make it difficult for a predator to see it clearly. The giraffe, one of the larger kinds of grasslands inhabitants, has evolved in such a way that its long neck allows it to source food at the tops of trees.

Many other animals that live in the grasslands are nocturnal, allowing them to avoid the main heat of the day and venture out at night to hunt and gather food. These animals include the prairie dog, barn owl and grey wolf of the American prairies, which all scout for food at night. Smaller mammals also venture out in the cool of the night, often when the moon is full or near full, to allow them to better spot animals that may be seeking them out as prey.

Many grasslands around the world have changed greatly over time. Some of these changes are the result of human activities, such as introducing grazing animals to a grasslands environment. Grazing animals such as cattle, sheep and goats compete with native species for food and often trample the ground, damaging the roots and soil structure.



**Source 1.10** An Asian steppe

**Source 1.11** A bison on the prairie

## KEY CONCEPT: CHANGE

### The American prairie

The prairies of North America were once dominated by Indigenous American tribes, such as the Cheyenne, Apache and Comanche tribes.

The Comanche lived in the grasslands in the region, which now includes Texas, Oklahoma and Kansas, in the United States. They were typical of many of the Indigenous tribes of North America. Their main food source was bison and they followed the great herds across the plains, as the bison travelled to find the best grazing. When the bison stayed in one location to eat the plentiful grass, the Comanche set up temporary villages. Then they moved with the bison when better grazing lands were needed. The bison provided more than food for the Comanche: their hides were used to make clothing and the distinctive pyramid tents, called tepees.

Some tribes hunted bison by building fences from fallen logs, and then herding the bison into a small area where they were killed with arrows and knives. Herding massive animals such as bison was difficult for tribesmen on foot. With the arrival of European explorers, and their horses, about 400 years ago, however, life for Native Americans changed dramatically.

Many tribes, including the Comanche, quickly realised the potential of using horses in their culture and soon became expert horsemen. As well as being faster and more nimble than bison, horses had one other great advantage for the grasslands tribes. Like bison, horses are grazing animals that eat grass. This meant that the tribes could move easily across the plains following the gradual movement of the bison herds; the grasslands now feeding both bison and horses.

But as European ranchers moved across the prairies through the 16th to 19th centuries, the numbers of Native Americans and their way of life gradually disappeared. Much of the vast grasslands of the prairie were turned into grazing land and farmland by the European settlers. However, the open plains remain an iconic image of American history and the American pioneering spirit.

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

**Source 1.12** With the arrival of the horse, tribesmen could hunt bison more easily.

**Source 1.13** It is estimated that 30 million bison lived in North America in the 1500s. Within 400 years this had fallen to about 1000. In this photograph, taken in the 1870s, a pile of bison skulls waits to be crushed for fertiliser.



## REVIEW 1.1.3

### Remember and understand

1 Why is the grasslands biome important for human populations?

2 What changed the grasslands of North America?

### Apply and analyse

3 Examine the map in Source 1.2 showing the distribution of the world's biomes.

- **a** Describe the distribution of grasslands in each continent.
- **b** What relationship do you notice between grasslands and human environments such as cultivated land and urban areas?
- **c** Why does this relationship occur?
- **d** Examine the three images of grasslands from different parts of the world (Source 1.9, Source 1.10 and Source 1.11). In which countries do you think each of these photographs was taken? Describe the slight differences in the images and give some reasons for your chosen country.

### Investigate and create

4 Compare the images of the grasslands with the pictures of Australia's deserts that appear in Source 1.21 on page 54. What are some of the main differences between the two biomes? Explain why these differences occur.

# THE TROPICAL FOREST BIOME

It is estimated that about half of all the plant, animal and insect species in the world live in tropical forests. Many of these are among the wettest places on Earth and are therefore known as **rainforests**. They can be considered to make up the world's richest biome and the abundance of life can be astounding. In Brazil, for example, researchers found that a single pond contained more fish species than exist in all of Europe's rivers. In Peru, a single tree was found to contain 43 ant species; this is more than the total number in all of the British Isles. One hectare of South American rainforest may contain over 750 different types of trees, and one-fifth of all of the world's birds live in the Amazon rainforest. This explosion of life is due to the ideal growing conditions that occur in the tropics.

These places experience the most stable climate conditions on the planet with virtually no seasonal changes in rainfall, temperature or available sunlight throughout the year. Most days are the same in the rainforest: hot and wet. It rains virtually every day, often in torrential downpours. The temperature hovers between about 26°C and 32°C all year round.

EASTERN AUSTRALIA: RAINFOREST REGIONS

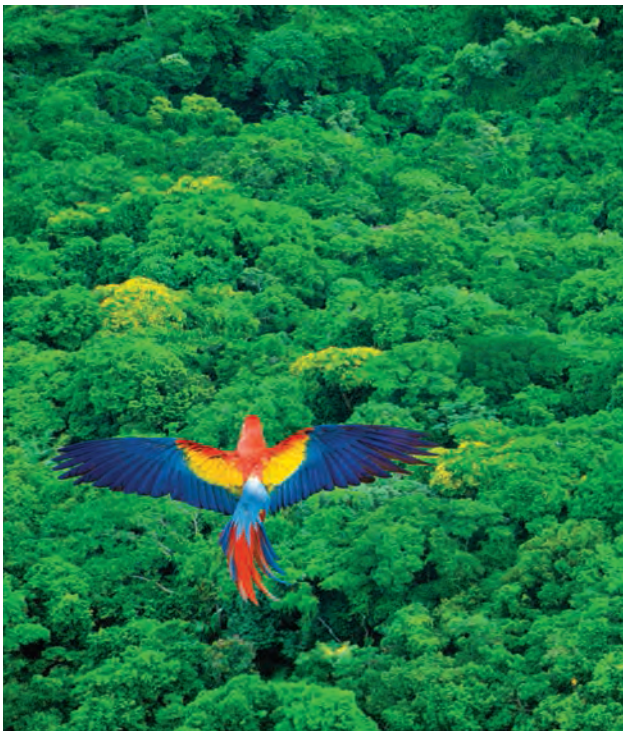

**Source 1.14**

Source: Oxford University Press

## Australia's rainforests

Though much of Australia was once covered in forest, now there are only a few small pockets near the east coast (see Source 1.14). Rainforests now make up only 2.5 per cent of Australia's remaining native forest. This surviving forest, however, is a real Noah's Ark for many plant and animal species, many of which exist nowhere else in the world. There are more than 1000 species of plants in Australian rainforests, of which about 700 exist nowhere else. These plants support thousands of insect species, hundreds of reptile and bird species and nearly 90 different types of mammals. The subtropical rainforests of New South Wales and Queensland are also internationally recognised for their direct links to the world's first flowering plants, which happened about 100 million years ago.

**Source 1.15** Tropical rainforests cover the slopes of many Queensland mountains and experience Australia's highest rainfall. The Daintree rainforest near Port Douglas is the oldest continuously surviving rainforest in the world.



**Ecosystem services**

About 80% of the plants we eat began in the world's tropical rainforests. Potatoes, corn, rice, avocadoes, oranges, bananas, coffee, chocolate and hundreds of other foods are rainforest plants.

About 25% of the drugs we use to treat illnesses, from leukaemia to headaches, come from rainforest plants.

Rainforest plants take in carbon dioxide and produce oxygen. The Amazon rainforest alone is thought to produce about one-fifth of the world's oxygen.

Rainforests regulate the Earth's temperature and rainfall, and hold much of the world's fresh water.

Rainforests in Africa, Asia, South America and Australia are home to Indigenous peoples.

Products such as toothpaste, golf balls, rubber tyres, paints, cosmetics, steroids and cork are all made from rainforest plants.

**Source 1.16** A scarlet macaw flies over the world's largest rainforest – the Amazon. The Amazon provides many ecosystem services.

# The gifts of the rainforest

Rainforests have provided humans with many resources for thousands of years. These resources are known as **ecosystem services**. Rainforests provide many services, including the ones described in Source 1.16.

**Source 1.17** Temperate rainforests are found in the temperate climate zone. Like tropical rainforests, they receive an abundance of rain and take in high amounts of carbon dioxide. However, they do not have the same levels of biodiversity as the tropical rainforests. The temperate rainforests of Tasmania and Victoria are characterised by ferns covering the ground and tall trees, some of them among the world's tallest.

## REVIEW 1.1.4

### Remember and understand

1 Use the map showing the world's biomes (Source 1.2) to describe the distribution of the world's tropical forests.

2 What are some of the links between the world's climate and rainforests?

### Apply and analyse

3 Describe the distribution of Australia's rainforests. Refer to particular places and states and use compass directions in your answer.

4 What are some of the differences between tropical and temperate rainforests?

### Investigate and create

5 Why do you think the amount of rainforest in Australia has decreased so much? Consider both natural processes and human activities.

6 What information from these pages would you use to explain the importance of rainforests?

7 Clearing of rainforests for farming, mining and urban development makes the tropical forest biome one of the world's most endangered.

**a** How might the clearing of a rainforest impact on people who live in it or nearby?

**b** How might it impact on people living in places that are further away?

# GOING WITH THE FLOW IN THE RAINFOREST

A rainforest, like all **ecosystems**, is a very dynamic place. Complex relationships between the climate (including rainfall, temperature, wind, humidity and sunlight), the shape of the land, soils, plants and animals have developed over millions of years and keep the rainforest alive and flourishing. A change to any part of the ecosystem can have devastating consequences for the whole ecosystem. The cross-section in Source 1.18 shows some of the flows of energy (intangible sources of power or nutrition) and matter (tangible sources of power or nutrition) that exist in a rainforest.

## Changes in the rainforest

It might seem logical that rainforests must have a deep rich layer of soil to support the great trees and other plants that flourish there. However, this is not the case. The heavy rain washes the nutrients of the soil deep into the ground where the roots of the plants cannot access them. The rainforest trees are able to survive in these soils because they have developed wide-spreading roots and the warm temperatures in the tropics allow leaf litter – dead plant material that has fallen to the ground – to be quickly recycled into plant nutrients.

When the rainforest plants are cleared to make way for farms, these nutrients are quickly lost and the soil becomes exposed to the heavy rain and tropical sun. Farmers often find, contrary to expectations, that their plants do not thrive in these conditions and the soil provides few of the nutrients the plants need.



SKILL DRILL

### Creating a flow diagram

Geographers use **flow diagrams** to show the movement, sequence or stages in a process. Flow diagrams can be created by adding text and arrows to an image, or by creating text boxes from scratch, joined by arrows, to describe the flow of a process.

You can create a flow diagram by following these steps:

**Step 1** Decide on a process you want to describe. For example, you might want to describe the life of an apple, from seed to compost stage.

**Step 2** Jot down the steps you wish to highlight in the process. Try to keep each step clear and separate.

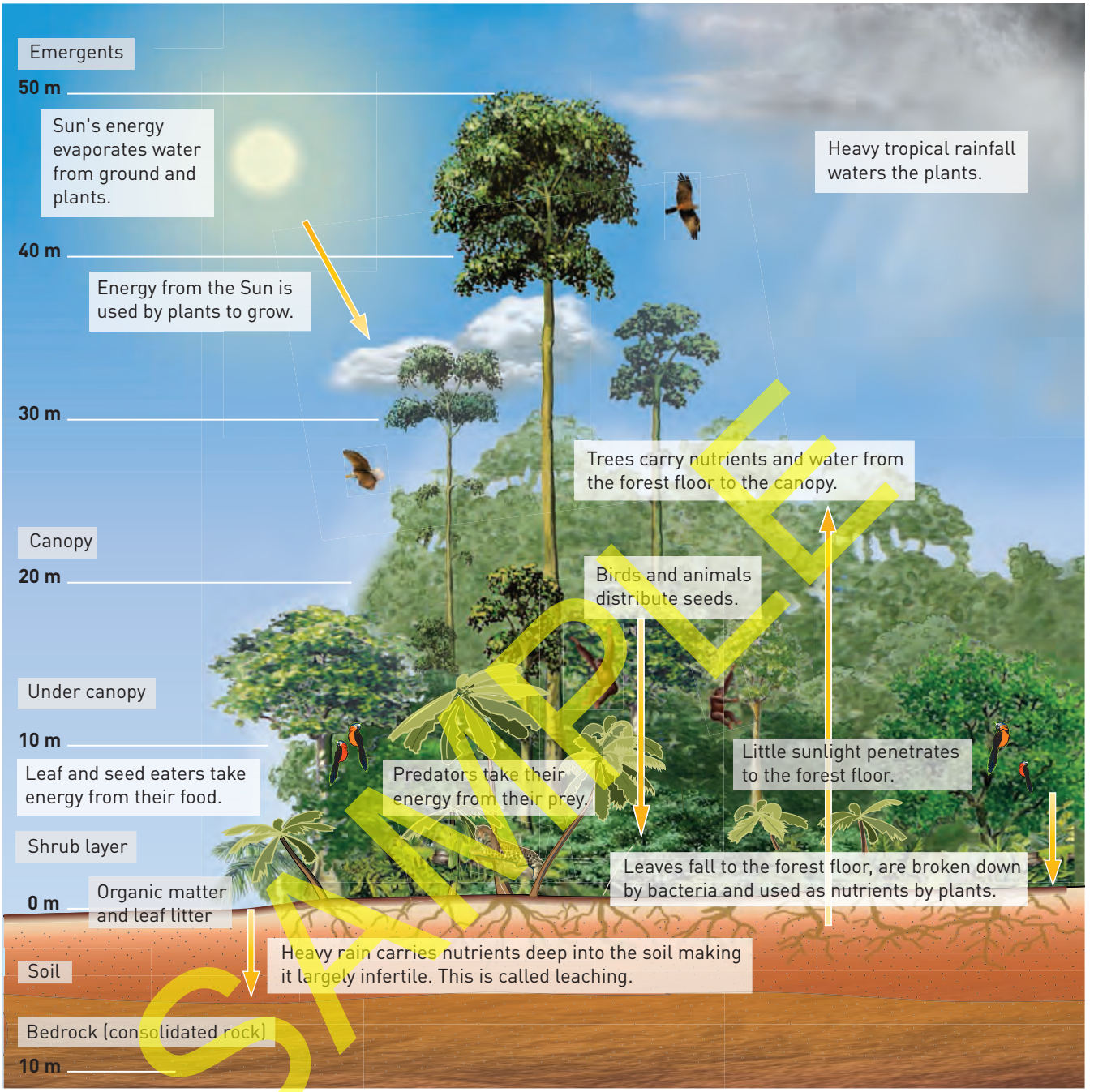
**Step 3** Create a text box for each step, and write or insert your text in each box.

**Step 4** Link each step with an arrow showing the direction of the process. Read through your diagram to make sure the steps you have included are logical and that you haven't missed any important parts of the process you are aiming to describe.

You can also create a flow diagram by adding your arrows and text to an existing image, following the process described here.

#### Apply the skill

**1** Use the steps above to construct a flow diagram of your own. Use the picture and labels of the rainforest from Source 1.18 to describe the flow of energy and matter that would occur between the different elements of the rainforest and the plants and animals that inhabit it.




**Source 1.18** Cross-section of a tropical rainforest



## REVIEW 1.1.5

### Remember and understand

1 Look at the illustration of the rainforest in Source 1.18 and identify an interaction that takes place between animals and plants.

2 What effect do you think there would be on the rainforest ecosystem if this interaction no longer occurred?

### Apply and analyse

3 Why are rainforest soils poor in nutrients?

4 How have rainforest trees adapted to the poor soils in the rainforest?

5 Describe how water is moved through the rainforest.

### Investigate and create

6 What changes of movement in energy and matter would result if the trees and vegetation in Source 1.18 were cleared to make way for farming land? Consider the living and non-living inhabitants of the ecosystem.

CASE STUDY

# THE KOKODA TRAIL

Papua New Guinea is a country with vast areas of rainforest. The forest covers the slopes of rugged mountain ranges such as the Owen Stanley Range. The Kokoda Trail crosses this range and was the location of fierce battles between the Australian and Japanese armies in the Second World War. The area is notable for steep mountainsides, dense rainforests and heavy rainfall. This turns the trail into a sea of mud and makes progress along it very difficult. Many Australians attempt to walk the trail every year to achieve personal goals, which perhaps include gaining an appreciation of the difficulties faced by the soldiers during the war.

SKILL DRILL

## Estimating gradient and aspect on topographic maps

Estimating gradient (angle of the slope) and aspect (direction of the slope) is an important skill for geographers to master. These factors also play a major role in determining the types of plants and animals that may live in a given area. Conditions may differ greatly across a small area if one part is almost always in shade (aspect) or exposed on steep slopes (gradient).

### Estimating gradient

Using a topographic map, it is possible to estimate the gradient between two points, by following these steps:

**Step 1** Determine the height of the two points. For example, examining Source 1.20, Owens Corner (186, 530) is at 600 metres and The Gap (241, 588) is at 2190 metres.

**Step 2** Estimate the difference in height between these two points (known as the rise): 2190 – 600 = 1590.

**Step 3** Estimate the straight line distance (the run) between these two points using the line scale. This is 40 km or 40 000 metres in this example.

**Step 4** Divide the rise by the run and multiply this by 100: (2190/40 000) × 100 = 5.5% slope.

### Estimating aspect

The aspect refers to the compass direction that the slope is facing. This is also simple to work out by following these steps:

**Step 1** Using the information we found out when estimating the gradient we can tell that the terrain slopes down from The Gap (at 2190 m) to Owens Corner (at 600 m).

**Step 2** Imagine an arrow from The Gap to Owens Corner and estimate the direction of this arrow using the north arrow. This arrow would be pointing south-west. The aspect, along this entire section, is therefore south-west. Aspect can also be calculated at a particular point. To do this draw 'your arrow' perpendicular to the contour lines, pointing downhill. You've worked out the aspect standing at that specific location.

### Apply the skill

1 **a** Estimate the aspect and gradient of the slope between The Gap and Kokoda (241, 638).

**b** Is this slope less steep or steeper than the slope between Owens Corner and The Gap?

2 Estimate the gradient and aspect for the slope between The Gap and Mt Kenevi (266, 584).

3 Estimate the aspect for the slope at (247, 615).

4 Provide three pieces of evidence that this landscape is very rugged and mountainous.

5 Estimate the total length of the Kokoda Trail from Owens Corner to Kokoda.



## REVIEW 1.1.6

### Investigate and create

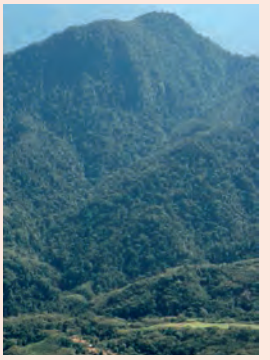
Conduct some further research on the Kokoda campaign and then complete the following tasks.

1 Which of the world's major biomes are shown on this map of the Kokoda Trail area (Source 1.20)?

2 What is the relationship between forest and terrain in this environment?

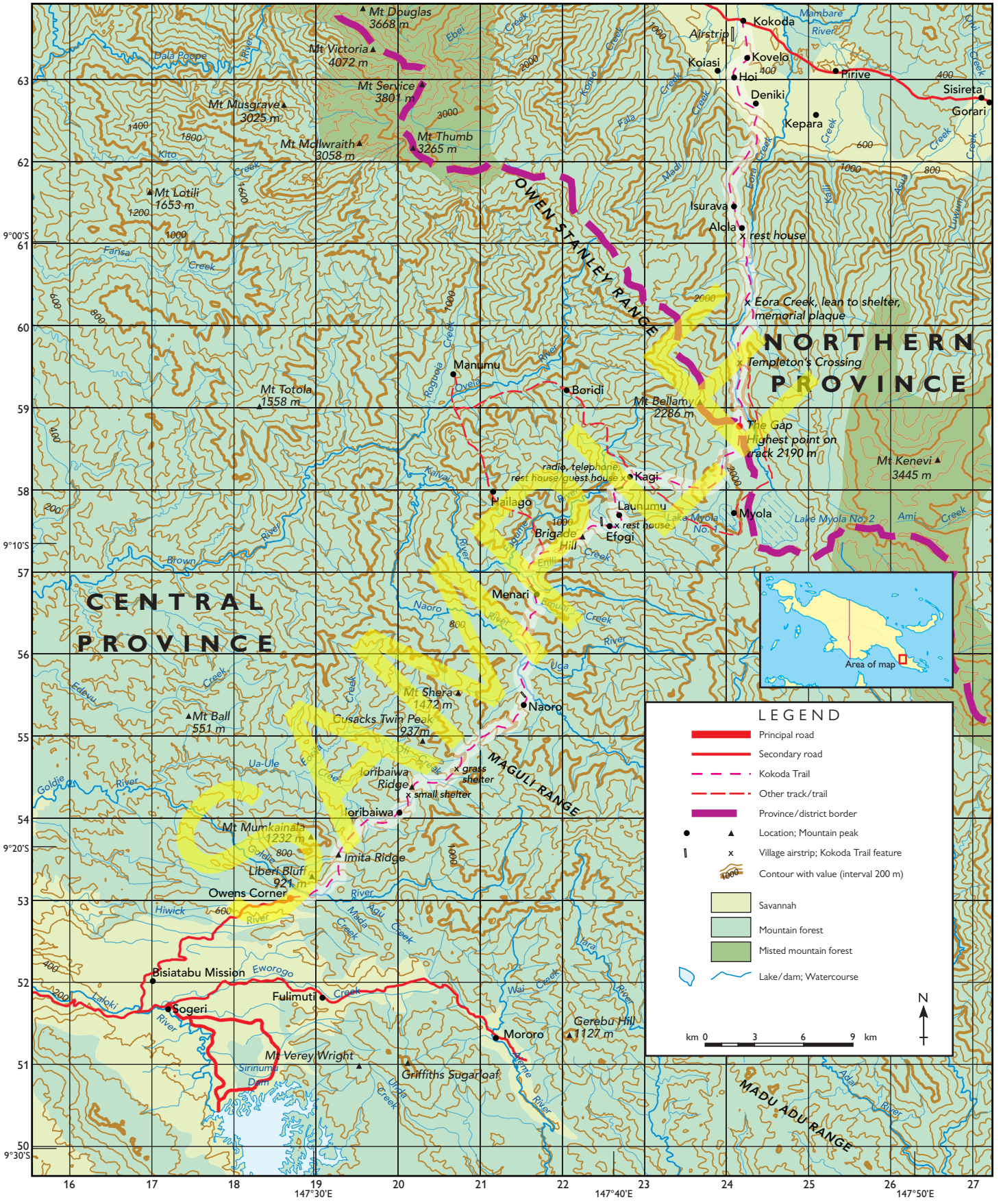
3 Explain why you think this relationship occurs.

4 Research the Kokoda campaign that took place between July 1942 and January 1943. Focus on the ways in which the natural environment (landforms, forest and rainfall) influenced the soldiers and the campaign.



**Source 1.19** The rugged terrain of the Owen Stanley Range, Papua New Guinea

## PAPUA NEW GUINEA: KOKODA TRAIL




**Source 1.20**

Source: Oxford University Press

# 1.1

CHECKPOINT

## WHAT ARE THE MAIN CHARACTERISTICS THAT DIFFERENTIATE THE WORLD'S BIOMES?

- **Investigate the distribution and physical characteristics of biomes.**

1 Considering the variety of biomes that exist across the world, why is it that Australia also has a wide variety of biomes? (Hint: Refer to Sources 1.21 to 1.23.) [5 marks]

2 Explain why latitude, but not longitude, plays a major role in the types of biomes that exist. [5 marks]

3 Outline why there are limitations to describing places according to just their dominant biome. [5 marks]

4 What is the dominant natural biome where you live? [5 marks]

5 Describe some of the ways in which this biome has been altered by human activities. [5 marks]

TOTAL MARKS [ /25]

## RICH TASK

### Australia's biomes

Many of Australia's original biomes have been changed by human activities. More than half of Australia's total land area is now used for food production, particularly sheep and cattle farming, covering 430 million hectares of land. This has resulted in significant changes to vegetation, land and water. Source 1.22 shows Australia's original biomes before they were changed by human activities.

### Australia's deserts

Australia is the second driest continent in the world, after Antarctica. The combined area of the 10 biggest Australian deserts makes up about 18 per cent of the total land area of our 'wide brown land'. We can describe Australia as **arid** or **semi-arid** because 70 per cent of the continent receives fewer than 500 millimetres of rainfall each year. Low rainfall has resulted in large desert areas across Australia.

Many people think of deserts as being entirely composed of large sand dunes, with the occasional date palm or cactus as the only sign of life. This image may come from movies or pictures they have seen of deserts around the world.

However, while the Sahara Desert in Africa does have date palms and sand dunes and most North American deserts have cactuses, there are variations within the desert biome. Some desert areas in Australia have large areas of red dunes, for example, while others are covered in vast areas of stones, called gibber plains.

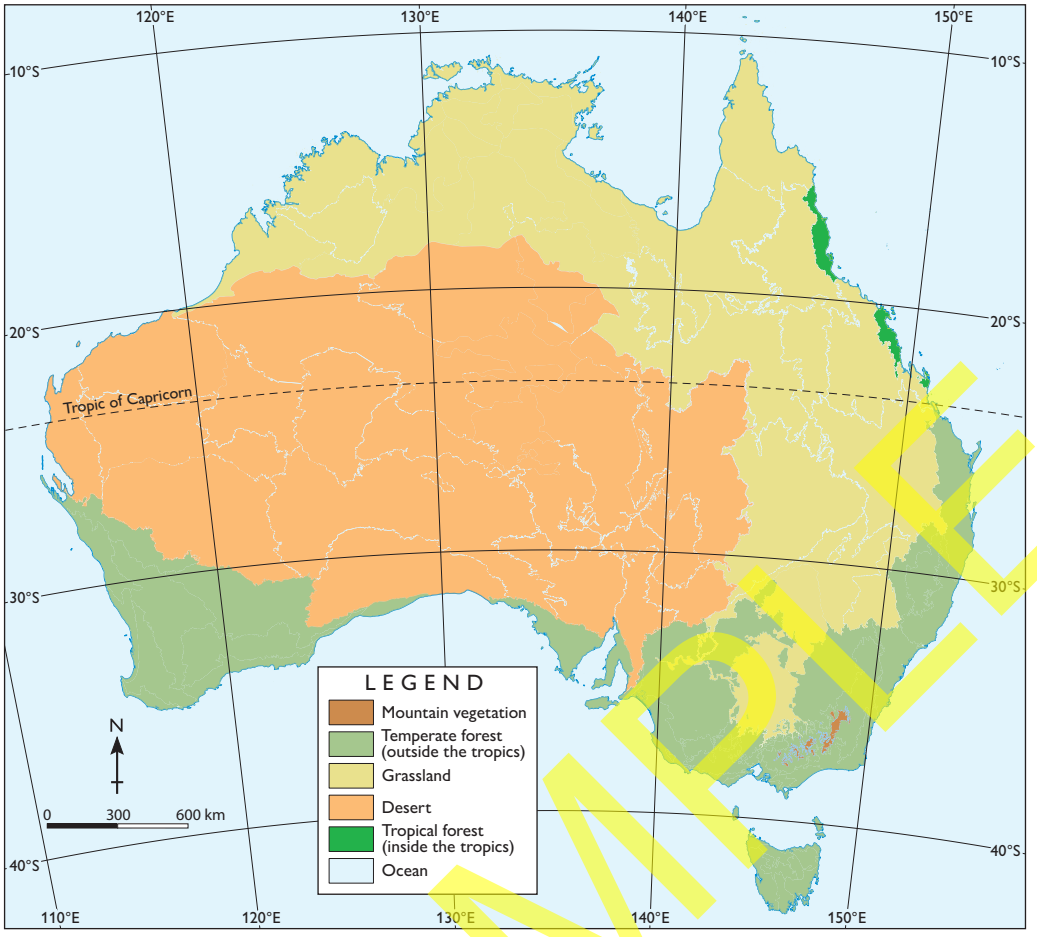
**Source 1.21** Different Australian desert landscapes: spinifex grass in the Great Sandy Desert (top); acacia trees in the Great Victoria Desert (middle); stony plains in the Simpson Desert (bottom)

In most of Australia's desert areas, grasses and low shrubs dominate the landscape (see Source 1.23). In the tropical deserts north of the Tropic of Capricorn, spinifex and tough Mitchell grass cover much of the ground. South of the tropics, woodland deserts are more common, with hardy acacia trees, such as the mulga and witchetty bush, in evidence.

### Acquiring geographical information

1 Compare Australia's biomes in Source 1.22 with the world's biomes in Source 1.2 and answer the following questions.

## AUSTRALIA: BIOMES




**Source 1.22**

Source: Oxford University Press

**a** Which biomes do not exist in Australia?

**b** Give a reason for each of these biomes being 'missing' in Australia.

### Processing geographical information

**2** The world biomes map (Source 1.2) shows large areas of desert, while the three images in Source 1.21 show us that there are significant variations in landscape within the desert biome.

**a** Why do you think there are such variations within the desert biome?

**b** Research one of the other biomes to find out if such variations exist in that biome's regions too.

### Communicating geographical information

**3** Construct a collage or create a PowerPoint/ Prezi display of Australia's major biomes. Include at least one image of each biome.

**Source 1.23** About one-third of Australia's total land area is used for cattle farming.

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

- Concepts: Space, Environment, Interconnection, Scale, Change
- Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
- Tools: Maps, Fieldwork, Visual representations

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

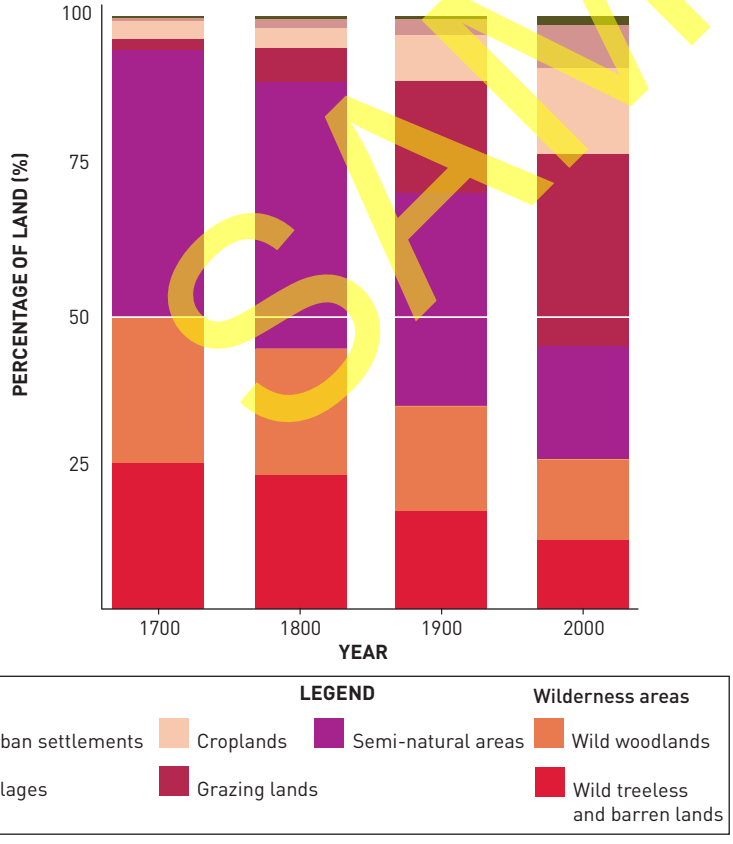
CHECKPOINT

# 1.2 CHANGES TO THE NATURAL ENVIRONMENT

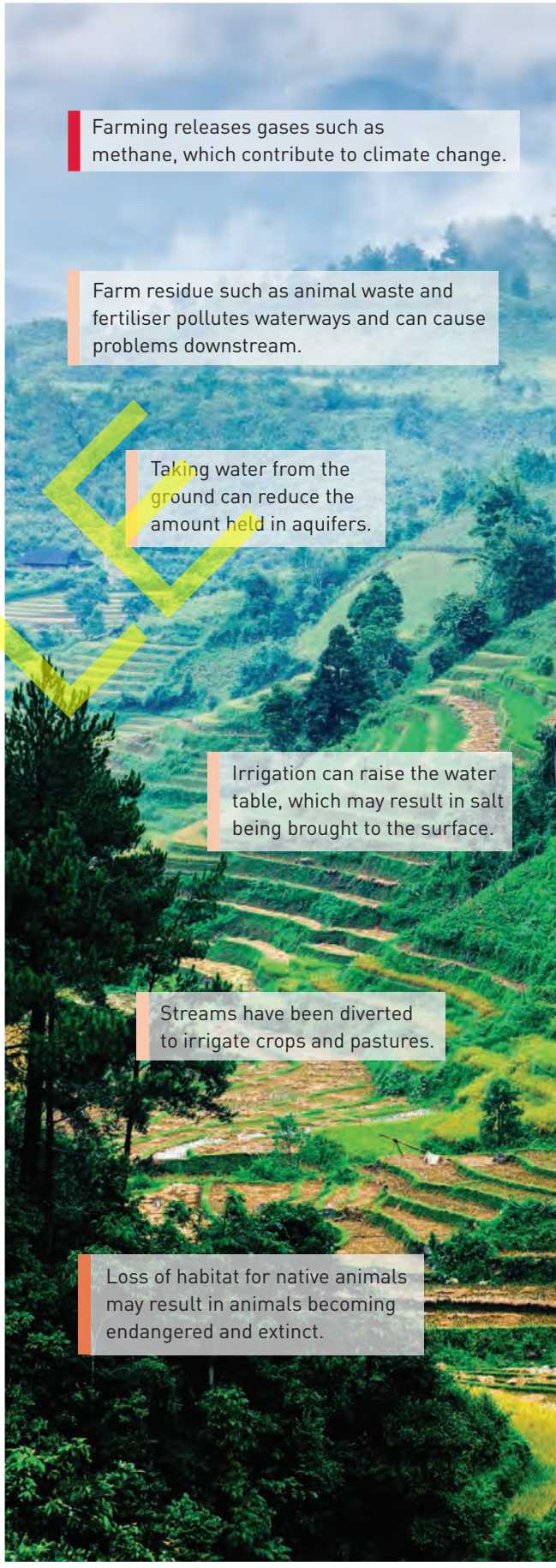
## HOW DO PEOPLE USE AND ALTER BIOMES FOR FOOD PRODUCTION?

The last 300 years have seen more extensive change to the Earth's biomes than in any other period in the Earth's history. Over half of the world's land area that is considered habitable has now been converted into farmland or housing to provide food, fibre, shelter and fuel to the world's people – and this area is expanding.

All around the world the natural biomes of forests, grasslands, tundra and even deserts are being converted into farms. In some places, large corporations are converting the land but in most places it is the work of small-scale farmers, each motivated by the need to provide food for their own families. Source 1.24 shows the extent of biome change around the world since 1700.




**Source 1.24** Changing land-use patterns worldwide between 1700 and 2000.




**Source 1.25** Some of the changes made to a landscape in China that is being used for farming.


## REVIEW 1.2.1

### Remember and understand

1 How much of the world's habitable land area has been converted into farms?

2 Name three potentially negative impacts that farming can have on the environment.

3 List two changes made on the Chinese farm in Source 1.25 that involve altering irrigation practices.

### Apply and analyse

4 Examine Source 1.24 and then complete the following.

- **a** Describe the change to the amount of wilderness areas from 1700 to 2000.
- **b** Use the world biomes map (Source 1.2) to classify the wilderness areas remaining today.
- **c** Which type of land use has increased the most? Why do you think this is the case?
- **d** The labels for Source 1.25 are in four different colours. Suggest a title for each colour.

### Investigate and create

Conduct some further research on the internet to complete these tasks.

5 Examine the image of a Chinese farming landscape as shown in Source 1.25. Describe the landscape as you think it would have been before people arrived in this valley.

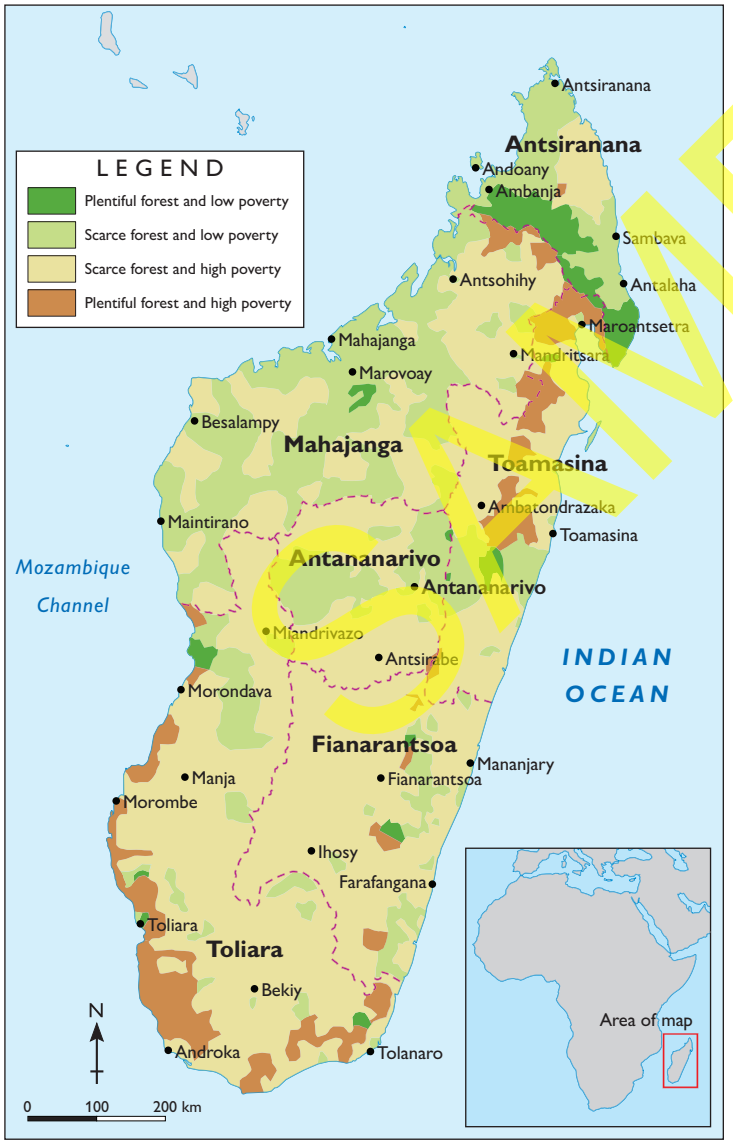
6 The labels on this image focus on the ways in which people have changed the landscape. What are the underlying causes of these changes?

7 Work together as a class to plan and conduct an informal debate about changes to the natural environment. The debate topic should be: 'A small-scale farmer should have unlimited capacity to farm their own land for the purpose of providing food for their family and community'. Students should be allocated to a team. One chairperson should be selected to moderate the debate. All arguments should be logical and well thought out and presented in appropriate language.

# CHANGING VEGETATION AND WATER

**Source 1.26** A woman in Madagascar plants a food crop on a burnt hillside.

### MADAGASCAR: DEFORESTATION AND POVERTY LEVELS




**Source 1.27**

Source: Oxford University Press

Farmers make many changes to the natural environment in order to grow crops and raise farm animals. The greatest changes are made to the natural vegetation. Forests are cut down, burnt and replaced with a single plant species, wetlands and swamps are drained and vast areas of native grasses are replaced with crops such as wheat and rice.

## Changes to forests

Around the world about 5 million hectares of forest is converted for agricultural use every year: an area about two-thirds the size of Tasmania. Most of this change takes place in tropical forests, particularly in South America and Africa. Few forests in regions such as North America and Australia have been converted into farmland in recent years, largely because most of the forest has already disappeared. In Australia, for example, around 50 million hectares of forests and woodland have been cleared for farming or affected by logging since European settlement.

In the developing world, there is a strong link between **deforestation** and poverty (see Source 1.27). Millions of people who live below the poverty line and struggle to meet their daily food requirements are becoming small-scale slash-and-burn farmers. They use a machete to slash the undergrowth in forests and then set it alight to clear the land. Seeds are thrown into the warm ashes and in this way a forest has been converted into a farm. The types of farm animals that small-scale farmers raise, such as goats and dogs, push deeper into nearby forest areas to forage for food. Over time, as soil fertility declines, the farmers and their animals move into a new patch of forest and begin the process again. In Madagascar, for example, where 80 per cent of the population lives in poverty, only 10 per cent of the natural forest remains.

KEY CONCEPT: SUSTAINABILITY

## Greening the desert

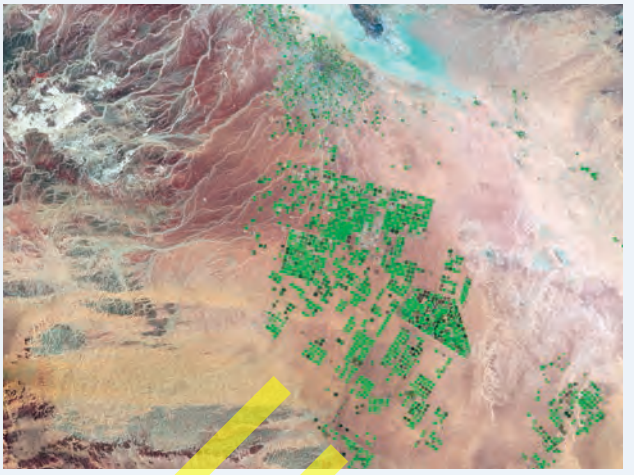
The types of changes being made to tropical rainforests and grasslands in South America and Africa for agricultural use are also being made to biomes in other parts of the world. In Saudi Arabia, for example, sections of the desert have been transformed into farmland for the purpose of growing crops.

Only a few centimetres of rainfall naturally in the Saudi Arabian desert each year, but crops can still be grown there thanks to large **aquifers** deep beneath the Earth's surface. These aquifers contain water that was trapped between layers of rock during the last Ice Age. They also store water that has fallen as rain over hundreds of thousands of years.

In Saudi Arabia, water is extracted from the aquifers by drilling deep into the ground under the desert floor and pumping it to the surface. Once on the surface, the water is pumped through a circular sprinkler system. This is known as centre-pivot irrigation. Sources 1.28 and 1.29 show the dramatic increase in centre-pivot irrigation in Saudi Arabia from 2000 to 2012. These satellite images show healthy vegetation in bright green, dry vegetation in orange and barren soil in pink. Each circular field shown in green is approximately 1 kilometre wide.

Because of the increasing rate at which water is being used, geographers and environmental scientists now believe that this type of farming has become unsustainable – both environmentally and economically. In time, supplies of water in the aquifer will become totally depleted as they are being used far more quickly than they can be replenished. The high cost associated with accessing water from the aquifers also means that crops grown in this way will soon become too expensive to buy.

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



**Source 1.28** Satellite image of the Saudi Arabian desert in 2000

**Source 1.29** Satellite image of the Saudi Arabian desert in 2012



# Changes to grasslands

Because the world's most important food crops – rice, wheat and corn – are grasses, they grow best in the world's grasslands biome. However, clearing of native grasses to plant these crops can have devastating effects on the natural environment. Across much of Australia, North and South America, Asia and Africa, native grasses have been cleared and replaced by these three crops to provide food.

**Source 1.30** Fields of wheat have replaced native grasslands across much of central America.

This farming then has a further impact on the biome. Because the rice, wheat and corn crops are harvested for human consumption, none of the nutrients from the plant material is returned to the soil. As a result, the soil fertility falls. This means farmers need to add chemical fertilisers to the soil, which further changes its composition. This can impact on the ability of the soil to hold water and can pollute waterways and coasts. Pesticides used to control weeds and insects also pollute the air, soil and water and may kill native plants and animals. Exposed soil becomes vulnerable to erosion by wind and rain and is washed away. Clearing of native grasses to make way for farming has many flow-on effects.

**Source 1.31** Conversion of the world's natural grasslands

| Case study regions | Existing grasslands (% of natural cover) | Estimated conversion of natural grasslands (%) | | |
|---|---|---|---|---|
| | | Crops | Cities | Other |
| North American prairie | 9.4 | 71.2 | 18.7 | 0.7 |
| South American savannah | 21 | 71 | 5 | 3 |
| Asian steppe | 71.7 | 19.9 | 1.5 | 6.9 |
| Sub-Saharan African grasslands | 73.3 | 19.1 | 0.4 | 7.2 |
| South-west Australian grasslands | 56.7 | 37.2 | 1.8 | 4.3 |

## Changes to water

Water is one of our most important resources, and agriculture is by far the greatest consumer of water around the world. About 70 per cent of the available water supply is used for agriculture, mostly for irrigation. Once water has been used to grow crops and given to animals to drink, it is, of course, returned to the environment. However, the farming process can change the quality of the water significantly, making it unsuitable for other uses and for the natural environment.

**Source 1.32** This Filipino farmer is spraying his rice crop with a pesticide to control insect pests. His fields drain into Laguna Bay, which is one of the world's most polluted water bodies and also home to a large freshwater fishing industry.

## Water pollution from farming

The water that is used on farms eventually flows through soil and rocks into nearby streams and rivers. Bare soil that is not protected by plants and held together by their roots can be washed away in the process, causing streams to become so cloudy that sunlight cannot reach the stream bed. This often kills many aquatic plants and animals.

Fertilisers such as nitrogen, phosphorus and animal manure can also end up in lakes and rivers, causing algae to grow out of control. This starves the water of oxygen and creates 'dead zones' in the water. Upon entering water sources, pesticides used in farming to control insects and weeds can poison fish and native animals, as well as kill the plants that create their habitats.

## Changing natural water flows

In many places, rivers are dammed to create a large reservoir of water that can be used for irrigation. In the last 50 years the amount of water held in dams has quadrupled and the volume of water taken from rivers and lakes has doubled. Most of this water is used for farming. The reduced volume of water in the rivers creates major problems for the natural environment and downstream users. In the lakes near the mouth of Australia's Murray River, for example, the water can be five times saltier than the sea partly because so much has been extracted for farming that the river cannot flush out the naturally occurring salt.

### REVIEW 1.2.2

#### Remember and understand

1 Describe the link between poverty and deforestation in your own words.
2 Is the scene in Source 1.30 a natural or human environment? Give evidence from the source for your answer.
3 How might the farmer shown in Source 1.32 affect the quality of fresh water?
4 How can fertilisers that are used on a farm eventually reach and kill fish?

#### Apply and analyse

5 Carefully examine Source 1.26.
   - **a** List the changes that you can see to the soil, vegetation and water that have taken place in this environment.
   - **b** Add changes that are likely to have occurred that you cannot see.
   - **c** Why has this farmer made these changes to the landscape? What are her likely motivations? Compare these with the likely motivations of the farmer who has changed the grasslands environment shown in Source 1.30.
   - **d** Examine Source 1.27. Describe the variations in forest cover between regions of low poverty and regions of high poverty.

6 Examine Source 1.31.
   - **a** What is the most common land use that replaces grasslands around the world?
   - **b** Which region has converted the most grassland? Suggest a reason for this.

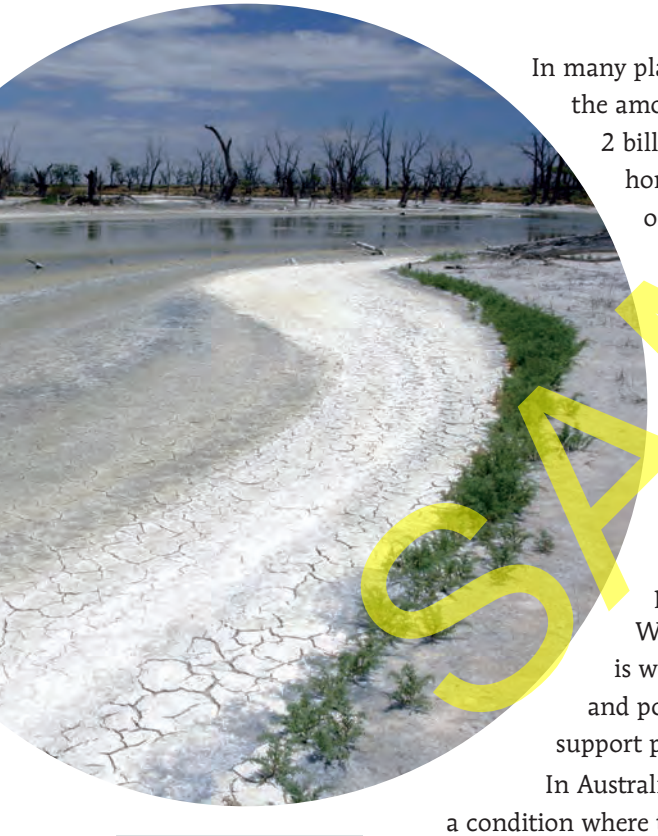
7 Examine Sources 1.28 and 1.29.
   - **a** Each of the agricultural fields in these images is about 800 metres squared in area. Estimate the change in area covered in 2000 and in 2012.
   - **b** What impact will this change have over time on the volume of underground water in this region?
   - **c** Can you think of the environmental impacts that would result from irrigating using water that has been extracted from under the ground?

#### Investigate and create

8 Use an ICT chart tool such as Microsoft Excel, or a protractor, to construct pie graphs for the conversion of grasslands in Australia, North America and Sub-Saharan Africa (Source 1.31). Describe the differences between these three regions as shown in your completed pie graphs.
9 Draw a sketch of a river flowing through a farming region. On your sketch, show five different ways in which the farms affect the quality or quantity of water in the river.
10 Discuss some ways in which the impacts shown on your sketch could be reduced.

# WEARING OUT THE SOIL

**Source 1.33** The most highly erosion-prone soil in the world is said to be found at China's Loess Plateau.



**Source 1.34** Soil salinity near Renmark, South Australia

In many places around the world, soils are being degraded to such an extent that the amount of food that can be grown is in decline. It is estimated that about 2 billion hectares of land have been affected in this way, an area that is home to about one-fifth of the world's population. **Soil degradation** occurs because human activities affect the soil's ability to support plants and animals. These activities include clearing forests to make way for farms and towns, increasing the numbers and density of farm animals, poor irrigation practices and overfarming by growing so many crops that the natural nutrients of the soil are removed and not replaced.

Soil degradation takes many forms. At its worst, the soil is broken down and washed away (see Source 1.33). It is estimated that 75 billion tonnes of fertile soil is lost this way each year. This is largely as a result of forest clearing that allows fragile soils, particularly on sloping land, to be attacked directly by heavy rain. Without the roots of forest plants that help bind the soil together, soil is washed away. In other places, nutrients in the soil such as nitrogen and potassium have become so depleted that the soil lies barren, unable to support plant life.

In Australia, soil degradation often takes the form of **salinity**. Salinity is a condition where the amount of salt causes problems in the soil and affects the environment. There are two types of soil salinity:

- primary salinity – a natural condition that develops in the landscape over time
- secondary salinity – caused by human impact.

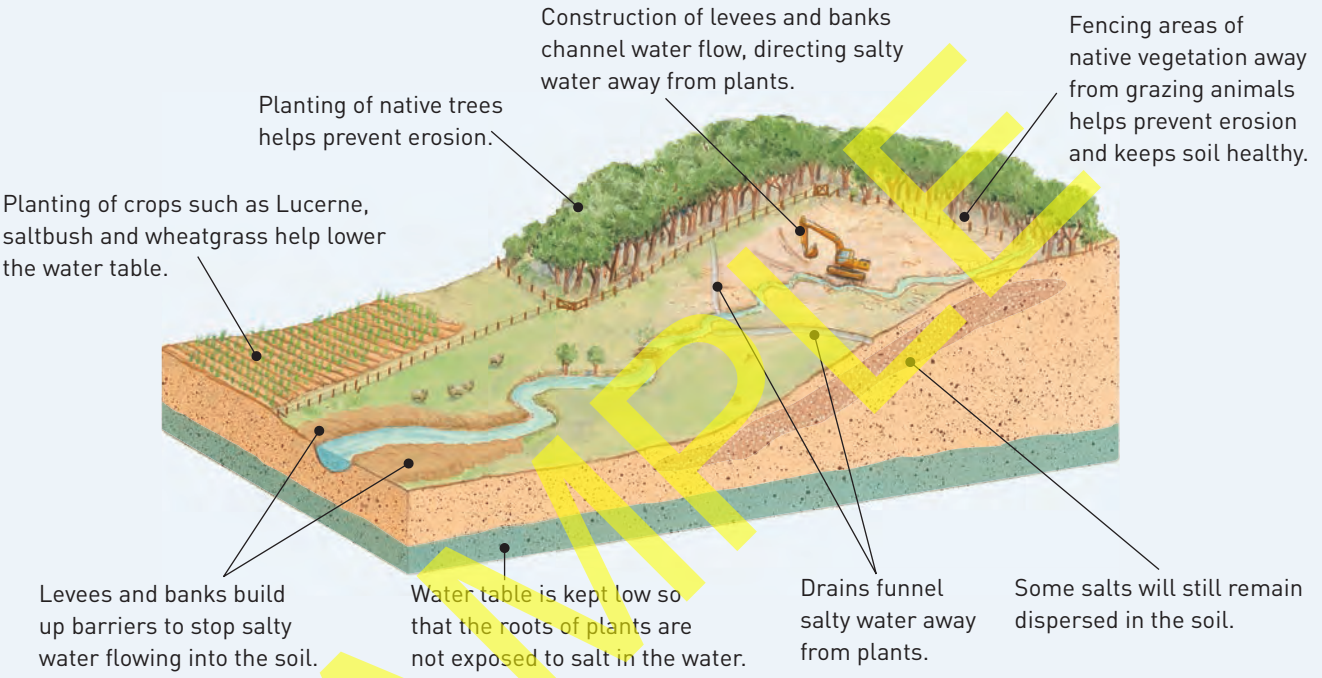
Human impact is related to the irrigation of soil to grow crops. Salts in the irrigation water are left in the soil, and eventually the soil becomes too salty for plant life to survive. Secondary salinity also occurs when trees that have deep roots are removed by humans to make way for crops with short roots. Termed 'dryland' salinity, salt held in the **water table** is then able to move up to the soil's surface, killing virtually all plant life. Approximately 2 million hectares of Australian farming land is degraded in this way (see Source 1.34).

## KEY CONCEPT: SUSTAINABILITY

### Managing salinity

Many Australian farmers, particularly in Western Australia, have responded to the threat of soil salinity by changing the ways in which they farm the land. Some of these changes have been more successful than others, but all are designed to use the soil in a more sustainable way. Source 1.35 shows some of the strategies used by farmers to combat soil salinity. The most successful strategy used so far appears to be lowering the level of the water table, which keeps salt in the water away from plants.

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




**Source 1.35** A range of responses and strategies can be used to tackle salinity.



## REVIEW 1.2.3

### Remember and understand

1 What is salinity? Why is it considered to be a cause of soil degradation?

2 How does forest clearing lead to soil degradation?

### Apply and analyse

3 How has the farmer in Source 1.35 managed salinity on the farm?

4 Select one of the farmer's strategies and comment on its potential effectiveness.

5 Examine Source 1.33 showing soil erosion in northern China.

- **a** What evidence is there that this is a farming area?
- **b** How has farming changed the soils in this place?
- **c** Compare this image with the image of rice terraces seen on the unit opener. Both these areas have been farmed in the same way, but one has experienced soil erosion while one has not. Brainstorm the possible reasons for these differing outcomes.

### Investigate and create

6 The eroded soil in Source 1.33 was once some of the most fertile soil in the world. Describe and sketch a system that would help to slow or reverse soil erosion in this place.

# SPREADING DESERTS

The **food security** of people who live in the world's dryland areas is under threat from a process known as **desertification**. As a result of desertification, once-productive land has become too infertile, too salty or too heavily eroded to continue to support the way of life previously experienced in those areas. According to research by the United Nations Desertification Convention released in 2013, there are currently 168 countries at risk from desertification.

There are many human activities that can lead to desertification but they are all related to the overuse of the land and water in vulnerable regions. This includes overgrazing by animals such as cattle and goats, the removal of forest cover, the use of trees and shrubs for firewood, extracting water from the ground, poor irrigation practices and growing crops on marginal farming land (land that is difficult to cultivate). Natural factors including drought can also contribute to desertification.

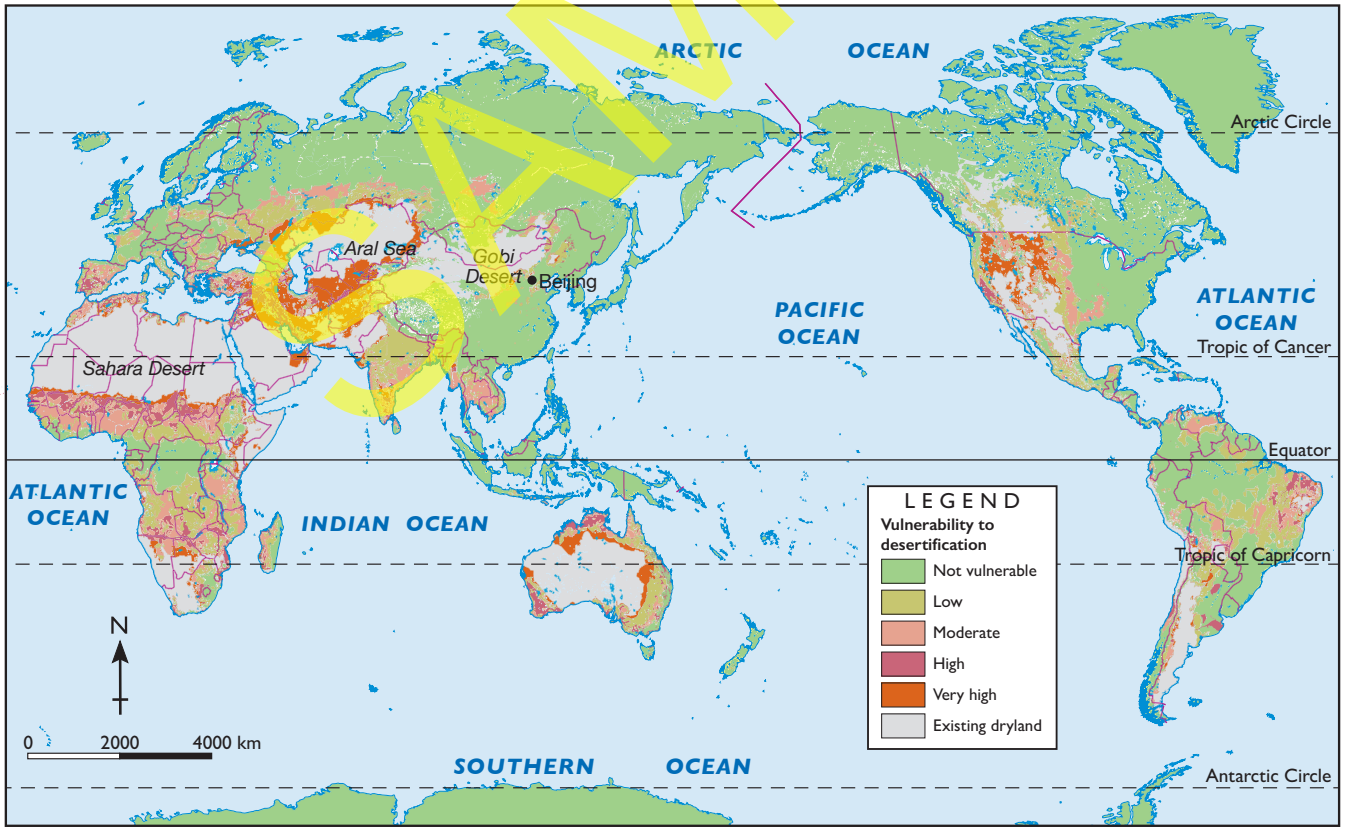
The United Nations currently estimates that the food security of about 250 million people around the world is directly affected by desertification. They believe that the food security of a further one billion is also threatened. There are many effects of desertification: sandstorms, crop losses, famine, environmental refugees and conflict are all direct or indirect results of desertification. About 12 million hectares of land are lost every year to desertification, which is about twice the size of Tasmania. It is estimated that this results in an annual loss of 20 million tonnes of grain. Most of this occurs in developing regions in Central Asia and Sub-Saharan Africa, further contributing to **food insecurity** in those regions.

### STRANGE BUT TRUE

Oxfam rates a country's ability to provide sufficient safe food for its population to live a fit and healthy life. Many European nations, along with Australia, are all 'food secure' on their index, with most of Africa and Asia rating the worst.



## WORLD: DESERTIFICATION VULNERABILITY




Source 1.36

Source: Oxford University Press

## KEY CONCEPT: ENVIRONMENT

### The Green Wall of China

Over the next few decades, the Chinese Government has plans to plant over one billion trees in an attempt to halt the advance of the Gobi Desert over productive farmland across vast areas of China. Nicknamed the Green Wall of China, this line of trees is expected to extend for 4480 kilometres and cover 4 million square kilometres on the desert margins.

Despite some local success stories, not all experts are convinced the wall will halt desertification. In fact, some geographers argue that it may even add to desertification over the longer term as the trees require large amounts of water to help them grow.

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

**Source 1.37** A line of trees on the edge of the Gobi Desert in China helps to protect crops from being covered in sand.



## REVIEW 1.2.4

### Remember and understand

1 What is desertification? What are some of the direct and indirect results of desertification?
2 Name three human activities that can lead to desertification.
3 How does desertification lead to food insecurity?

### Apply and analyse

4 Using Source 1.36, describe the global pattern of desertification. Ensure you name specific countries, regions and continents in your description.
5 What is the spatial association between existing dry lands and areas vulnerable to desertification? Explain why this spatial association exists.
6 How do you think desertification may lead to wars between countries or civil conflicts within countries?

### Investigate and create

7 In what ways might climate change be a leading cause of desertification in some regions of the world?
8 a Examine Source 1.37. How effective do you believe the line of trees will be in stopping the advancing sand dunes of the Gobi Desert? Give some reasons for your answer.
  a Design a better solution for the issue. It may be stopping the sand in another way, moving it, or changing the human activity in the area. Be prepared to justify your solution.

# 1.2

CHECKPOINT

## HOW DO PEOPLE USE AND ALTER BIOMES FOR FOOD PRODUCTION?

- **Investigate the human alteration of biomes to produce food, industrial materials and fibres and the environmental effects of these alterations.**

**1** Which biome(s) do you believe have been altered the most by humans? [5 marks]

**2** Making reference to your answer above, explain why some biomes are more easily altered than others. [10 marks]

**3** Why is it that many areas of the world have been changed by humans to produce food but it is those areas in less developed or poorer nations that show the most environmental impact? [15 marks]

TOTAL MARKS [ /30]

## RICH TASK

### The environmental impact of changing diets

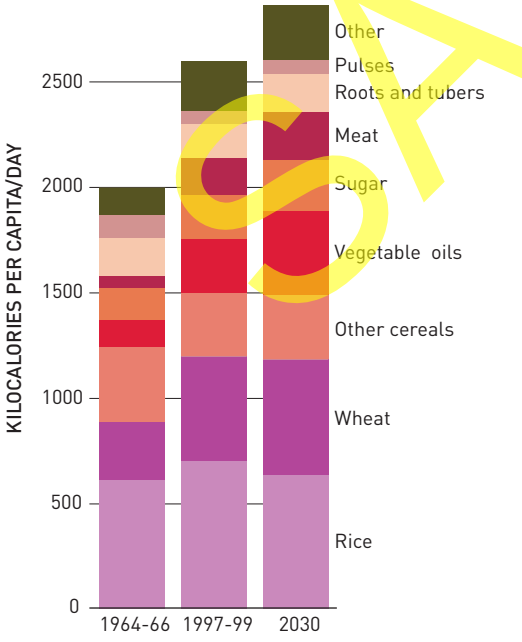
The diets of many people around the world are changing and this is having significant impacts on the environment. As the wealth and wellbeing of people in countries such as China and India increases, the diets of people in those countries are gradually changing. With greater wealth, many people are moving from a diet based almost entirely on grains and plants to a diet with more protein from meat and dairy products. Food production industries are also changing to meet this growing demand.

### Processing geographical information

**1** Use the information presented here to suggest ways in which people in developed countries such as Australia could reduce the environmental impacts of their diets.

### Communicating geographical information

**2** Design an advertising campaign to communicate your findings to the Australian public.




**Source 1.38** A compound column graph showing observed and predicted changes in the human diet between 1964 and 2030

Source: http://www.unep.org/pdf/foodcrisis_lores.pdf

| 1kg | Water footprint (L)[1] | Emissions (kg C02)[2] | Land use ($m^2$)[3] | Grain for feed (kg) | Calories (Kcal) |
|---|---|---|---|---|---|
| Beef | 15 500 | 16 | 7.9 | 6 | 2470 |
| Chicken | 3900 | 4.6 | 6.4 | 1.8 | 1650 |
| Eggs | 3333 | 5.5 | 6.7 | * | 1430 |
| Milk | 1000 | 10.6 | 9.8 | * | 610 |
| Wheat | 1300 | 0.8 | 1.5 | * | 3400 |
| Rice | 3400 | * | * | * | 1300 |

**Source 1.39** The ecological footprint of different food types

Source: http://ccafs.cgiar.org/bigfacts/dietary-change/

Here are some facts you might consider:

- Currently 33%, 50% by 2050, of cereal grown feeds animals for human consumption (UN report, 2011).
- Meat consumption is expected to increase from 39 kg/person/year in 2009 to over 49 kg/person/year by 2050 (FAO, 2012).
- The production of animal protein must be more than tripled if the projected global population of nine billion people in 2050 were to consume meat and dairy at current North American and European levels (Consultative Group on International Agricultural Research report, 2012).
- With rising incomes in the developing world, demand for animal products will continue to surge; 74% for meat, 58% for dairy products and 500% for eggs. Meeting increasing demand is a major sustainability challenge (Food and Agriculture Organisation of the UN, 2012).
- Today, the number of urban residents is growing by nearly 60 million every year. By 2050, the urban population will almost double to 6.4 billion people. Almost all urban population growth in the next 30 years will be in cities of developing countries (World Health Organization, 2013).

SKILL DRILL

## Analysing secondary geographical data and drawing conclusions

Geographers often use secondary data sources such as graphs and statistics to draw conclusions about what they have found. Geographers need to be able to correctly interpret data that has been collected and represented by other people. By following the steps below you will learn to interpret a range of secondary data sources (e.g. graphs, tables, reports) to reach conclusions about your investigation.

**Step 1** Gather a range of secondary data sources and write down two or three key facts that are presented.

**Step 2** Identify any patterns or exceptions that you notice.

**Step 3** Pay particular attention to the title, date of the data and its source. Is the information already dated, is it still relevant, or is it commenting on a situation or place at a particular point in time?

**Step 4** Check the information on graphs carefully. Pay particular attention to ranges of figures and make sure that you understand the classifications. Are things being measured in kilograms or tonnes, for example? You may need to convert the figures to the same units of measurement in order to understand and compare them.

**Step 5** Remember to think about bias – ask why the author has written the piece of information. Are they trying to influence opinion on an issue? Are you getting the complete picture? Try to find a range of sources on the same subject to ensure you have the most complete data available.

**Step 6** Compare the facts and figures you have summarised. It may be helpful to use the PQE method to do this and your notes to reach your conclusion. Support your conclusion with information from the data.

**Step 7** Present your conclusion to an audience. This may be done verbally, graphically or in a written form. Make sure you use the evidence you have gathered to support your conclusion.

### Apply the skill

1 Examine the information in Sources 1.38 and 1.39. Follow the steps to draw a conclusion about the environmental impact of changing diets.

2 Which information best supports your conclusion, what other information would you need to further support your conclusion and where could you find this information?

CHECKPOINT

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

» Concepts: Space, Environment, Interconnection, Sustainability, Change
» Inquiry skills: Acquiring geographical information, Processing geographical information, Communicating geographical information
» Tools: Graphs and statistics, Spatial technologies; Visual representations

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